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1871  
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MISSOURI  
BOTANICAL  
GARDEN.



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M.DCCC.LXIX.



C O N T E N T S.

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PART I.—1869.

*Sertum Angolense, sive Stirpium quarundam novarum vel minus cognitarum in itinere per Angolam et Benguelam observatarum Descriptio Iconibus illustrata. Tentavit FRIDERICUS WELWITSCH . . . . . page 1*



SERTUM ANGOLENSE,

SIVE

STIRPIUM QUARUNDAM NOVARUM VEL MINUS COGNITARUM

IN ITINERE PER

ANGOLAM ET BENGUELLAM

OBSERVATARUM

DESCRIPTIO ICONIBUS ILLUSTRATA.

TENTAVIT

FRIDERICUS WELWITSCH.



## PRÆFATIO.

INTER cunctos orbis terrestris tractus quos circuli æquinoctiales includunt, illi Continentis Africanæ omnium longius scientiæ occulti remanserunt, ac nonnisi nostris temporibus, et quidem non sine perplurimorum peregrinatorum animi fortitudine et audacia prompta pariter ac doctrina et genio insignium sacrificio, scientiæ paullatim paullatimque innotuerunt.

Ingentes tamen ejusdem Continentis plagæ centrales, intra zonam æquinoctialem cis et trans æquatorem extensæ, ad hodiernum usque diem adhuc penitus ignotæ permanent, in mappis imo recentissimis solum latis spatiis vacuis delineatæ, in scientia, inprimis historiam naturalem spectante, hiatibus profundis indigitatæ.

Attamen jam hodie Africæ æquinoctialis terræ litorales plures, nec non penetralia quædam ipsis propiora, tam in orientali quam occidentali vasti continentis plaga sita, scientiæ naturalis scrutinio quodammodo aperta prostant, id quod respectu plagæ orientalis præcipue laboribus curisque celebratorum peregrinatorum Kirk, Speke, et Grant et inprimis Prof. Guilh. Peters debetur, qui Floram atque Faunam terræ Mossambicensis et descriptionibus et iconibus numerosis iisque elegantissimis illustravit.

Terras æquinoctiales in plaga occidentali sitas quod attinet, Guineæ superioris Flora tam explorationibus clar. Chr. Smith, Palisot, Thonning, aliorumque, quam, præcipue tempore ulteriore, conamine et industria nunquam satis laudanda clar. peregrinatorum E. Vogel, Barter, et inprimis G. Mann, saltem pro majore parte, jamjam cognita patet.

Floræ Guineæ inferioris fragmenta quædam colligere mihi tandem licitum fuit, dum Gubernii Lusitani jussu honoratus ejusdemque auxiliis munitus, annis 1854 usque ad 1860 Regni Congo partem, dein *Angolam* et denique *Benguellam* perlustravi. Iter hoc meum sat longum fuit ac summopere arduum; sæpius atque sæpius morbis in istis terris endemicis nec non Nigritarum invadentium bellis interruptum, aliis locis imo ipsarum terrarum ob perdurantem nimiam siccitatem desolatione perturbatum, nihilominus, Deo favente, feliciter peractum, non tamen sine gravi valetudinis meæ detrimento absolutum.

Varia hujusce explorationis eventa, inprimis quæ ad Floram Angolensem spectant, jam curis benevolis ceber. Jos. D. Hooker, G. Bentham, Alph. de Candolle, Dan. Oliver, G. Reichenbach, fil., aliorumque rei herbariæ peritissimorum virorum in lucem edita prostant, et siquidem hæc uti et illa, in posterum edenda, quidquam ad Africæ æquinoctialis historiam naturalem elucidandam contribuunt, hoc omnino Augustissimo Regi Populoque Lusitano debetur, quorum auxilium admodum validum, durante omni itinere mihi præstitum, hic publice et gratissimo animo lætus agnosco.

Inter stirpes novas vel parum cognitatas quas ex terris Angolensibus reportavi, non paucae prostant, quæ vel ob florum habitusve totius elegantiam aut singularitatem, vel ob qualitatam suarum in autochthonum colonorumque vita quotidiana et sanandis morbis præstantiam, vel denique respectu earum distributionis geographicæ præ ceteris notabiles, illustratione iconographica satis dignæ videbantur.



Hunc in finem proinde earum plurimum icones analyticas delineandas curavi et descriptiones uberiores elaboravi, quas hodie sub *Serti Angolensis* titulo Floræ Africanæ fautoribus offero, scriptuli mei imperfectionum nequaquam immemor, simulque magnopere deplorans, ejusdem absolutionem et crebris valetudinis meæ vicissitudinibus aliisque vitæ eventis omnino inopinatis longius retardatam fuisse.

Priusquam autem ad ipsarum stirpium descriptionem progredior, pauca quædam, sed non levioris momenti, præmonenda habeo, quæ imprimis circa Regni Angolensis situm, extensionem et divisionem, ejusdemque territorii in variis latitudinis gradibus variam supra mare elevationem versantur, quibus denique notulas breves, præcipue de montium fluviorumque directione et indole, nec non de temporum imbriumque introitu et decursu agentes, addere liceat, ut quæ infra de specierum singularum stationibus vel habitationibus narranda sunt, melius intelligantur.

Nomine "*Provincia Angola*" sensu generali sumpto, *Lusitani* omnem illum immensum terrarum tractum, ab ipsis olim detectum eorumque nunc dominio subjectum comprehendunt, qui in Africæ tropicæ transæquatorialis plaga occidentali inter 5° 12' et 18° lat. austr.\* sese extendit, et penetralia dicti continentis nunc ad 200, nunc fere ad 350 mil. geogr. petit, limitibus tamen his orientem versus necdum ubique rite constitutis.

Vastissimum hocce territorium juxta Oceani Atlantici oram orientalem per tredecim fere latitudinis gradus extensum, quatuor illa antiqua Nigritarum regna, *Loango*, *Congo*, *Angola* et *Benguella* dicta amplectitur, quæ cuncta olim unita regique potentissimo "*Mani-Congo*" appellato subjecta, nomine communi "*Congo*" designabantur †. Postea autem, et quidem jam a seculo XV.‡ ad hodiernum diem usque hic idem terrarum tractus apud geographos et in mappis plurimis nomine "*Guinea inferior*," et apud historiographos Lusitanos "*Guiné Portuguez*," i. e. Guinea Lusitana, designatus invenitur, nominibus tamen antiquis pro singulis regnis nihilominus conservatis.

Antiqui regni "*Loango*" Lusitani hodierni solummodo partem meridionalem inter flumina "*Cacondo*" et "*Zaire*" sitam, in mappa supra citata sub denominatione "*Districto de Cabinda*" indicatam, sibi vindicant, quam, cum illam perlustrare non mihi licuit, hoc loco obiter commemoratam prætermitto.

Regnum *Congo*, sensu hodierno sumptum, ad septentrionem flumine *Zaire*, ad austrum flumine *Loge*, a quibusdam geographis perperam "*Ambriz*" nuncupato, limitatur. *Angola* proprie sic dicta inter flumina *Loge* et *Cuanza* comprehenditur, dum *Benguella* a sinistris ripis ejusdem fluminis *Cuanza* ad flumen *Cunene* et quidquam ultra sese extendit, *territorium Benguellense*, sensu strictiore sic denominatum, simulque ad meridiem *terras Mossamedenses*, continentis interiora orientem versus late longeque pervagantes, includens. Secundum fluviorum indicatorum variam inter se quoad eorum ostia distantiam, etiam cujusvis adductorum regnorum extensionem litoralem variare obvium est, sicque territorii

\* Conf. Mappam nitide delineatam nuper Olissipone editam sub titulo: "*Angola, mappa coordenado pelo Visconde de Sá de Bandeira, Tenente general, Ministro da Guerra, e por Fernando da Costa Leal, Tenente Coronel, Governador de Mossamedes.*" Lisboa 1864. Fol. sing. max.

† Conf. *Cavazzi* ap. *Labat* (T. 1. pag. 21), & *Demagnet*, *Nouvelle histoire de l'Afrique* etc. Paris, 1767, vol. i. pag. 13.

‡ Inter Lusitaniæ reges qui primus titulum "*Senhor de Guiné*" id est, Guineæ dominus, assumpsit, fuit Dom João II.; Conf. *De Barros* *Asia*, Dec. 1. Lib. III. Cap. 3, nec non *Lopes de Lima*, *Ensaio sobre a statistica*, etc., Lib. III. pag. v.



Congo litus circiter a 6° 10' ad 7° 50', illud Angolæ a 7° 50' ad 9° 20', Benguellæ demum ab hoc ultimo ad 18° lat. austr. usque sese extendit.

Præter flumina supra notata, non pauca alia, in longinquis penetrantium terris nascentia, Oceanum Atlanticum petunt, inter quæ in Congo flumina *Lilundo* et *Ambrige*, in Angola, *Lifune*, *Dande* et *Bengo*, in Benguella denique *Cuvo*, *Cutumbella* et *Bero* notabiliora sunt, permultis aliis minoribus rivisque innumeris hic prætermisissis, quæ, etiamsi durante pluviarum periodo non raro sat profunda ac dilatata, hiberno tamen tempore (*i. e.* imbribus omnino carente) vix aquis suis oceanum attingunt, sed versus eorum ostia, arenis ardentibus absorpta sensim sensimque disparent, vel ad stagna hinc inde in lacus extensa ab oceano vicino arena accumulata separata restringuntur.

Totius hujus territorii limites occidentales sive oceanici vel planitiibus formantur nunc angustioribus arenosis suaviter undulatis, nunc latius versus terras internas extensis, hinc inde limosis aut paludosis, vel rarius collibus rupestribus clivisve abruptis, ad 100–300 ped. elevatis, quorum cacumina sæpius horizontaliter truncata, præsertim juxta litora Benguellæ australioris frequenter obvia, et jam a primis navigatoribus Lusitanis apte cum mensis comparata, illis litoribus aspectum admodum peculiarem impertiunt, simulque vegetatione peculiari, sparsa quidem sed admodum distincta, arborum pygmæarum ornantur, inter quas *Vitis macropus* et *Bainesii*, *Pachypodium Lealii*, *Sesamothamnus Benguellensis* et *Welwitschia mirabilis* maxime notabiles.

Orientem versus omne territorium ab ora maritima per gradus ad terras internas modo suavius modo abruptius ascendit, montium catenis nempe pluribus, a Lusitanis “*Serras*” sive “*Morros*” nuncupatis, interiora versus gradatim altioribus percurritur, quarum summa juga in Angolæ penetrantibus ad 4000, in Benguellæ interioribus ad circiter 6000 ped. elevantur. In universum hæ montium series a septentrione austrum versus decurrunt, latere suo orientali sensim ad radices catenæ sequentis ascendentes, dum contra latere occidentali, oceanum spectante, plerumque abruptius descendunt, unde facile perspicitur quamobrem rivi plurimi et flumina fere omnia nonnisi cataractis pluries repetitis præcipitata, ex terris interioribus in regiones inferiores profluunt. Attamen harum catenarum decursus nequaquam semper continuus, neque ubique directionem supra indicatam sequitur, sed in variis locis illarum una alterave vel omnes magis versus orientem retrocedunt, uti prope urbem “*Loanda*,” dum aliis locis litori propiores emergunt, uti hoc pone urbem “*Benguella*” observatur; hinc etiam catenarum singularum inter se distantia, montiumque quibus componuntur amplitudo magnopere variant, etiamsi generaliter et catenæ ipsæ et montes singuli versus territorii interiora sensim ampliores. Catenæ singulæ rarius insigniter deprimuntur, sed frequentius montibus disjunctis variæ altitudinis interceptæ vel aliis locis jugorum transversorum ope cum proxima interiore serie conjunctæ sunt vel etiam vallibus angustis plus minusve profundis, tempore pluviarum totidem torrentium alveis, persulcatæ. Seriei interioris juga excelsiora, quæ in Benguella jam ad 80–100 mil. geog. a litore distantiam eminent, in Angola autem nonnisi 150–180 mil. intervallo ab oceano divisa surgere incipiunt, pluribus in locis in planities undulatas deplanata inveniuntur, ex quibus dein iterum vel monticuli disjuncti, obtuse aut acutius conici, non raro ad summum usque cacumen silvis fruticetisve ornati, prominent, uti e. g. in Districtu *Huilla*, vel rupes ingentes,



parietibus fere perpendiculariter erectis, nunc vegetatione denudatis nunc fruticulorum variorum viriditate vestitis, columnarum angulatarum ad instar repentius surgunt, quemadmodum hoc in Districtu *Pungo-Andongo* observare licet, ubi petrae giganteae undique praeruptae, a colonis nomine "*Pedras negras*" dictae, nec non aliae, circiter 15 mil. geog. orientem versus ab his distantes "*Pedras de Guinga*" nuncupatae, et quoad aspectum non minus singulares, vallem fluminis *Cuanza* ad septentrionem supereminent, in eorum cacuminum rimis faucibusque numerosam herbarum aromaticarum catervam nutriendas, dum juxta basim hinc pascuis latissimis, illinc silvis sempervirentibus cinguntur.

In *Benguellae* maxime australis (*i. e.* Districtus *Mossamedes*) interioribus, montium catenae, inter quos illa "*Serra de Xella*" (sive *Chella*) dicta, imprimis notabilis, non solummodo latere occidentali sed simul etiam austrum versus, hoc autem latere suavius sensimque descendunt, qua ratione planitiei Huillensis rivi omnes et imo fluvius "*Cacolovar*" qui cunctos pedetentim absorbet, directionem australem sequuntur, fluvio ipso *Cacolovar* demum prope pagum munitum "*Humbe*" in flumen *Cunene* sese effundente.

Lacus [Lusitanis "*Lagoas*"] minoris majorisve extensionis in nulla fere territorii parte desunt, sed in universum in Angola paullo quam in Congo et Benguella frequentiores, omnesque, paucissimis exceptis, in fluminum rivorumque vicinitate siti inveniuntur, eorumque plurimi plantarum aquaticarum, imprimis *Nymphæarum* et *Pistiarum* uberissima copia superbientes, *Cyperorum*, praesertim *Papyri* denso agmine marginati, simul *Crocodilorum* et, si profundiores, *Hippopotamorum* deliciae, ast accolarum Europensium sanitatis, pro dolor! inimici. Plerique, et majorum omnes, fluviis ipsis vel rivis quibus proximis originem suam et, si persistentes, etiam eorum durationem debent, quapropter una cum illis Jove pluvio ampliores, tempore sicco vero valde angustati vel omnino exsiccati, sicque aestate piscatoribus, hyeme contra agricultoribus magnum proventum suppeditantes. Margines enim fere omnium, post aquarum recessum successivum limo relicto laetificati, opimas fructuum agrestium, imprimis *Zae Mayidis*, *Phaseolorum*, *Cucurbitarum* nec non *Arachis hypogaeae* messes largiuntur.

Etiam si territorii Angolensis lacus, imo eorum amplissimi, nequaquam cum illis immensis lacubus comparari possunt, qui in ejusdem continentis plaga orientali cis et trans aequatorem jure celebrantur, ipsis tamen quoad stirpium aquaticarum, quibus ornantur, numerum et varietatem vix inferiores sunt.

Inter illos, quos plantis natantibus praesertim abundantes vel fere omnino obtectos reperi, *Lagoa de Quizembo* in Congo, *Lagoas de Bombo*, de *Libongo*, de *Foto*, de *Quilundo* et de *Quibinda* in Angola, nec non *Lagoa de Giraúl* prope Mossamedes et demum *Lagoa Ivantalla* [sive *Yavantalla*] in Districtu Huilla sita, primum locum tenent, omnes non solummodo plantis aquaticis sed simul et aliis, quae eorum ripas palustres vel limo humido tectas inhabitant, ditissimi, et ob stirpium cultarum messes amplas, in eorum areis exsiccatis quolibet anno obtentas, incolis utilissimi. Praeter supra indicatos permulti alii lacus, tam in plaga litorali quam in Provinciae penetralibus siti, nigritis ac colonis ejusdem fere utilitatis sunt, inter quos ii, qui juxta ripas fluminis *Cuanza*, intra oppi-



dulum “*Massangano*” et dicti fluminis faucem se extendunt, et numero et amplitudine æque insignes.

Supra commemorata vasti territorii per gradus elevatio, quacum, uti facile intelligitur, etiam imbrium copia increscit earumque duratio protrahitur, dum contra aëris pressio ac soli temperatura sensim diminuuntur, similem quoque vegetationis, qua diversæ elevationis terræ vestiuntur, graduationem sive modificationem provocat, quæ omni peregrinatori e regione inferiore in altiorem penetranti, prompte sub oculis cadet, nam non solummodo, herbarum singularum fruticumque atque arborum, quæ tum apparent, ab iis regionis inferioris diversitate indicatur, sed simul etiam agrorum silvarumque diversa indole et vigore, fontium et rivorum numero et frigore aucto, totius demum terrarum ipsorumque habitantium caractere physiognomico mutato interpretatur.

Notabilis hæc naturæ scenarum mutatio, viatori ab ora maritima ad terras internas elatiores progredienti primum ad earum circiter 1000 pedum supra mare elevationem sese manifestat, ubi loco pratorum languescentium virgultorumque sæpius spinosorum nonnisi rarius silvulis clavis interruptarum regionis inferioris modo relictæ propemodum repente prava intensius virentia, herbæ elatiores, fruticeta robustiora et silvæ extensæ arboribus altioribus densiusque sociatis ac frequenter scandentium agmine multiformi ornatis compositæ apparent, nec non rivuli et fontes nunc muscorum amœna viriditate marginati alteram diversam vegetationis regionem annunciant, quæ ad peregrinatorem esurientem, terræ relictæ ardore cruciatum potu refrigerante silvarumque primævarum gratissima umbra benefaciat, et phytologum repentina præsentia complurium stirpium prius non observatarum oblectet. Arbores nunc vastissimæ ac formosissimæ, partim solitariæ partim in sylvas densissimas congestæ apparent, inprimis ex ordinibus *Mimosæarum*, *Meliacearum*, *Myrtacearum*, *Myristicacearum* et *Rubiacearum*, et *Palmæ* plures, præcipue *Elais guineensis* et *Raphiæ* species, formosas suas comas ubique ostentant.

Hæc autem totius fere terrarum circumjacentium indolis immutatio ipsaque silvarum primitivarum magnificentia vix altius quam ad 2500–3000 pedum altitudinem supra oceanum ascendunt; tum enim viator iterum aliam Floræ regionem attingit, non minus generali vestitus vegetabilis sui aspectu quam generum et specierum ibidem occurrentium ab iis præcedentis regionis diversitate indigitatam. Silvæ enim nunc minus densæ et humiliores, pratorum herbæ graciliores arctiusque gregatæ, pascua extensiora et sæpius, modo *Labiatis* vel *Acanthaceis* pygmæis, modo *Orchidearum* terrestrium, *Liliacearum* *Iridiarum*ve floribus fulgidis variegata sese repræsentant, et una cum rivorum fontiumque numero aucto, fruticum quoque atque arborum species mire multiplicantur, ita quidem ut in dato quodam circuitu hujus regionis facile duplus vel hinc inde imo triplus specierum diversarum numerus quam in æquali ambitu regionum inferiorum reperitur. Ast non solum specierum et generum Floram constituentium numerus his locis insigniter auctus invenitur, sed etiam plures plantarum ordines, in terris inferioribus rarissime vel nullibi visi, uti *Santalacæ*, *Daphnoideæ*, *Proteacæ*, *Selagineæ*, *Cyrtandreeæ*, et *Ericacæ*, ceteris stirpibus associatæ obveniunt, sicque alteram tertiam vegetationis regionem, stirpium habitu, numero et indole definitam pronunciant.

Accidit quidem nonnunquam ut species singulæ quædam, terris altioribus peculiare, vel ibidem frequentes, juxta fluminum aut rivorum ripas in regiones inferiores vel



imo ad fluminum ostia usque descendant, sed hoc rarius obvenit, tumque stirpes tali modo migrantes in his locis potius ceu hospites adventicii quam incolæ stabiles considerandæ, et plerumque etiam habitus sui quadam mutatione originem suam denunciant. Sic exempli gratia *Phœnix spinosa* Thon., riparum fluminis *Cuanza* in Districtu *Pungo Andongo* decus formosissimum, hinc inde fere ad limites internos territorii litoralis descendit, sed ibidem, etiamsi fructifera, nana sæpiusque fere acaulis, vel solummodo trunco brevi 1-4-pedali munita permanet. Pari modo etiam Umbelliferarum arbor (*Alvardiæ* spec.) quæ in Districtu *Golungo Alto* silvis primævis trunco ad 25 ped. alto et semipedem crasso vel crassiore occurrit, in territorii litoralis collibus quos hinc inde invadit, solummodo fruticulum vix bipedalem, trunculo fere herbaceo, ægre digitum crasso donatum repræsentat.

Hac stirpium diversarum per tres diversos terrarum elevationis gradus inter limites definitos distributione inductus, etiam tres Floræ Angolensis Regiones phytogeographicas statui posse opinor\*, quarum prima *regio litoralis* est †, quæ ab ora maritima ad terras internas circiter 1000 pedes elevatas, nunc longius nunc brevius sese extendit; secunda dein sive intermedia, “*montoso-sylvatica*” denominanda, terras inter 1000 et 2500 circiter pedum altitudinis sitas comprehendens, imprimis silvarum primævarum late extensarum præsentia distincta ‡, et denique *regio superior* sive *alto-plana*, quæ omnes illas terras internas amplectitur quarum elevatio supra oceanum 2500 pedes excedit §.

Harum regionum indolis expositionem fusiolem jam olim in commentatione Annalibus maritimis Olissipone editis inserta||, exhibere tentavi, eodemque loco etiam ordinum singulorum fere omnium Floram Angolensem constituentium inter dictas tres regiones distributionem indicare studui, simulque plantarum ab autochthonibus vel colonis in qualibet regione cultarum enumerationem cuivis ordini adducto adnexi, persuasus quod tam totius territorii quam regionum singularum qualitates ac relationes climatologicæ, ex plantarum in una alterave vel in omnibus tribus regionibus majore vel minore abundantia cultarum indice melius tutiusque pateant, quam si istæ solummodo secundum observationes thermometricas, ombrometricas etc. alioquin durante itinere vix sat exacte instituendas interpretentur.

Imbres primi, post hibernum mensibus Junio, Julio, et Augusto regnantem, pluviisque omnino carentem, versus medium vel finem Septembris, veris initium, advenire solent, plerumque, ne dicam semper, inter fulgura et tonitrua summæ vehementiæ de cœlo

\* Conf. Journ. Linn. Soc. Lond. 1858, vol. iii. pag. 150 seq., et Diar. ejusdem, 1861, pag. 182 seq.

† Conf. respectu hujus regionis indolis, “Observations on the Origin and the Geographical Distribution of the Gum Copal in Angola,” by Fred. Welwitsch, Journ. Linn. Soc. Lond. vol. ix. pp. 287-302. Necnon: *Sertum Benguellense*, &c. Bearbeitet von Med. Dr. H. Wawra und T. Peyritsch. Wien, 1860.

‡ Quoad arbores notabiliores silvas istas constituentes conf. ‘*Synopse explicativa das amostras de madeiras e drogas medicinaes, &c., collegidas na Provincia de Angola, enviadas a exposicaõ internacional de Londres em 1862, por Frederico Welwitsch.*’ Lisboa, 1862.

§ Conf. “Lettre du Dr. Welwitsch à M. Alph. de Candolle, sur la végétation du plateau de Huilla, et observations de M. de Candolle, à ce sujet,” in Bibliothèque Universelle [Archives des Sciences Physiques et Naturelles], Livr. Juillet 1861.

|| Apontamentos phytogeographicos sobre a Flora da Provincia de Angola, etc., por Fred. Welwitsch. [Annaes do Conselho ultramarino, 1858, n. 55.]



cadentes. Sunt autem hæ pluvie vernaes, etiamsi non raro et imprimis in terris interioribus ad Novembris finem vel Decembris medium repetitæ, nec tam continuæ nec tam copiosæ quam autumnales, quæ mensibus Martio et Aprili adveniunt, quapropter hæ a colonis *pluvie magnæ* [chuvass grandes] et illæ *pluvie parvæ* [chuvass pequenas] nominantur. Quibusdam vero annis pluvie vernaes per longius tempus, etiamsi nequaquam quotidie cadentes, continuantur, simulque autumnales præcocius cadunt, ita ut ab Octobris initio ad Aprilis finem, pluvia paucis tantum hebdomadibus interrupta perdurat, et tum plantarum omnium, ac totius naturæ vegetabilis ubique luxuria summa, sed, pro dolor! etiam inundationes, arva et segetes, pascua et silvas nec non raro domicilia pagosque integros repentino impetu devastantes, præsertim in regionibus inferioribus timendæ. Hoc autem rarius accidit, et in universum cunctæ totius Provinciæ Angolensis terræ, præcipue vero australiores et oceano propiores, magis siccitate quam humiditatis excessu laborant. Perpensa hac imbrium tam in totius territorii ambitu quam in ejus districtibus singulis vicissitudine facile colligitur quod de pluviarum quantitate annua generatim vix aliquid certi ac definiti statui possit.

Idem fere de aëris temperatura valet, quæ in diversis terrarum elevationibus, et in ejusdem elevationis locis nunc ventis magis expositis nunc in vallibus profundioribus reclusis, uti facile expectandum, admodum variat. Generaliter tamen temperatura anni media in regione superiore altoplana, et quidem non ob calorem diurnum, qui ibidem, jugis excelsis exceptis, fere idem, sed ob noctes insigniter frigidiores, ab illa regionum inferiorum 15–20 grad. thermom. F. recedit; in regione superiore secundum observationes plures in Pungo Andongo et Huilla institutis temperatura anni media inter 55° et 60° F., in regionibus vero inferioribus inter 77° et 80° F. vacillare videtur, excepto tamen districtu litorali de *Mossamedes*, qui ob ventorum refrigerantium, sæpius ex austro vel austro-occidente flantium accessum liberum, nec non minus ob oceani aquarum ex austri regionibus frigidis affluentium et juxta hæc litora maximo impetu septentrionem versus decurrentium vim moderantem, climate multo frigidiore gaudet, quam hoc in territorio circulum æquinocbialem tangente vel imo pro parte ab ipso incluso, esset expectandum. Hac eadem ex ratione etiam Flora Mossamedensis vix indolem reapse tropicam repræsentat, sed potius subtropicam vel fere Capensem, uti hoc præsentia specierum plurium ex generibus *Juncus*, *Triglochin*, *Ceratogonum*, *Cressa*, *Euclea*, *Mesembryanthemum*, etc., et ipsius *Vogeliæ Africanæ* aliarumque stirpium Capensium frequentia indigitatur, et simul cerealium Europæorum atque *Vitis viniferæ* cultura prospera illustratur.

Generalibus hisce de Provinciæ Angolæ constitutione physica et vegetabilium in ejusdem territorio distributione præmissis, pauca quædam adhuc de mensuris et numeri signis adhibitis, nec non respectu nominum locorum natalium specierum describendarum hic adjungere liceat.

Mensuræ hinc inde in specierum descriptione usitata, uti et illæ quæ ad terrarum supra mare elevationem spectant, *pedem Anglicum*, in 12 pollices et pollicem in 12 lineas divisum, indicant. Terrarum altitudines methodo thermometrica a cl. Princep\* indicata determinare studui, observationibus hunc in finem institutis in eodem loco pluries et non

\* Conf. Table for ascertaining the Heights of Mountains from the Boiling-point of Water. By James Princep. London, 1841.



raro etiam ad diversas diei horas repetitis demumque inter se comparatis; valores hacce methodo partos non omnino exactos esse, omnibus notum est, sed ad stirpis cujuscumque loci natalis altitudinem statuendam satis habere veritatis videntur.

Nomina locorum natalium specierum descriptionibus appensa secundum orthographiam Lusitanicam scripsi; sunt autem hæc nomina nunc linguæ Nigritarum illis terris autochthonum omnino propria, nunc Lusitanica, id est a colonis Lusitanicis ibidem introducta, nonnumquam etiam ex ambabus his linguis hybrida, sed jam longo usu vindicata simulque indigenis bene cognita et proinde peregrinatoribus futuris quam nomina scriptis quibusdam vel mappis antiquioribus exarata, duces fideliores.

Nomina vernacula, quibus stirpes quædam vulgariore vel frequentius obvenientes in locis suis natalibus a Nigritis vel colonis designantur, non nisi rarius et caute speciebus singulis adnexi, quoniam ex istorum perplurium, primum sedule collectorum et dein inter se et una cum stirpibus quibus addicta fuerunt comparatorum studio cognovi, eorum plurima nonnisi ambigui valoris, vel solummodo paucis incolis cujusdam loci cognita esse, vel non raro, et imo in uno eodemque loco, stirpibus inter se valde diversis, vel vix habitu aliquantulum similibus attribui.

His missis restat ut viris illustribus qui in conficienda hac commentatione mihi opem tulerunt, gratias meas maximas atque sincerissimas agam, quos inter clarissimi Dr. Jos. D. Hooker, Horti Museique botanici Kewensis omnium amplissimi ac ditissimi Director, nec non Prof. Dan. Oliver, ejusdem Musei custos et bibliothecarius, primo loco prædicandi: viri generosi, eruditione et humanitate æque insignes, quorum benevolo consilio auxilioque efficacissimo, si quid meriti huic scriptulo inhæret, omnimodo et juste tribuendum.

Pariter clarissimis viris Joh. J. Bennett, herbarii Musei Britannici præfecto, et Guilh. Carruthers, ejusdem herbarii curatori, pro singulari et semper prompta urbanitate, qua illius herbarii locupletissimi usum mihi faciliorem reddiderunt, me summopere gratum confiteor; lectoris autem benignæ indulgentiæ harum paginarum imperfectiones iterum atque iterum commendo.

## DESCRIPTIONES.

### Ordo ANONACEÆ.

Trib. III. MITREPHOREÆ, Benth. et Hook. f. Gen. Pl. p. 21.

MONODORA ANGOLENSIS, Welw. n. sp.\* (Tab. I.) Glaberrima, foliis membranaceis vel demum plus minusve coriaceis, obovato- vel elliptico-oblongis, breviter acuminatis cuspidatisve, basi cuneatis, herbaceo viridibus, floribus pendulis, sæpius in ramulis brevibus lateralibus foliiferis solitariis oppositifoliis; sepalis e basi latiuscula lanceolatis crispatis, petalis exterioribus amplis ovatis acuminatis incurvis, lateribus utrinque reflexis, interioribus unguiculatis conniventibus laminis transversim ellipticis

\* Primam tam hujus speciei novæ quam *Monodoræ Myristicæ*, Dun., olim perperam Floræ Americanæ vindicatæ, in Angola certe indigenæ notitiam jam olim clar. W. W. Saunders in litteris (Loandæ, Sept. 1857) communicavi, denique anno sequente, ambas species in "*Apontamentos phytogeographicos sobre a Flora de Angola*, p. 587," commemoravi.



abrupte cuspidatis basi exauriculatis; fructu ovato-ellipsoideo longitudinaliter sulcis levibus latiusculis percusso.

*Habitat* in silvis primævis editioribus Distr. Golungo Alto et paullo frequentius in silvaticis rupestribus Distr. Pungo-Andongo ad 2500–3500 ped. altit. A Novembr. usque Januarium florens, Maio–Julio fructificans. *Exsic.* Welw. Iter Angol. n. 774 et 776.

Arbor 20–30-pedalis, coma densiuscula ovoidea, trunco recto ad basim 1–1½ ped. diametri, cortice obiter rimoso aspero nigrescente; rami primarii erecto-patentes, secundarii et ramuli patentissimi cylindracei, juniores et floriferi purpurascens, subdistiche foliati. *Folia* alterna, petiolo brevi 2 lin. longo canaliculato suffulta, obovato-vel elliptico-oblonga, nunc ovato-lanceolata, 4–5½ poll. longa, 2 poll. lata, basi cuneato-angustata, apice abrupte acuminata vel breviter cuspidata, margine integro, penninervia, supra intense viridia nitidula, subtus absque nitore pallide virentia, secundum expositionem arboris nunc membranacea et decidua, nunc plus minusve coriacea et persistentia. *Flores* speciosi, totius ordinis facile elegantissimi, multicolores, suaviter odori, in ramulorum extremorum ramellis abbreviatis solitarii, longius pedunculati, nutantes, demum penduli, pedunculo oppositifolio, gracili, circiter 2 poll. longo, medio bractea ampla, membranacea, herbaceo-viridi, late ovata, vel cordato-ovata acuminata, longitudinaliter plurinervia, semiamplectente, demum decidua munito. *Sepala* a lata basi lanceolata, petalis multoties breviora, herbaceo-viridia, undulato-crispa, a basi supra pedunculum reflexa, longe persistentia. *Petala* (basi semper inter se coalita mox post fecundationem a calyce annulatim soluta et junctim secedentia) tenuiter carnosa, exteriora elongato-ovata sensim acuminata, obtusiuscula, 2–2½ poll. longa, utraque superficie reticulatim scrobiculata, a basi patula arcuatim incurva, lateribus undulato-crispis recurvis, primum e viridi purpurascens basi nivea, demum maculis circularibus rubris, aurantiacis et flavicantibus undique variegata, interiora exterioribus multoties breviora et duplo angustiora, erecto-conniventia, omnino albida vel albido-rosea, levia, margine plano, spathulata, unguibus latiusculis fere laminæ æquilongis, lamina nunc transverse elliptica, nunc obcuneata abrupte cuspidata, cuspidate obtusiuscula barbulata. *Stamina et gynæcium* generis; antheræ badio-albidæ, loculis contiguis; pollen albidum. Ovarium bene efformatum, mox post fecundationem verticaliter pluristriatum; stigma nunc integrum peltatum, nunc obscure plurilobulatum vel solummodo obiter radiato-striatum. *Fructus* in pedunculo nunc lignose indurato et incrassato pendulus, suberoso-lignosus, glabriusculus, ovato-vel oblongo-ellipsoideus, 6 poll. circiter longus, 3½–3¾ poll. diametro, basi obtusus, vertice breviter apiculatus, secundum longitudinem sulcis pluribus latis sed parum profundis costisque obiter prominentibus percursus, unilocularis, pulpa farinosa fuscescente semina involvente farctus, indehiscens, vel rima longitudinali apertus. *Semina* numerosa, oblongo-obovoidea, 5–7 lin. longa, ad hilum oblique truncata, mutua pressione non raro varie gibba vel angulata; testa tenuiter coriacea, tenax, levigata, fusco-badia, nitida; albuminis cereaceo-carnosi gratissime et fortiter fragrantis lamellæ numerosæ, planiusculæ, æquali fere inter se crassitudine, respectu peripheriæ seminis verticaliter seriatae. Embryo minutus, hilo proximus.

*Observatio.*—Semina *Monodoræ Angolensis*, uti illa *Monodoræ Myristicæ* ab autochthonibus ob nuclei aroma gratissimum, illud *Myristicæ moschatae* æmulans, nec non ob virtutem egregie stimulantem et restaurantem magni aestimata, hinc inde etiam in condiendis cibis usitata multoque commercio circumvecta, in omnibus mercatoriis Angolensibus prostant et sub nomine “*Xipepe*” vel “*Gipepe*” venduntur. Arbores ipsæ amborum specierum in Angola plerumque “*N-pepe*, in Insula Sti. Thomæ autem” “*Jobo*” nuncupantur. Nomen vero “*Xipepe*” vix idiomatici *Bundico* proprium, sed spurium, et ni fallor, a vocabulo “pepper” (Piper) olim a mercatoribus Anglicis ibidem introducto, derivatum et a Nigritis, commercii gratia, genio linguæ Bundicæ accommodatum.



Trib. IV. XYLOPIÆ, Benth. et Hook. f. *l. c.* p. 27.

*XYLOPIA ODORATISSIMA*, Welw. n. sp. Arbor parva ramosissima, ramulis pubescentibus, foliis petiolatis coriaceis, ellipticis vel oblongo-ellipticis, obtusis, basi rotundatis, supra glabrescentibus, subtus præcipue in costa piloso-pubescentibus; floribus axillaribus subsessilibus vel breviter pedicellatis solitariis vel 2–3 fasciculatis; calyce trifido lobis ovato-deltaideis; petalis exterioribus elongatis, interioribus sæpius paullo brevioribus lineari-subulatis; antheris connectivo truncato leviter dilatato, disco staminifero denique deciduo; ovariis circa 10, pilosis, stylo subulato andrœcium superante, ovulis 4–6; carpellis maturis obliquis, breviter stipitatis, mono-oligospermis, longitudinaliter nervosis glabris.

*Habitat* frequens in montosis silvaticis editioribus ad plagam australem de Morro de Lopollo Distr. Huilla, inter 5000 et 5500 ped. altit., Decemb.–Febr. florens, Apr. et Maio fructificans. *Exsic.* Welw. Iter Angol. no. 757.

Arbuscula in silvis densioribus circiter 10–15 pedes alta, comæ tunc laxioris forma sat variabili, ramis valde inæquilongis fere horizontaliter patentibus, ramulis extimis vario modo curvis inter arborum vicinarum ramificationes subscandentibus; in declivibus vero apricis petrosisque plerumque frutex 4–6-pedalis, jam paullo supra basim ramosus, ramis erectiusculis, cylindricis, glabratis, crebre et patentim ramulosis comulas dense foliosas efformantibus; ramuli juniores et floriferi plus minusve sericeo-pubescentes. *Folia* persistentia, in vivo molliter coriacea, supra halitu glaucescente lætius, subtus pallide viridia, exsiccatione utrinque multo pallidiora et rigidiora, petiolo 2 lin. longo, leviter canaliculato cum ramulo articulato suffulta; lamina  $1\frac{1}{2}$ –2 poll. longa,  $1-1\frac{1}{3}$  poll. lata, apice obtusa vel rarius subacuminata, basi rotundata vel hinc inde subcordata, subtus inprimis ad petiolum et costam molliter pubescens. *Flores* creberrimi, suavissime fragrantés, ad axillas foliorum solitarii vel plerumque 2–3 fasciculati, brevissime pedicellati, carnosuli, rigiduli, fragiles, extus undique sericeo-tomentelli, primum albidii, demum flavescentes. *Calycis* profunde 3-partiti lobi deltaidei, circiter lineam longi, apice apiculati. *Petala* exteriora  $\frac{2}{3}$ – $\frac{3}{4}$  poll. longa, obtuse carinata, a basi ovata concava abrupte linearia obtusiuscula; interiora angustiora, paullo breviora et apicem versus subulata, sub anthesi erecto-patula, prompte decidua. *Andrœcium* et *ovaria* descripta. *Carpella* matura 4–8, omnino glabra, nitidulo-rubra, stipite recto 2–3 lin. longo, crassiusculo, subangulato suffulta, nunc monosperma, obovoidea, pisi majoris mole, nunc 2–4-sperma, oblique obovoidea vel claviformia pollicaria, omnia juxta apicem appendice alæformi rostrata.

*Observatio.*—Stirps ob florum miram copiam eorumque odorem gratissimum, quem late spargunt, inter affines insignis, nec non propter corticem aromatico-amaricantem pharmacographis de futura Africæ tropicæ materia medica scripturis commendanda. Autochthonum illius regionis medici circumforanei (*quibanda* dicti), non semper omnino imperiti, e florum vix apertorum infusione tepida potum parant stimulantem simulque subnarcoticum, de cujus tamen applicatione speciali non edoctus fui.

## Ordo VIOLARIEÆ.

## Trib. III. ALSODEIEÆ, Benth. et Hook. f. Gen. Pl. p. 118.

*ALSODEIA (CERANTHERA) ILICIFOLIA*, Welw. n. sp. (Tab. II.) Fruticosa vel subarborescens, glabra; foliis coriaceis, ovali-oblongis, elongatis, acutis, argute et grosse spinuloso-serratis; floribus flavis, brevissime pedicellatis, recurvis, in paniculas angustas terminales folio breviores fasciculatim dispositis; sepalis ovato-ellipticis,



obtusis; petalis obtusis (sepalis subbrevioribus\*); tubo stamineo brevi, extus haud producto, antheris connectivo dorsali ovato obtuso, appendicem anteriorem ovalem integram vel emarginatam superante; capsula coriacea, ruguloso-aspera.

*Habitat* sporadica in rupium convallibus umbrosis Distr. Pungo Andongo, ubi prope Præsidium ipsum, loco dicto "Barrancos de Catete," Febr. c. alabastris et fructu submaturo, Maio denique iterum cum alabastris legi, ad altit. circiter 3500 ped. supra mare. *Exsic.* Welw. Iter Angol. no. 889.

Frutex validus, sive arbuscula, 8-12-pedalis, *Ilicis aquifoliae* habitum quodammodo simulans, rigiditate omnium partium insignis, sempervirens. Trunculus rectus cortice cinereo-virescente parum aspero, ligno albido compacto, sæpius jam ad 3 vel 4 pedes altitudinis supra basim ramosus; rami erecto-patuli, laxè ramulosi, cylindrici, adultiores levigati et nitenti-virides; ramuli novelli plus minusve angulati, erectiusculi, firmi et tenaces. *Folia* alterna, breviter petiolata, rigidicoriacea, glaberrima, supra intense viridia, subtus ex albido virentia et prominule venulosa, nunc ovali-oblonga, elongata et acuminata, nunc breviora et late elliptica, penninervia, nervo mediano valido subtus valde prominente, in petiolo firmo erecto-patula; petioli in uno eodemque ramo longitudine variantes, nunc vix semipollicem, nunc plus quam sesquipollicem longi, semiteretes, canaliculati, ad insertionem laminæ dorso gibbi; lamina 7-9 poll. longa, 2-2½ poll. lata, basi breviter angustata vel obtusiuscula, apice acuta vel acuminata, margine argute serrata, serraturis sinu lato obtusissimo sejunctis apice rigido-spinulosis, spinulis 1-1½ lin. longis, subulatis. *Paniculae* terminales, erectæ, angustæ, 5-7 pollices longæ, aphyllæ; pedunculi communis angulati, sub lente tenuiter velutino-pubescentis rami basi bracteis brevibus crassiusculis ovatis muniti, inferiores 1-2 poll. longi, parce ramulosi, erectiusculi, superiores sensim breviores, summi brevissimi. *Flores* (nonnisi in alabastris observati) flavii, ceraceo-carnosuli, pedicellati, juxta ramulos pedunculi per fasciculos pauciflores ½-½ pollicis inter se distantes dispositi, ex pedicello ipsis sæpius dimidio breviorè basi bibracteolato, crassiusculo, angulato, arcuatim recurvato nutantes vel fere penduli, vix tres lineas longi. *Sepala* a basi lata ovato-elliptica, erecto-imbricata, concava, obtusissima, margine ciliolata, crassiuscula, rigida, dorso tenuiter pubescentia et sulcato-striata, petalis latiora, in fructu persistentia. *Petala* juvenilia ejusdem fere figuræ ac sepala, sed iis angustiora et breviora. *Stamina* descripta. *Ovarium* glabriusculum; placentæ pauci-(uni-?) ovulatae; stylus terminalis, rectus, pro more floris crassiusculus, cylindricus, medio quidquam incrassatus, apice obtusiusculo stigmatosus, staminibus paullo brevior. *Capsula* ovoidea, coriacea, calyce indurato stipata, extus rubro-purpurea, undique rugulis papillisque aspera, elastice dehiscens, 3-valvata, 3-sperma, vel placentæ unius abortu disperma, valvis cymbimorphis sublignosis, medio placentiferis. *Semina* (vix bene matura) subglobosa vel sublenticulari-compressa, diametro longiore circiter 5 lineas longa, pone umbilicum excavatum obtuse rostrata, testa crustacea, levigata, nitidula badio-flavescente. Embryo in albumine copioso axilis excentricus, umbilico approximatus; cotyledones obovato-ellipticæ, planiusculæ, vaginatim conferruminatæ, radícula hilo proxima.

### Ordo BIXACEÆ.

Trib. II. ONCOBÆ, Benth. et Hook. f. Gen. Pl. 125.

ONCOBA WELWITSCHII, Oliv. Flora of Trop. Afr. MS. (Tab. III.) Arborescens, inermis, glabra; foliis membranaceis, longe petiolatis, ovatis, acuminatis, basi late rotundatis; floribus pedunculatis, ad ramulos annotinos vel vetustiores nascentibus 3-5 fasciculatis; sepalis 3 late ellipticis; petalis circiter 10 obovatis longiuscule unguiculatis, sepalis plus quam duplo longioribus; antheris linearibus quam filamenta capillaria multo brevioribus; ovario papilloso-setoso, placentis 5-6; stylo gracili longiusculo

\* Flores in nostris speciminibus necdum bene evoluti et solummodo in alabastris anthesi proximis examinati; relatio proinde inter sepala et petala in postero accuratius statuenda.



apice in lobos 5-6 breves patentis diviso, stigmatibus truncatis; capsula ovoidea, dense echinata, 5-6-valvata, valvis intus nudis medio placentiferis post dehiscentiam recurvis; seminibus dense verruculosus.

*Habitat* sporadica in silvis primævis Distr. Golungo Alto prope Bungo Aquitamba, ad 2300 ped. altit., necnon sub forma fruticis in silvis secundariis circa Sange. Floret Novemb. usque Febr., Martio usque Jul. fruct. maturat. *Exsic.* Welw. Iter Angol. no. 537.

Arbuscula 12-15-pedalis, hinc frutex vix 8 pedes altus. Truncus in forma arborescente rectus, diametro semipedali, raro crassior, cortice minute rimuloso badio-cinerascente, ligno albido denso, sæpius jam ad altitudinem 4-5 pedum supra basim ramosus, ramis robustis elongatis ascendentibus, infra longe denudatis, apicem versus parce ramulosus; ramuli graciles, patentis, tenuiter sulcati, lenticellis ellipticis obsiti, novelli levigati apice densius foliosi. *Folia* alterna, longe petiolata, ampla, ovata, longe acuminata, supra læte viridia, verniceo-nitidula, subtus pallide virentia, glabra; petioli 3-4½ pollices longi, graciles, patuli, basi obiter canaliculati, ad insertionem laminæ quidquam incrasati et curvati; lamina (in foliis adultis ex apice petioli fere pendula) 6-10 poll. longa, 3-5 poll. lata, margine integro vel obscure repando, basi rotundato-obtusa, apice nunc sensim, rarius abrupte in acumen 1 poll. circiter longum attenuata; stipulæ laterales geminæ, foliaceæ, lineari-subulatæ, semipollicem circiter longæ, erectæ, deciduæ. *Flores* polygami, ex speciosissimis inter congeneres, diametro 4-pollicares, quondam in eodem ramo multo minoribus mixti, ad ramulos vetustiores vel imo ad truncum ipsum nascentes, plerumque 3 vel 4 fasciculati, pedunculis 1-1½ poll. longis coloratis basi minute bracteolatis suffulti, evolutione successiva aperti. Alabastra globosa, apiculata, paullo ante anthesim vesiculose turgescencia. *Calyx* tenuiter coriaceus, triphyllus, sepalis æstivatione late imbricatis, concavis, obtuse carinatis, pollicem longis, semipollice latioribus, extus pube minutissima caduca subvelutinis, fusco-rubentibus, demum deciduis. *Petala* 9-12, plerumque 10 vel 11, alba vel albido-rosea, obovato-spathulata, patentia, membranacea; lamina obovata 1-1½ poll. longa, venulis sursum divergentibus percursa, margine integro obiter undulata, sensim in unguem ½-¾ poll. longum compresso-planum 1 lineam latum attenuata, una cum staminibus decidua. *Stamina* numerosissima; filamenta filiformia, ascendentia, albida, pollicem longa; antheræ terminales, intense flavæ, oblongo-lineares, basi subcordatæ, quam filamenta multoties breviora, biloculares, longitudinaliter dehiscentes; pollinis granula globoso-ellipsoidea, levia. *Ovarium* ovoideum, papillis acutiusculis undique echinulatum; ovula juxta placentas parietales 5 vel 6 perplurima; stylus rectus, cylindricus, fere pollicem longus, apice radiato 5-6-lobus, demum indurescens, in fructu persistens. *Capsula* matura globosa vel sæpius ovoidea, undique aculeis rigidulis 1 pollicem longis læte aureo-flavis echinata, tarde dehiscentis, 5- vel 6-valvata, valvis crassis, lignoso-duris, demum arcuato-recurvis, intus nudiusculis, medio placentiferis. *Semina* permulta in pulpa nidulantia, parvula, duabus lineis vix longiora, ovoidea, fuscula, crebre verruculosa, vertice truncato areola in centro umbonata instructa; testa crustacea; embryo rectus; cotyledones planæ, ovatæ; radícula crassiuscula cotyledonum fere longitudine, hilo proxima.

#### Ordo POLYGALEÆ.

*POLYGALA GOMESIANA*, Welw. n. sp. (Tab. IV.) Perennis, herbacea; caule erecto 2-5-pedali; foliis lineari-lanceolatis linearibusve, utrinque sæpius angustatis, glabris vel sparse pilosulis; racemis terminalibus amplis multifloris, bracteis bracteolisque membranaceo-scariosis ovato-lanceolatis acuminatis persistentibus, pedicellis patentissimis pilosis; sepalis anterioribus liberis, alis suborbicularibus diametro semipollicaribus, coloratis; capsulis obcordatis, alis dimidio brevioribus anguste marginatis.



*Habitat* in pratis humidis altius herbidis juxta rivulos Distr. Huilla, frequens circa Lopollo, ad 5000 ped. altit. A Decembr. usque Apr. florens et fructificans. *Exsic.* Welw. Iter Angol. no. 1032.

Herba elata, radice lignescente oblique descendente, oligocephala, perennans. *Caules* e radicis collo 1-3 erecti, virgati, tri- vel quatuor- rarius quinquepedales, simplices vel apicem versus parce ramosi, cylindrici, obiter sulcato-angulati, pilis raris mox deciduis glabrentes, a basi ad medium densius, supra remote foliati. *Folia* alterna, erecto-patula, subsessilia, plerumque omnino glabra, late herbaceo-viridia; inferiora et media approximata, lineari-lanceolata,  $1\frac{1}{2}$ -3 poll. longa, semipollice vix latiora, utrinque sensim angustata, subacuta vel apice obtusiusculo breviter apiculata, margine integro, nervo imprimis subtus ad basim prominulo flavescente percursa; superiora magis distantia, sensimque angustiora, breviora et acutiora, sæpius linearia; floralia sub anthesi plerumque decidua. *Racemi* in caule et ramulis terminales, erecti, stricti, ampli,  $\frac{1}{4}$ -1-pedales, multiflori, juveniles bracteis apice densius congestis breviter comosi. *Flores* ex majoribus et speciosissimis totius generis, in pedunculo communi pilis brevibus patulis vestito densiuscule gregati, una cum bracteis, bracteolis pedicellisque amœnissime rosei vel roseo-purpurascens, subnutantes. *Bractea* tenuiter membranaceo-scariosa, 3-4 lin. longæ, ovato-lanceolata, longe acuminata, patulæ, una cum bracteolis itidem patulis paullo brevioribus obtusioribusque persistentes. *Pedicelli* graciles,  $\frac{1}{2}$ - $\frac{3}{4}$  poll. longi, albido-pilosi, sub anthesi horizontaliter patentés, demum arcuato-deflexi, fructiferi cernui. *Sepala* 5, omnia libera; tria exteriora inter se subæqualia, parva,  $1\frac{1}{2}$ -2 lin. longa, obovato-elliptica, obtusiuscula, extus sparse pilosa; interiora (alæ) multo majora, lætissime roseo-purpurea, oblique lato-obovata vel fere orbicularia, diametro circiter semipollicaria, ima basi abrupte attenuata, glabra, tenuiter venulosa, obiter convexa, petala occultantia. *Petala* tria, basi inter se et cum staminum vagina concreta; inferius (carina) concavo-galeatum, dorso crista latiuscula intense purpurea profunde bifida auctum, ad verticem leviter emarginatum, ad marginem prope basim utrinque plus minusve profunde sinuatum et pilosum; lateralia quam carina breviora, ovato-oblonga, margine superiore inflexa laxè crispata, ad faciem internam laminae partis cum vagina staminali connatae piloso-pubescentia, ad ejusdem partem liberam glabra, verticaliter sursum curvata, apice obtusa vel subtruncata. *Staminum* vagina basi juxta margines piloso-ciliolata; antheræ oblongo-ovoideæ, obiter compressæ, subtiliter puberulæ vel sæpius omnino glabræ, apice oblique truncato biporosæ (septulo parum efformato vel deliquescente?) *uniloculares*. *Pollinis* granula (in una eademque anthera) nunc sphæroidea nunc breviter-ellipsoidea, longitudinaliter costato-striata, sensu directioni costularum contrario et non raro jam intra antheras necdum apertas tubificantia. *Ovarium* obovatum, vertice circa styli insertionem pilosum; stylus compressus latiusculus, medio dilatatus, paullo supra medium arcuatus, ad apicem plus minusve oblique truncatus vel obscure angulatus, anguste stigmatosus. *Capsula* obcordata, rigidulo-membranacea,  $2\frac{1}{2}$ -3 lineis vix longior, compressa, anguste marginata, ad apicem nunc pilis raris obsita nunc omnino glabra, disco utrinque bigibba. *Semina* oblongo-obovoidea, circiter  $1\frac{1}{2}$  lin. longa, pilosa, vertice areola depressa notata, caruncula pro seminis mole parva; albumen parcum.

*Observatio.*—Nomine specifico hujusce stirpis elegantissimæ ac culturæ dignissimæ virum saluto, doctrina et urbanitate pariter insignem, clar. *Bernard. Ant. Gomes*, Med. Doctorem, horti scholæ medico-chirurgici Olissiponensis fundatorem, Floræ fossilis Lusitaniæ scrutatorem sedulum, nec non medicum expertissimum, studiorumque meorum fautorem.

#### Ordo DIPTEROCARPEÆ.

VATICA AFRICANA, Welw. n. sp. (Tab. V.) Frutex vel arbor parva; ramulis novellis tomentoso-pubescentibus, raro glabris; foliis coriaceis, oblongo-ellipticis, obtusis, basi vel obtusis vel anguste rotundatis, nunc subcordatis, supra glabrescentibus, subtus ferrugineo vel albo tomentosis; cymis racemiformibus axillaribus folio brevioribus vel



floribus apices ramulorum versus fasciculatis; sepalis subliberis ovatis obtusis, petalis oblongo-lanceolatis sepalis triplo longioribus; staminibus indefinitis bi- (vel pluri-) seriatis, filamentis filiformibus, antheris ellipticis ovatisve, connectivo breviter apiculatis; fructu globoso subapiculato, calycis fructiferi lobis inter se subæqualibus patentibus oblanceolatis vel oblongo-obovatis, obtusis acutisve, nervis anastomosantibus prominulis grosse reticulatis.

*Habitat* in silvis et dumetis arenosis Distr. Huilla, inter 4000 et 5500 ped. altit., imprimis frequens ad basim de "Morro de Lopollo." Floret Octobr. usque ad Januar., Apr. et Maio fructificat.

Stirpis hujusce polymorphæ præcipue duæ in Angola mihi obvenerunt formæ, inter se habitu et magis adhuc foliorum indumento diversæ, junctimque vix commode describendæ, quapropter eas hic seorsim tractandas et characteribus utrique peculiaribus limitandas esse existimavi, ut sequitur.

*α. denudans.* (Tab. V. fig. 1.) Forma plerumque fruticosa, foliis subtus laxe ferrugineo-tomentosis pubescentibusve vel glabratis.

Frutex humanæ altitudinis resinosis, paullo supra basim ramosus, rarius arbuscula vix 8-pedalis, habitu *Grewiæ* speciem æmulans; rami cylindrici, inferiores et superiores breves, mediis elongati, patentes, glabrentes, ramulis novellis et florigeris gracilibus subangulatis tomento laxiusculo pubescentibus vel hinc inde furfuraceo tomentellis. *Folia* alterna, petiolata, chartaceo-coriacea, quoad figuram sat varia, plerumque oblongo-elliptica, ad basim et apicem rotundato-obtusa, nunc ad basim angustato-rotundata vel subcordata, ad apicem emarginata, rarius utrinque subangustata fere lanceolata, supra glabrescentia, halitu flavescente virentia, nervis impressis oblique striata, prope basim paullo supra petioli insertionem glandula concava rubra orbiculari vel subelliptica notata, subtus basi ferrugineo-tomentosa vel villosa-pubescentia, aut fere deglabrata æneo-viridia, nervo medio et lateralibus valde prominentibus elevatim costata, inter nervos prominule reticulato-venulosa\*; petioli 3-6 lin. longi, cum ramulis articulati, cylindrici, villosa-pubescentes, nunc adultiores glabrentes vel tenuiter verruculosi; lamina 1-2½ poll. longa, ½-1½ poll. lata, ast plerumque pollice angustior. *Stipulae* petiolares geminae, lineari-lanceolatae acuminatae, sub folii evolutione caducae. *Inflorescentia* cymoso-racemosa, axillaris vel spurie terminalis, pedunculo communi tunc ex penultimi folii axilla infra gemmam apicalem evoluta. *Pedunculus*, pedicelli, bracteolæ et calyx villosa-pubescentes. *Sepala* basi breviter coalita, in alabastro linea vix longiora, evidenter imbricata, ovata, obtusa, erecto-subpatula, persistentia, post anthesim sensim aucta. *Petala* oblongo-lanceolata, sepalis duplo subtriplove longiora, sub anthesi patentia, extus tenuissime velutino-tomentella albida, intus flavicantia glabra, solum medio basin versus pilosula, prompte decidua. *Stamina* perplura, ultra 50, circa ovarium annulatim seriata, patula; filamenta gracilia, compressiuscula, plerumque biserialia, albida; antheræ flavæ, connectivo nunc magis producto et robustiore ovatae, nunc illo brevior subellipticae, loculis inter se fere semper magnitudine inæqualibus, introrsum dehiscentibus. *Ovarium* ovoideum, pilosum, tri-, rarissime biloculare, loculis biovulatis; stylus firmulus, rectus, cylindricus, apicem versus parum attenuatus, stigmate breviter tri-, rarissime bilobo, lobulis teretibus patulis apice subtilissime fimbriatis. *Fructus* calycis nunc valde aucti fundo insidens, globosus vel ovoideo-globosus, pisi magni mole vel imo paullo major, plus minus pubescens vel subtomentosus, durus, styli basi indurata apiculatus, vix dehiscens, uni-, rarissime bilocularis, mono-, rarissime dispermus; calycis fructiferi sepala basi breviter coalita in alas subæquales foliiformes

\* Facies inferior foliorum, oculis nudis aspecta, tomentosa quidem apparet, et in quibusdam formis revera tomento tenui undique obducta est; sed lente fortiore examinata plerumque solum nervi et venularum acies pilis crispulis plus minus dense obsita inveniuntur, areolæ autem e venularum anastomosi ortæ solummodo pilis raris adpersæ vel plerumque centro omnino glabras sese manifestant, id quod in varietate *β. hypoleuca* nunquam observare mihi licuit.



scariose-rigidulas, oblanceolatas, apice obtusiusculo apiculatas, læte rubentes, obiter pubescentes,  $1\frac{2}{3}$  poll. longas, 6–8 lin. latas, utrinque elevatim reticulato-venosas expansa. Semina perfecta non visa. Crescit hæc varietas satis frequens in collinis apricis arenosis inter pagum Lopollo et Morro de Lopollo, ad 5000 circiter pedum elevationem; Decembr.–Januar. florentem, Maio demum 1860 fructificantem legi. *Exsic.* Welw. Iter Angol. no. 1035.

*Observatio.*—Stirps, ut videtur, late per Africam austro-tropicam diffusa, a clar. Dre. Kirk (fide spec. herb. Kew.) etiam in Zambesiæ editioribus (Highlands of Batoca-country, Jul.–Octobr. 1860) lecta.

*β. hypoleuca.* (Tab. V. fig. 12.)

Forma arborea, foliis subtus dense albo-tomentosis.

Arbor parva, 12-pedalis et altior, habitu *Cratægo Ariae* Linn. non dissimilis, trunco recto,  $\frac{1}{2}$ –1 ped. prope basin crasso, coma laxissima, depresso-dilatata; rami patenti-divaricati, crassi, varie curvi, ramulis abbreviatis robustis, apice ad ultimorum foliorum axillas florigeris. *Folia* quoad figuram iis varietatis præcedentis subsimilia, etiam ad petioli insertionem glandulifera, sed omni sensu triplo majora et crassiora, petiolis  $\frac{1}{2}$ –1 poll. longis, lamina  $2\frac{1}{2}$ – $5\frac{1}{2}$  poll. longa,  $1\frac{2}{3}$ – $1\frac{3}{4}$  poll. lata, apice obtuso sæpius emarginata, basi non raro subcordata; juniora utrinque tomentosa, adultiora supra læte viridia et tenuiter pubescentia, subtus tomento denso albido obtecta. *Flores* majores, petala villosa-tomentosa. *Fructus* non observatus. Crescit sporadica et rarior in silvis subumbrosis maxime e *Leguminosis* constantibus ad altit. 4000–4500 ped., inter Mumpulla et Nene, ubi Octobr. 1859 c. alabastris et Decembri cum flore legi. *Exsic.* Welw. Iter Angol. no. 1036 [*Vatica hypoleuca*].

*Observatio.*—Varietas admodum conspicua, extra Angolæ limites hucusque nondum observata, forsitan species propria, sed fructu nondum cognito vix bene limitanda. Ceterum monendum habeo, stirpes perennes generatim, et imprimis arborescentes Floræ Huillensis aliorumque districtuum Angolæ et Benguellæ interiorum, ob silvarum incendia a pastoribus ibidem vagantibus per secula quolibet anno repetita, quoad habitum et variarum partium indumentum maximopere variare, id quod præcipue in variis *Syzygii*, *Parinari*, *Anonæ* et *Fici* speciebus observare licet, quæ in silvis nullo adhuc incendio mutilatis quæ arbores proceræ superbiunt, dum eadem species in pascuis proximis post combustionem silvarum enatis (a nobis nomine “*dumeta secundaria*” indicatis) nonnisi sub formis pygmæis, ceu fruticuli humiles sæpius vix palmares sive pedales, ast densis cæspitibus crescentes, et nihilominus hocce in statu læte florentes atque fructificantes occurrunt.

## Ordo STERCULIACEÆ.

Trib. 1. STERCULIÆ, Benth. et Hook. f. Gen. Pl. i. p. 217.

### OCTOLOBUS, Welw. gen. n.

*Flores* unisexuales. *Calyx* campanulatus, tubo subcylindrico limbo octofido; lobi coriacei marginibus late membranaceis induplicatis undulato-crispulis. *Petala* nulla. *Staminum* columna brevis, cylindrica, androphoro elongato-conico tomentoso imposita; antheræ perplurimæ in discum orbicularem vertice depressum connatæ. *Ovarii* carpella perplurima, multiseriata, in capitulum globosum gynophoro brevi impositum conferta, capitulo basi verticillo staminum imperfectorum cincto; carpella turgida, libera, elongato-ovoidea, dense tomentosa, unilocularia; stylus subnullus; stigma sessile obiter bilobum; ovula plurima biseriata. *Carpella* matura 8–10 distincte stipitata, turgida, obovoidea vel



clavata, gibba, rostro obliquo terminata, tarde dehiscentia, 1-3-sperma. *Semina* subglobosa, hilo lato sessilia, testa lævigata, subcoriacea; albumen nullum. *Embryo* subglobosus; cotyledones crassæ, hemisphæricæ; radícula brevissima, inclusa; plumula pilosa.—Arbor Africae tropicæ austro-occidentalis, laxe comosa, ramulis robustis. *Folia* alterna, indivisa, longiuscule petiolata, petiolis apice incrassatis, obovato-lanceolata, obtuse acuminata, obscure sinuata, coriacea, glaberrima. *Stipulae* geminae laterales caducae. *Flores* magni ad ramulos sessiles, subsolitarii, fulvo-villosi. Genus antheris uniseriatim annulatis, albuminis defectu et ovarii loculis pluriovulatis *Colæ*, Schott, proximum et affine, sed calyce constanter 8-fido, coriaceo, carpellorumque numero indefinito sine negotio distinguendum. Species unica.

### OCTOLOBUS SPECTABILIS, Welw. sp. n. (Tab. VI.)

*Habitat* sporadica in silvaticis rupestribus Distr. Pungo Andongo, præsertim prope Præsidium loco dicto "Barranco da Pedra Songue" Jan. 1857 cum flore, Apr. c. fr. legi. *Exsic.* It. Angol. no. 1202.

Arbor 15-20-pedalis, rarius altior, trunco recto, gracili, basi 1-2 ped. circumferentiæ, cortice albido-griseo leviter rugoso, coma laxa sursum dilatata vertice depressa. *Rami* vagi, elongati, erecto-patentes, longe denudati, albicantes, apicem versus parce ramulosi, ramulis patulis, cylindricis, pennæ anserinæ vel hinc olorinæ crassitudine, novellis et junioribus angulato-sulcatis villoque fulvescente mollissimo demum deciduo vestitis, adultis glabris, longitudinaliter rugulosis, albescentibus. *Folia* alterna, versus apicem ramulorum congesta, integra, petiolata, obovato-lanceolata, coriacea, supra læte, subtus pallide viridia, juventute bistipulata; petiolus  $\frac{1}{2}$ - $2\frac{1}{2}$ -pollicaris, angulatus, junior laxe villosus demum glabratus, basi tumescens, subcanaliculatus, apice abrupte calloso-incrassatus, callo subcylindrico 2-3 lin. longo transverse ruguloso, subviscido, modice arcuato ad basim laminæ terminante; lamina utrinque glaberrima, 5-9 pollices longa, 1- $2\frac{1}{2}$  poll. lata, plerumque obovato-lanceolata, nunc, præsertim in ramulorum extremis, lanceolata, basi sensim attenuata, ad insertionem subtruncata, apice obliquo obtusiuscule acuminata, margine integro vel hinc inde obscure sinuato, penninervia, nervo medio basi valido ad apicem usque producto, lateralibus multo tenuioribus in utraque pagina sed subtus argutius prominentibus, versus marginem evanescentibus. *Stipulae* geminae, juxta basin petiolorum laterales, liberæ, anguste lineari-lanceolatae, subulato-acuminatae, erectæ, rigidulæ, 2-3 lineas longæ, ad ramulorum novellorum apices comoso-gregatae, caducissimæ. *Flores* unisexuales, monoici, apetalæ, sat magni, imo totius tribus maximi, ad ramulos infra foliorum comam apicalem sessiles vel breviter pedunculati, solitarii, vel rarissime 2-3 gregati, bracteis pluribus brevibus, scariosis, late ovatis, extus tomentellis, intus nudis, striatis, demum deciduis, quodammodo calyculati. *Alabastra* globosa vel obovoidea. *Calyx* turbinato-campanulatus, sesquipollicem longus, carnosus-coriaceus, extus undique villosus-tomentosus, villo fulvo-cinnamomeo, post fecundationem deciduus; tubus cylindricus sursum quidquam dilatatus, diametro semipollicari, intus plurisulcatus et papillis minimis cinnamomeo-aurantiacis plus minus dense obsitus; limbi octofidi, æstivatione induplicato-valvati; lacinia lanceolata,  $\frac{3}{4}$  pollic. longæ, erecto-patulæ, margine circumcirca membrana latiuscula, tenuiter carnosæ, fragili, induplicata, undulato-crispula cinctæ, facie interna papillis tenuibus brevissimis cinnamomeis densissime gregatis velutino-tomentosæ. *Androphorum* anguste conicum, dense tomentellum, una cum staminum columna brevi glaberrima et antherarum disco circiter calycis tubo æquilon-gum; antheræ numerosæ (25 et plures), rectæ, biloculares, arcte inter se in discum vertice truncatum connatae, singulae fere lineam longæ, cinnamomeæ. *Gynæcii* circumscriptione obovoidei carpella per-plurima (60-80) pluriseriatim dense congesta, ascendencia, inter se libera, oblique elongato-ovoidea, dense canescentia, unilocularia, biseriatis pluriovulata, ovulis horizontalibus; stigma ad carpellorum apicem oblique sessile, turgidum, obtusum, plus minusve evidenter bilobum, atropurpureum, dense papillosum. *Staminum* imperfectorum basim gynophori annuli ad instar cingentium antheræ liberæ, plus minusve arcuatae, dorso connectivo crasso sursum curvato adnatae, illis androphori plerumque breviores, vel varie defiguratae, omnino steriles. *Carpella* matura 6-10, rarius plura,



distincta, stipite 2–4 lin. longo, cylindrico vel subcompresso villosa suffulta, magnitudine et figura inter se inæqualia, obovoidea vel clavata, lateribus subcompressa, ceteroquin turgida,  $1\frac{1}{4}$ – $1\frac{3}{4}$  poll. longa, coriacea, oblique vel recurvato-rostrata, extus tomentosa e viridi flavicantia, interna facie plicato-rugulosa denseque resinoso-punctata, unilocularia, 2- rarius 3–4-sperma, tarde dehiscencia. *Semina* subglobosa vel obovoidea pisi maximi mole et majora, hilo latissimo orbiculato vel ellipsoideo sessilia; testa subcoriacea, lævigata, atra vel atropurpurea, nitida, strato interiori tenaci reticulatim fibroso. *Embryo* exalbuminosus, semini conformis, rectus; cotyledones crassæ, hemisphæricæ, radiculam brevissimam obtuse conicam, plumula pilosa superatam, arcte includentes.

*Observatio.*—Gynæcii structura et configuratio generis præsentis notabilem cum illa quarumdam *Anonacearum* offert similitudinem, etiamsi vera affinitas has inter et *Sterculiaceas*, in systemate sub cohorte longius distante militantes, vix, ac ne vix quidem invenienda.

### Ordo ZYGOPHYLLÆ.

#### ZYGOPHYLLUM. Sectio A. FABAGO.

##### Subsectio a. *Simplicifolia*.

ZYGOPHYLLUM ORBICULATUM, Welw. n. sp. Glabrum, glaucum, fruticulosum, caulibus obliquis vel ascendentibus vix sesquipedalibus, crassis, succulentis, rigidis, cylindricis, subflexuosis, ramis patulis, articulatis, ad nodos leviter incrassatis, foliis planis crassissimis, flabellato-orbiculatis vel summis obovato-spathulatis, bene adultis 2– $2\frac{1}{2}$  pollices latis, glaucis, glaberrimis, margine rotundato integris, basi in petiolum brevem cuneato-angustatis, internodiis longioribus, stipulis carnosis ovatis obtusis 3–4 lin. longis, pedunculis geminis (vel ternis!) 3–5 lin. longis, fructiferis pollicaribus, floribus pentameris, calycis tarde decidui carnosuli laciniis obtusis, petalis albis longe unguiculatis, calyce duplo longioribus, stamina superantibus, squamis quam filamenta paullo brevioribus, subliberis, albido-membranaceis, apice fimbriatis; ovario clavato, obtuse 5-gono, stylo staminum longitudine; fructu majusculo late penta-  
ptero, depresso obovoideo, vertice parum emarginato stylo apiculato (axi 9- diametro 7–8-lineari, alis semiobovatis elevatim reticulatis), loculicide 5-valvi, loculis endocarpio solubili 1–2-spermis, seminibus dense foveolatis, raphe ex parte libera.

*Habitat* frequentissimum in sabulosis et petrosis maritimis Distr. Mossamedes, ex Giraul usque Cabo negro, sæpius in *Zygophylli simplicis*, *Sesuviorum* et *Vogeliæ Africanæ* consortio. Maio–Julio flor., mox et usque ad Sept. fructificat. *Exsic.* Welw. Iter Angol. no. 1637.

*Fruticulus* dumosus, rigidissimus, 1–2-pedalis, succulentus, quibusdam *Scævola* vel *Crassula* speciebus habitu non absimilis, plagæ maritimæ sabulosæ vel rupestris decus triste. Caules pennæ olorinæ vel hinc inde digiti minimi crassitudine, plerumque tortuosi, lignescentes epidermide tenui flavo-fuscescente facile secedente tecti, nunc opposite nunc dichotome ramosi. Internodia circiter pollicaria. *Folia* simplicia (anne ceu *phyllochia* consideranda?), inferiora et adultiora, petiolo brevi cuneato excepto, fere orbiculata, diametro non raro bipollicari et majore (lamina  $\frac{1}{4}$  poll. crassa, succoso-carnosa, in viva planta, more phyllodiorum *Acaciarum* verticaliter sita), ea ramulorum novellorum flabellato-spathulata, nervis 3–5, solum in folio exsiccato prominentibus percursa et minus glauca; pedunculi 2 vel 3 (rarius sed quondam certe plures ad 5) ex eadem stipularum axilla erecti, fructiferi elongati et patentés. *Calycis* herbaceo-viridis laciniæ carnosio-tumidulæ, obovato-oblongæ, obtusæ, concaviusculæ, post anthesin reflexæ. *Petala* flabellata, ungue longo, lateribus integra, apice rotundato



denticulata, nervis purpurascensibus flabellatim partitis percursa, una cum ungue  $3\frac{1}{2}$ –4 lin. longa. *Squamæ* circiter  $\frac{2}{3}$  longitudinis filamentorum, filamenta quasi vaginantes. *Ovarium* in disco leviter concavo sessile 5-loculare, ovula in loculis 4 vel 5. *Fructus* plene maturus scariosus, plerumque calyce reflexo suffultus, circumscriptione obovoideus, basi truncatus, vertice quidquam depresso sive emarginato styloque indurato  $1$ – $1\frac{1}{2}$  lin. longo superatus, ad axim usque pentapterus; alæ compressæ, nervo hinc inde evanescente marginatæ, demum ab axi centrali solubiles; loculorum endocarpium solubile, tenuiter pergameum, nitidulum. *Semina* in loculis 1 vel 2, obovato-subreniformia, lenticulari-compressa, marginata,  $2$ – $2\frac{1}{2}$  lin. longa, testa brunnea foveolis alveoliformibus dense obsita.

### Ordo BURSERACEÆ.

Trib. I. BURSEREÆ, Benth. et Hook. f. Gen. Pl. v. i. p. 321.

#### PAIVAEUSA, Welw. gen. nov.

*Flores* unisexuales, axillares, apetalæ; masculi subsessiles, plures in capitula involucrata breve pedunculata dense congesti; feminei solitarii vel foliorum abortu subfasciculati, breviter pedunculati.

**FLORES MASCULI.** *Calyx* subobliquus, profunde 6–8-fidus, laciniis obtusis, erectis, sæpius inæqualibus, æstivatione imbricatis. *Stamina* 6–8 fundo calycis circa discum crenatum inserta, exserta; filamenta filiformia glabra; antheræ breves, erectæ, biloculares, loculis basi subliberis lateraliter dehiscentibus. *Ovarii* rudimentum obsoletum.

**FLOR. FEM.** *Calyx* maris, sed amplior et basi ad latus externum tribracteolatus. *Ovarium* ovoideum in stylum attenuatum, basi squamulis 6–7 brevibus minutis ciliatis non raro in discum confluentibus cinctum, biloculare; stylus brevis; stigmata duo reniformia; ovula in loculis gemina prope apicem loculi septo inserta, pendula. *Fructus* (immaturus) pedunculo elongato tribracteolato et calyce persistente stipatus, ovoideus, longitudinaliter bicostulatus, stigmatibus persistentibus terminatus, tomentosus; epicarpium coriaceum bivalve; putamen chartaceum incomplete biloculare, pyrenibus 1–2 in quoque loculo; pyrenes ossei, compressi, membrana carnosulo-mucosa obducti, ex apice columellæ centralis funiculo crasso penduli, liberi, monospermi. *Semen* loculo conforme, inversum, compressiusculum, testa membranacea, endopleura solubili. *Albumen* 0. *Cotyledones* rectæ, planæ, late obcordatæ, ad radiculae insertionem emarginatæ, tenuiter membranaceæ, virides; radícula brevis, recta, cylindrico-conoidea, obtusiuscula, supera.

Arbor parva Africae austro-tropicalis, coma laxa ramulis crassis tuberculato-cicatratis, cinerascentibus, gemmis novellis rufo-tomentosis. *Folia* ad apices ramulorum patentia, longe petiolata, digitato 5-foliolata, foliolis subsessilibus lanceolato-vel obovato-oblongis obtusiusculis integerrimis cum petiolo articulatis, coriaceis, subtus tomentosus. *Flores* parvi, inconspicui; feminei subsolitarii, masculi numerosi cymoso-fasciculati, cymis in capitula densa bracteis involucrata contractis.

Genus insigne sed valde anomalum, *Burseraceis* quidem absque fere dubio adnumerandum, ast nulli ex generibus cognitis arcte affine, imo ab omnibus hucusque descriptis floribus apetalis, cotyledonibus omnino planis foliisque digitatim 5-foliolatis longius distans, et probabiliter novæ inter tribum *Burseracearum* sectionis typus. *Calyx* 6–8-fidus una cum staminibus 6–8 prope marginem disci insertis et inæqualibus necnon pyrenes liberi aliquam cum genere *Protium* affinitatem indigitant; petalorum defectus forsitan ex cymularum perplurium arcta condensatione florumque singulorum mutua pressione explicandus.

Dicatum est genus hocce clarissimo domino Barão do Castello de Paiva, botanices in Academia Portensi Professori, Faunæ malacologicæ Maderensis etc. fortunato exploratori.



Species unica :—

PAIVAEUSA DACTYLOPHYLLA, Welw. (Tab. VII.)

*Habitat* in silvis parum densis siccioribus Districtus Huilla, ad 5000 ped. circiter altitud., inprimis inter pagum Lopollo et flumen Monino, ubi specimina c. flore et alia cum fructu immaturo legi Februario 1860. *Exsic.* Welw. Iter Angol. no. 452.

Arbuscula 8–15-pedalis, aspectu *Viticis* speciem quodammodo referens, trunco recto  $\frac{1}{3}$ – $\frac{1}{2}$  ped. diametri, cortice aspero late rimoso, cinerascete vel fere nigrescente, coma laxiuscula sursum dilatata; rami patuli arcuato-ascendentes, crassi, rigidissimi, fere cinerei, undique foliorum delapsorum cicatricibus in tubercula aspera elevatis obsiti, sæpius varie curvi vel tortuosi, parce ramellosi, ramellis crassiusculis abbreviatis, novellis fulvo-sericeis vel rufo-tomentosis, apicem versus foliiferis. *Folia* patentia, alterna, longe petiolata digitato-5- rarius 3- rarissime 7-foliolata, paullo ante florescentiæ periodum decidua; petioli 2–3 pollices longi, rigidi, subteretes, molliter sericeo-tomentosi, basi tumescente cum ramulo articulati, apice subcompresso-dilatati; foliola penninervia, obovato-oblonga, nunc fere lanceolata vel lineari-oblonga, apice obtusa vel rarius breviter acuminata, basi sensim angustata, subsessilia vel breve petiolulata, cum petiolo communi articulata, supra, inprimis juniora, pube tenui adpersa pallide virentia, juxta costam mediam densius pubescentia, adulta fere glabra et nitidula, subtus nervo mediano crasso pinnatim venuloso percursa, dense molliter tomentosa, tomento primum ex albedo cinereo, demum flavo-fuscescente; foliola 3 superiora inter se subæqualia,  $2\frac{1}{2}$ –5 poll. longa,  $1$ – $1\frac{2}{3}$  poll. lata, intermedium longius petiolulatum, infima duo reliquis duplo triplove breviora angustioraque et plerumque sessilia vel brevissime petiolulata. *Flores* dioici, versus apicem ramulorum axillares, nunc foliorum summorum lapsu vel abortu spurie terminales, utriusque sexus apetalæ. *Masculi* plures 30–∞ minuti ad pedunculi communis perbrevis crassiusculi cylindrici apicem carnosio-incrassatum [quasi anthodium fingentem] sessiles vel uno alterove brevissime pedicellato, subcymuloso-fasiculati, densissime in capitulum involucretum congesti; involucrum obliquum 6–8-lobum, lobis ovato-oblongis vel suborbicularibus, florum capitulo fere dimidio brevioribus ipsoque adpressis. *Calyx* viridescens, sæpius obliquus, plus minusve profunde 6–8-fidus, laciniis erectis, æstivatione imbricatis, lineari-oblongis vel spathulatis, inæquilongis, etiam latitudine inter se non raro variantibus, dorso, inprimis apicem versus, barbularis, margine ciliolatis, intus nudis. *Stamina* 6–8 circa basim disci crenulati parum elevati, ob mutuam florum pressionem sat polymorphi inserta, calycis laciniis longiora; filamenta filiformia, compressiuscula, glabra, albida; antheræ erectæ, filamentis multo breviores, paullo supra basim insertæ, flavæ, loculis turgidis, minute glanduloso-punctatis basi subliberis, latere dehiscentibus. *Ovarii* rudimentum rarissime minimum, plerumque nullum. *Flores feminei* quam masculi multo ampliores, nunc solitarii, rarius folii unius alteriusve abortu 2–3 fasciculati, subsessiles vel breve pedunculati, rigidi. *Calyx* maris sed ipso multoties major et crassior, minus profunde et plerumque 6-partitus, dense rufo-tomentosus, intus glaber, basi tribracteolatus, bracteolis calycis laciniis similibus, pariter rufo-tomentosis sed iis multo brevioribus. Squamulæ ovarii basim cingentes sæpius in anulum disciformem confluentes, minutæ, tenuiter ciliatæ. *Ovarium* ovoideum, æque rufo-tomentosum, calycis limbum erecto-patulum parum superans; stigmata turgida fusco-purpurea. Cetera ex caractere generis.

#### Ordo MELIACEÆ.

Trib. MELIÆ, Hook. et Benth. gen. pl. i. 330.

NAREGAMIA ALATA, Wight et Arn.  $\beta$  *Africana*, Welw. Forma vel, si mavis, varietas, a specie typica in Wight Icon. Pl. Ind. Orient. i. tab. 90 depicta, et in ejusdem auctoris Prodr. Floræ Penins. Ind. Orient. i. 116, descripta, *caulibus* et *foliis calycibusque hirtulo-pubescentibus* nec non calycis lobis *latioribus* fere *deltoideo-ovatis acutiusculis* discrepans.



*Habitat* in arenoso-humosis subumbrosis juxta margines silvarum pro maxima parte e *Macrolobii* et *Pterocarpi* speciebus consistentium Distr. Pungo-Andongo, ad 3100 ped. circiter altit. supra mare, imprimis ad sinistram rivi Lutete. Ineunte Octobr. cum fl. lecta. *Exsic.* Welw. Iter Angol. no. 1301.

*Suffrutex* humilis, subcæspitose crescens, totius *Meliacearum* Ordinis stirps minima, ast floribus pro more permagnis ornata, habitu quodammodo *Turrae* speciem pygmæam referens; rhizoma repens vel oblique dependens, pennæ corvinæ vel rarius anserinæ crassitudine, dure lignosum, tortuosum, fibris lateralibus tenacibus stipatum, collo pluricipite. *Cauliculi* 2-3 vel interdum plures, 1-3 pollices alti, teretes, subsimplices, basi nudiusculi, superne pubescentes, foliis alternis paucis (5-8), superioribus in eorum axillis flores gerentibus vestiti. *Foliorum* trifoliolatorum petioli 3-6 lin. longi, anguste alati pubescentes; foliola subsessilia obovata, apice rotundato integra vel obiter emarginata, rarius ovato-acuminata, omnia facie utraque pubescentia et margine dense ciliata. *Pedunculi* axillares petiolis subæquilongi, erecto-patuli, puberuli, sæpius bi-triflori, pedicellis bracteolatis inæquilongis, lateralibus abbreviatis plerumque flores abortientes gerentibus, intermedio longiore, calycem versus quidquam dilatato et flore perfecto terminato. *Calyx* vix lineam longus, pubescens hirtulusve; corolla 1-1½ poll. longa, splendide alba, parum sed suaviter odora; petala anguste spathulata longe unguiculata apice obtuso concaviuscula, sub prima anthesi conniventia, demum apice patula. *Antheræ* quidem sæpius 5, ast hinc inde etiam 6, et in uno flore imo 7 observavi, earumque appendiculæ fere semper latiores et obtusiores quam in speciminibus Indicis herbarii Kewensis, ab ipso clar. Wight collectis. Ceteroquin stirps Angolensis quoad characteres essentielles et habitum omnino cum specie Indica convenit, novumque Floræ Indiæ Orientalis cum Tropicali-Africana nexus argumentum sistit.

## Ordo HAMAMELIDEÆ.

### MYROTHAMNUS, Welw. gen. nov.

*Flores* dioici spicati; spicæ amentiformes squamis unifloris.

**FLOS MASC.** *Perianthium* nullum. *Stamina* 4-8, sæpius 5; filamenta brevissima in stipitem brevem basi squamæ insertum concreta; antheræ magnæ, basifixæ, oblongo-quadratae, loculis adnatis, rimis lateralibus dehiscentibus, connectivo in rostrum subulatum breviter producto. *Ovarii* rudimenta nulla.

**FLOS FEMIN.** *Perianthium* nullum. *Staminum* rudimenta nulla. *Ovarium* sessile, squama longius, oblongo-ovoideum, obtuse trigonum, tricarpellare, triloculare, apice trilobum, carpellis apice in stylos breves recurvos subspathulatos intus late stigmatosos productis; ovula numerosa, angulo interiori loculorum biserialiter inserta. *Capsula* coriacea, ovario similis, sed paucio turgidior, carpellorum apice divaricato intus dehiscente, polysperma. *Semina* minuta, ovoidea, oblique pendula, funiculo brevi, hilo vix conspicuo, testa tenuiter coriacea, raphe tenui; albumen copiosum carnosum. *Embryo* minutus, albumini immersus, oblongus, cotyledonibus brevissimis, radícula brevi crassa.—*Fruticulus* 1-3-pedalis, rarius frutex 6-7-pedalis, Africae australis tropicæ et subtropicæ, balsameo-resinosus, rigidus, virgatus, glaberrimus, a basi ramosus, ramis ramulisque strictis oppositis, petiolis stipulisque persistentibus subspinulosis. *Folia* opposita brevissime petiolata, cum petiolo articulata, coriacea, flabellato-cuneiformia, subacuta, apice crenato-dentata, longitudinaliter plicato-nervosa, in petiolum brevem latiusculum subvaginantem angustata; stipulæ parvæ, subulatae, in apice vaginæ petioli sitæ. *Spicæ* strictæ, cylindræ, erectæ, ramulos breves crebros terminantes.

*Myrothamnus flabellifolia*, Welw. Apont. phytogeogr. Angol. p. 578, nota 8 (1858).

*Cliffortia? flabellifolia*, Sond. in Harvey et Sond. Fl. Cap. ii. 597 (1862).



*Planta exogena anomala*, &c., Thomson in Append. ad Speke, 'Journ. of the Discovery of the Source of the Nile,' p. 468 (1863). [Clar. Dr. Thomson solum pl. masc. vidit.]

Genus summopere curiosum ast quoad ordinem, cui subscribendum, quidquam dubium, secundum acutissimi Hook. fil. sententiam *Hamamelideas* inter et *Saxifragaceas* ambiguans. *Hamamelideis* tamen affinius videtur. Habitu hinc *Tetracarpæam Tasmanicam* Hook. fil. (*Saxifragacea*) illinc quasdam *Myricæ* vel *Cliffortiæ* species simulat, a quibus tamen florum, imprimis femineorum, et fructus forma longius distat. A *Saxifrageis*, cum quibus genus nostrum notis non paucis, et præcipue gynæcii structura trimerâ, ovulorum numero et situ nec non albumine copioso congruit, tamen floribus strictim dioicis, absentia omnis perianthii et disci, staminibus denique basi in stipitem concretis nec liberis et, quod forsân non omnino prætervidendum, succo balsameo-resinoso omnium partium differre videtur. A *Rosaceis*, quas inter planta nostra *Spiræarum* tribui gynæcii fabrica aliquantulum accedit, nihilominus ob flores dioicos, calycis et corollæ defectum, staminum numero diminuto et albuminis copiosi præsentiam excludenda erit.

Juxta systematis Endlicheriani principia genus *Myrothamnus* prope *Salicineas* collocandum esse videtur, quocum ordine floribus unisexualibus, absque ullo perianthio, in amentis ramulos terminantibus dispositis, staminum numero variante et filamentis inferne coalitis, carpellorum stigmatumque dilatatorum structura, eorumque ovulis numerosis, succo denique balsameo, in quibusdam *Populi* speciebus pariter obvio, et quodammodo etiam habitu et vitæ tenacitate convenit, etiamsi imo hac in vicinitate ob ovarium trimerum, albumen copiosum et folia opposita anomalum genus remanet.

Species unica.

#### MYROTHAMNUS FLABELLIFOLIA, Welw. l. c. t. viii.

*Habitat* in dumetosis rupestribus editioribus Distr. Pungo Andongo, imprimis in Serra de "Pedras de Guinga" inter 3000 et 4000 ped. altit., nec non in Distr. Huilla ad 5000–5500 ped. altit. loco "Morro de Lopollo" dicto. Decembr. Jan. floret; Apr. Maio fructificat. *Exsic.* Welw. Iter Angol. no. 1278 et 1279.

Stirps singularis fruticulus sistit plerumque 1–3-pedalem, sed in editis Distr. Huilla etiam humilem vidi et prostratum, *Salicum alpestrium* more Lichenum Muscorumque cæspitibus incumbentem; e contrario, expositione et solo magis faventibus semper erectus crescit et altitudinem multo majorem attingit; sic in Distr. Pungo Andongo, ubi in rupibus giganteis "Pedras de Guinga" dictis circa earum summa juga ultimam et fere unicam vegetationem fruticosam offert, frequens ceu frutex 5–7-pedalis occurrit, trunco interdum prope basim circumferentia 3–5-pollicari. *Cortex* cinerascens, longitudinaliter late lamellosus, lamellis tenuibus facile secedentibus. *Lignum* album, densum, durum, grate aromaticum. *Rami* inferiores pauci, distantes, medium caulis versus frequentiores et densiores ramulisque crebre ramellosis decussatim oppositis, strictis, virgatis, novellis quadrangulis læte purpurascens, adultioribus cylindricis et cinereis,  $\frac{1}{2}$ –1 pollicem inter se distantibus, ad apicem usque foliosis. *Folia* 5–7 lineas longa, 3–4 lin. lata, quoad figuram descripta apice plus minusve profunde dentata [dentibus 3–10, sæpius 6, obtusis vel acutiusculis, apice glandula terminatis], tempore humido erecto-patula, flabellatim expansa, utrinque glauco-viridia, durante autem hieme sicco arcte plicata et convoluta, brunneo-nigrescentia, et ramulis strictim adpressa; petioli semiamplectentes, longe decurrentes, superiore parte carinati, apice excepto adnati et internodium vaginantes, adultiorum foliorum lamina delapsa, a ramulis subsoluti et una cum stipulis induratis per



longius tempus persistunt, demum per lamellas secedunt ramulosque denudant. *Spicæ* utriusque sexus amentiformes, in ramellis lateralibus crebris abbreviatis foliosis terminales, strictiusculæ, graciles,  $\frac{2}{3}$ –1 pollicem longæ, ad  $1\frac{1}{2}$ –2 lin. latæ, cylindraceæ, obtusiusculæ, masculæ fere semper omnino rubentes, femineæ virescentes. *Squamæ* florigeræ lato-ovatae, obtusiusculæ, basi subcordatæ, rachin semiamplectentes, per paria oppositæ, concavæ, dorso obiter carinatæ, herbaceo-virides vel leviter rubentes, margine subscariosæ, quoad substantiam subcoriaceæ et rigidulæ, illæ florum masculorum staminibus fere æquilongæ, dum quæ flores femineos stipant, ovario multo breviores. *Stamina* 4–8, sæpius 5, basi squamæ inserta, sub anthesi ob squamam patulam exserta; filamenta perbrevia, supra libera, basi in stipitem brevem coalita; antheræ ex aurantiaco rubentes, loculis valde turgidis, post dehiscenciam late hiantibus exsiccato-induratis; pollen intense flavum. *Ovarium* herbaceo viride; stigmata atropurpurea, dense papillosa. *Ovula* in quoque carpello 12–16, quorum tamen perpauca plenam maturitatem attingunt, nam sæpius solummodo 2–5 semina in capsula dehiscente inveniuntur. *Capsula*  $1\frac{1}{2}$  lin. longa, lineam lata, stylis induratis persistentibus tricornis, trivalvis, valvis (carpellis) apice hiantibus, interne juxta suturas omnino solutis, unilocularis, pleiosperma. *Semina* etc. descripta.

*Observatio.*—Stirps in vivo admodum elegans et ob aroma gratissimum quod spargit, apud Nigritas Angolenses nomine “*Cachinde candange*” ceu *tonicum* validum celebrata, per Africam austro-tropicam, ut videtur, late diffusa, a celeb. peregrinatoribus Speke et Grant etiam ex Africa centrali [6° lat. austr.], sed solum floribus masculis adlata, a clar. Zeyher quoque trans Cancrum, in interioribus territorii Capensis [Magalisberg], ast solum modo sterilis, lecta.

Vis vitalis fruticis hujus ingens est; per anni dimidium enim, nempe a Maio ad Octobrem, imbribus tum omnino deficientibus solis ardore adustus, in statu quasi exsiccato perdurat, foliis nunc arcte convolutis, induratis, ramulo strictim adpressis, nigrescentibus siccisque, imo digitorum tritu facile pulverizandis, fere emortuus adparet, patriæ suæ ardentis tristis imago; ast statim primas post pluvias vernaes omnimodo reviviscit, foliorum nunc de novo viridium flabella expandit, sicque læto virore ornatus flores fructusque progignit.

## Ordo COMBRETACEÆ.

### Subordo I. COMBRETÆÆ.

CACOUCIA, Aubl. nec Walp.\* [Schousbœa, Willd. nec Schum.]

CACOUCIA PLATYPTERA, Welw. n. sp. *C. fruticosa*, scandens, hinc arbuscula stans, ramis patentibus, elongatis, arcuatis, ramulisque rigidis cylindricis juventute pubentibus; foliis oppositis v. rarius alternis, coriaceis, glabris, lucidis, breviter petiolatis, oblongis, ovatis v. ovato-lanceolatis, integerrimis apice sensim v. abrupte in cacumen obtusum productis, basi breviter attenuatis, rotundatisve v. subcordatis; racemis ad ramulos laterales et apices caulis terminalibus, amplis, elongatis, subdensis, undique sericeo-tomentosis, strictis; bracteis flore evoluto plus quam dimidio bre-

\* *Cacoucia cordifolia*, Walp. Rep. ii. p. 68, certe non est *Combretacea*, sed *Euphorbiacea*, et probabiliter *Alchornea* species, a Schum. Descr. of Guin. Plant. ii. p. 223 [edit. separ.] sub nomine “*Schousbœa cordifolia*” descripta. Beat. Schumacher l. c. expressis verbis affirmat *Schousbœam* suam a genere homonymo Willdenovii *diversam* esse, et ab ipso institutam, quoniam Willdenovii *Schousbœa*, lege prioritatis, generi “*Cacousia*,” Aubl., ceu *synonymum* subscribenda.



vioribus; tubo calycino obtuse pentagono, limbo intus ad basin disco carnosio cupuliformi margine libero 5-plicato fasciculatimque piloso vestito; fructu membranaceo late 5-alato, circumscriptione, alis inclusis, ellipsoideo-sphærico, diametro sesquipollicari, alis æqualibus, semiorbicularibus, levigatis, chartaceo-rigidulis, transverse striolatis, singulis medio 8-9 lin. latis, margine obscure denticulato-vel crenulato-ciliatis, nucleo lineari-oblongo, medio tumidulo verticaliter impositis.

*Habitat* in Districtus Golungo Alto dumetosis altioribus juxta margines silvarum primitivarum, inprimis in Serra de Alto Queta, ad 2000-2300 ped. alt. Floret Aprili, Maio; fructificat Aug., Sept. *Exsic.* Welw. Iter Angol. no. 1752.

*Caulis* primarius rectus, cylindricus, cortice e viridi cinerascete sublevigato, ad altitudinem 3-5 ped. nudus, mox inordinate elongato-ramosus, ramis plerumque sursum arcuatis, vetustioribus glabratibus e viridi purpurascens, ramulis oppositis, novellis pube albido-sericea obtectis. *Folia* majora una cum petiolo  $\frac{1}{4}$ - $\frac{1}{2}$ -pollicari basi plerumque plus minusve curvato 5 pollices longa, 2-2 $\frac{1}{4}$  poll. lata, perennantia, utraque facie et inprimis supra valde nitentia, intensissime viridia, rigidula, subtus paullo pallidiora, costa valida elevatim semicylindrica percursa, penninervia, reticulatim venosa, non raro in eodem specimine opposita vel alterna, rarius ternatim verticillata. *Racemi* spicæformes, validi, substricti, elongati, robustiores pedales vel etiam sesquipedales, nunc simplices nunc basi patentim ramosi, subdensi, undique, id est inclusis bracteis, calycibus et dorso petalorum, tomento sericeo, in vivo albido, exsiccatione demum ferrugineo vel fuscescente obducti. *Bracteæ* florum inferiorum perfecte evolorum calycis medium vix attingentes, lanceolatae, acutatae, demum deciduae. *Flores* speciosi, dentis staminibus longe exsertis pollicares vel paullo longiores, amœnissime roseo-coccinei, breve pedicellati, sub plena anthesi plus minusve patentes, subcarnoso-rigiduli, in racemos ambitu cylindrico-conicos apicem versus densiores dispositi. Tubus calycinus, ovarium obducens, obtuse pentagonus, vix 2 lin. longus, lineam latus, medio tumidulus, supra ovarium abrupte in limbum (demum caducum) tubuloso-campanulatum, modice arcuatum, intus pilosulum dilatatus, ore 5-fido, lobis deltoideis erecto-subpatulis; discus fundum limbi calycini ovario insidentem vestiens, carnosus, cupuliformis, adnatus, ore libero 5-crenato, crenis plicæformibus obtusis, læte flavis, glandulas fingentibus, apice fasciculatim barbatis. *Petala* ovata vel ovato-lanceolata, brevissime unguiculata, calycis lobis parum longiora, abrupte acuminata, intense coccinea, carnosula, dorso pube albida, in vivo vix sine lentè perceptibili, demum rufescente vestita, planiuscula et recta. *Stamina* 10, calycis limbo prope medium inserta, longe adnatim decurrentia, alterna altius adnata, omnia longe exserta; filamenta filiformia juxta tubi calycini directionem curva, æstivatione inflexa; antheræ cordato-ovoideæ, dorso ad emarginaturam fixæ, intense flavæ. *Ovula* plerumque 4, ex apice pendula. Stylus filiformis, staminibus vix brevior, stigmate subtruncato vel rarius tenuissime lobulato. *Fructus* adolescentes primum lineari-oblongi, dein oblongo-ellipsoidei, una cum alis, illo tempore adhuc brevibus, flaccidis et margine subundulatis carnosuli et ex albido virentes, solummodo versus ulteriorem maturationis periodum formam in diagnosi notatam coloremque roseum et rigiditatem chartaceam acquirunt. *Fructus* maturi corpus, dentis alis, elongato-ellipsoideum, obtuse pentagonum, utrinque æqualiter attenuatum, membranaceo-fibrosus et subspongiosus. *Semen*, a me nonnisi in speciminibus siccis examinatum, fructus cavitati pentagonæ conforme, aliquantulum compressum, circiter 9-10 lin. longum, testa membranacea laxiuscula fusca. *Embryonis* recti cotyledones crassiusculæ, carnosæ, convexo-planæ vel subsemicylindricæ, anguste oblongæ, obtusæ, dorso convexo longitudinaliter paucisulcatæ, interna facie plana levigatæ, apicem versus quidpiam concavæ ibidemque marginibus breviter inflexis semivaginatim conjunctæ. Radicula perbrevis obtuse conica.

Stirps perbella, sempervirens, ob fructus pro more amplos et colore roseo insignitos in statu fructifero non minus quam in florifero decora, inter Combretaceas Angolæ et forsan Africæ totius facile



formosissima, quodammodo florum *Alois arborescentis* spicas fulgidas frutici lucide frondoso impositas exhibens; nunc ad arbores vicinas altius scandens, nunc sub forma arbusculæ 6–8-pedalis laxæ comosæ in dumetis silvas densas cingentibus hinc una cum *Bandeiræa speciosa* et *Dalhousiea bracteata* superbiens, illinc in *Camoënsiæ maximæ* et *Eureiandræ formosæ* societate fruticeta adornans et una cum socialibus indicatis Adonistis admodum commendanda.

*Observatio.*—Species typica hujus generis *Tropico-Americana*, *Cacoucia coccinea*, Aubl. Plant. Guian. i. p. 450, t. 159, habitu cum nostrate *Africana* fere omnino convenit, sed præter alias notas inprimis fructu coriaceo pentagono exalato facile a nostrate distinguenda.

Subordo II. GYROCARPÆ (Benth. & H. f. Gen. Pl. i. p. 689).

**ILLIGERA PENTAPHYLLA**, Welw. n. sp. *I.* caule basi lignescente, obiter angulato, sparse hirtulo, late scandente, ramis patentibus elongatis, junioribus cano tomentellis; foliis sparsis longe petiolatis, digitatim quinquefoliolatis, foliolis breve petiolulatis, ovatis, oblongo-ellipticis vel ovato-lanceolatis obtuse acuminatis, basi rotundata subemarginatis, margine integerrimis, utrinque glabris, juvenilibus crebre pellucido-punctatis, adultis coriaceis, intense viridibus, subtus pallidis, inter nervos pilis adspersos venis atropurpureis elevatim reticulatis, sub lente dense punctulatis; floribus laxè cymosis, in paniculas axillares et terminales foliis longiores dispositis, pedunculo, cymarum ramulis bracteolisque et calycis tubo dense cano tomentellis; petalis calycis lobos herbaceos subæquantibus sed iis angustioribus et flavescens, sub anthesi stellatim patentibus; fructu rigide chartaceo, corpore elongato-ovoideo subcompresso-4-gono, utrinque attenuato, late verticaliter bialato, alis circiter 15 lin. altis et sesquipollicem latis, rotundato-obtusis, planis et dense transversim paralleli-venosis.

*Habitat* in Districtus Golongo Alto editioribus de “Serra do Alto Queta” juxta oras silv. primitivarum, sed sporadica. Nov.–Decbr. florens, Martio–Maio fructificans. *Exsic.* Welw. It. Angol. no. 1753.

*Frutex* parum alte lignescens, sempervirens, habitu et crescendi modo varias *Cissi* vel *Vitis* species eximie æmulans. *Caulis* primarius cylindræus, mox ad 2 vel 4 ped. altitudinis in ramos 6–15 pedes longos divisus. *Rami* paullo supra foliorum axillas oriundi, late patentibus, parum angulati, tenuiter dense sulcati, etiam adultiores hinc inde pilis raris adspersi, petiolorum reflexorum ope vel ipsorum torsione spirali per arborum vicinarum coronas scandentes vel ex iis penduli; ramuli novelli et inflorescentia tota, calycis limbo petalisque exceptis, tomento plus minusve denso, canescente, exsiccatione demum rufescente obducta. *Petioli* circiter 2 pollices longi, rigiduli, basi gibboso-incrassati, initio recti, horizontaliter patentibus, demum deorsum flexi, medio non raro bis terve spiraliter intorti, apice paullo incrassato in petiolulos quinque circiter 3–5 lineas longos, canaliculatos, juxta excavationem hirtulos, cum petiolo articulatos, fere umbellatim dispositos divisi. *Foliola* quoad laminæ figuram inter se æqualia (terminale tamen ceteris majus, paullo longius petiolulatum, circiter 3 poll. longum, medio 2 poll. latum), penninervia (nervo mediano costisque utrinque binis tribusve arcuatis inferne prominentibus, apicem versus sensim evanescentibus), supra intensissime lucido-viridia, subtus multo pallidiora, juxta nervos pilis raris rectis rigidulis obsita, margine integerrimo obiter reflexo. *Paniculæ* laxæ, pyramidatim thyrsoidæ, terminales, non raro sesquipedales, axillares breviores. *Pedunculus* communis obtuse angulatus, aphyllus, ramis fere horizontaliter patentibus, ad insertionem tumidis, inferne longius nudis, a medio ad apicem usque ramulis cymuligeris, pluries dichotome partitis, extremis basi bractea elongato-ovali munitis, vestitus. *Pedicelli* brevissimi cum flore articu-



lati ibidemque bracteolis tribus ovato-lanceolatis, tubum calycis longitudine vix superantibus, patulis vel recurvatis instructi. *Florum* sub plena anthesi diameter transversalis circiter semipollicaris vel saltem 5-linearis. *Calycis* tubus oblongus, rectus, linea una vix longior, obtuse tetragonus, dense canescens, supra ovarium abrupte in limbum subcampanulatum, carnosulum, glabrescentem, herbaeo-viridem,  $2\frac{1}{2}$ –3 lin. longum, fere ad basin 5-fidum (in alabastro late ovoideum) dilatatus, laciniis sub anthesi stellatim patentibus. *Petala* calycis laciniis æquilonga sed iis angustiora, acutiora, tenuiora et pallide flavescentia, basi pilosula. *Staminodia* ad externam cujusvis filamenti basim gemina, in alabastro late ovata, obtusa, filamentis paulo breviora, in flore expanso angustiora, subspathulata, dorso obiter excavata, filamentis multoties breviora, turgidula, albida. *Filamenta* filiformia, firma, pubescentia; antheræ amplæ, adnatæ, oblongo-clavatæ; loculi oppositi connectivo crassiusculo læte purpureo apice obtuso separati, valvulis modice convexis, flavis, rigidulis, oblique *extrorsum* [nec uti in Laurineis *sursum*] flexis dehiscentes; pollinis granula intense flava, pro more sat magna, sphæroidea et undique tenuissime echinulata. *Disci* pilosi glandulæ in pluribus floribus oblitteratæ, vel saltem mihi non conspicuæ. *Ovarium* generis. *Stylus* staminibus vix longior, inferne cylindricus puberulus, apicem versus infundibuliformis, hinc latere fissus, limbo reniformi-dilatato margine incrassato undulatoque stigmatoso. *Fructus* plene maturus, inclusis alis transversim  $3\frac{1}{4}$  poll. latus,  $1\frac{1}{2}$  poll. altus, subsiccus, rigidus, fusco-badius, corpore [drupa] spongioso-coriaceo, elongato-ovoideo, compresse tetragono, angulis facierum brevissime vel vix alatis, lateralibus vero in alas amplas supra descriptas extensis. *Semen* e cylindrico subcompressum, circiter semipollicem vel 7 lineas longum, testa membranacea. *Cotyledones* rectæ, crassæ, amygdaloideo-carnosæ, fere semicylindricæ, 5 lin. longæ, interna facie concaviusculæ, *evidenter petiolatæ*, radiculam superam, retractam, acutiuscule conicam, plumula sat conspicua coronatam amplectentes.

*Observatio.*—Omnes sex *Illigeræ* species hucusque descriptæ aut indicatæ [De C. Prod. xvi. p. 250] vel Indiæ orientalis peninsulam, vel insulas Java, Sumatra et Timor inhabitant, omnesque a specie supra proposita Tropico-Africana foliis *tri- nec quinquefoliolatis* sine negotio distinguendæ. In eodem territorio distr. Golungo Alto, sed locis humidioribus magisque umbrosis varietas obvenit, a forma supra descripta foliolis duplo longioribus nec tamen latioribus sed basi evidentius emarginatis discrepans, ceteris autem characteribus omnibus optime cum forma typica conveniens.

### Ord. PASSIFLOREÆ.

#### I. BASANANTHE (Peyr. in Schlecht. Bot. Zeit. 1859, p. 101, et in Wawra und Peyr. Sert. Benguel. p. 29.)

**CHARACT. REFORMATUS.**—*Flores* hermaphroditi. *Calyx* profunde 5-partitus, tubo brevi explanato, limbi laciniis lineari-oblongis, obtusiusculis, campanulatim conniventibus vel patulis. *Petala* 5, linearia, calycis laciniis subæquilonga, iisque angustiora. *Corona* membranacea simplex, filamentosa. *Gynophorum* cupulare, breviter stipitatum, stipite simplici vel annulo carnosio cincto. *Stamina* 5, basi ovarii inserta, filamentis hypogynis filiformibus; antheræ lineari-oblongæ, sagittatæ, apice obtusæ, connectivo non producto. *Ovarium* ovoideum, sessile, basi attenuatum; stylus gracilis, mox trifidus, cruribus filiformibus, stigmatibus capitellatis. *Ovula* 3 placentis totidem inserta. *Capsula* ovoidea, subcoriacea vel crustacea, 3-valvis, 3-sperma. *Semina* oblongo-subreniformia, compressa, testa scrobiculata, uno latere tenuiter marginata, arillo nullo, funiculo crasso elongato arcuato.

*Herbæ* perennes vel suffrutices graciles, in regni Benguellæ littore nec non interioribus editis hucusque observatæ, a basi ramosæ, caulibus ascendentibus vel decumbentibus, undique glaberrimæ. *Folia* alterna, petiolata, cordata vel lanceolata, serrata. *Stipulæ* subulatæ vel filiformes. *Cirrho* proprii



nulli, nisi pedunculorum in caulis parte inferiore frequenter abortientium cruribus, apice obtuso glanduliferis, bracteolisque setiformibus induratis et varie incurvis instructis, repræsentati. *Flores* axillares pedunculati, in pedunculo bifurco gemini vel rarius solitarii, albidi, suberecti vel nutantes, pedicellis 3-bracteolatis. *Fructus* penduli. Genus floribus hermaphroditis et corona filamentosa *Eu-Passifloreis*, placentis autem pauciovulatis et habitu, quodammodo *Tryphostemati*, Harv., simili, *Modeccarum* Tribui accedens, inter ambos, uti optime monuit clar. generis auctor, intermedium. Duæ hucusque mihi cognitæ species: typica nempe, ob characteris specifici expositionem huc inserenda, et altera nova, mox infra exponenda.

1. *BASANANTHE LITORALIS*, Peyr. Sert. Beng. p. 30. Suffruticosa, 1–2-pedalis, a basi ramosa, ramis virgatis arcuato-ascendentibus, simplicibus vel medio patenti-ramulosis, foliis membranaceis, petiolatis, lanceolatis, basi in petiolo utrinque papillis elongatis fimbriato decurrentibus, apice mucronatis, margine acute serratis; pedunculis bi-, rarius unifloris, erecto-patulis; pedicellorum bracteolis verticillatis, calycis laciniis petalisque sub anthesi stellatim expansis. Descript. uberior apud Peyr. *l. c.*

*Habitat* in arenosis maritimis breve dumetosis inter urbem Benguella et flumen Catumbella, præcipue ad dextram rivi Maribondo, ubi Junio 1860 floriferam et fructiferam legi. In eodem fere loco a cl. Wawra mense Januario c. flore et fr. lecta fuit. *Exsic.* Welw. Iter Angol. no. 872.

*Observatio.*—Specimen typicum hujus speciei examinare non mihi licuit, ast mea specimina cum descriptione auctoris optime congruunt, notis solummodo minoris momenti, ex. gr. petiolorum fimbriis etc. discrepantia.

2. *BASANANTHE NUMMULARIA*, Welw. n. sp. (Tab. IX.) Herbacea, basi suffruticulosa, vix palmaris, caulibus cæspitosis decumbentibus crebre ramulosis, ramulis ascendentibus foliosis, foliis chartaceo-rigidulis, breve petiolatis, cordato-suborbiculatis, basi in petiolo canaliculato breviter decurrentibus, apice rotundatis vel emarginatis, margine undique dentato-serratis, pedunculis arcuatim deflexis uni-, rarius bifloris, bracteolis pedicellorum subalternis, calycibus petalisque sub anthesi campanulatim conniventibus.

*Habitat* in pascuis breve herbidis, subarenosis District. Huilla, non procul a Lopollo, inter 5000 et 5500 ped. alt.; mensibus Januar. et Febr. c. flore et fructu legi. *Exsic.* Welw. Iter Angol. no. 871.

Herba perennis cæspitosa, vix palmaris, glaberrima, e glauco virescens. Radix carnosio-fibrosa, digitum fere crassa, cylindrica vel subfusiformis, multiceps, plerumque oblique descendens, infra in fibras paucas elongatas, terram profunde penetrantes partita. Caules numerosi, basi nudiusculi, angulati, decumbentes, mox in ramos graciles 3–5 pollices longos, ascendentes vel erectos, subflexuosos, obiter angulatos, dense foliosos divisi, cæspites non raro semipedalis diametri et latiores formantes. *Folia* alterna, approximata, petiolis  $1\frac{1}{2}$ – $2\frac{1}{2}$  lin. longis suffulta, utrinque glaucescentia, carnosula, rigidescentia, cordato-orbicularia vel subreniformia; lamina semipollice paullo latior, apice plus minus emarginata vel rotundata, basi in petiolo canaliculato breviter decurrens, circumcirca inæqualiter dentato-serrata, dentibus nunc acutis nunc obtusioribus, omnibus mucronulatis, nervo medio et lateralibus divergentibus subtus magis prominulis. Stipulæ geminæ, filiformes, gracillimæ, petiolo æquilongæ vel ipso paulo breviores, erecto-patulæ, longius persistentes. *Pedunculi* axillares 2–4 lin. longi, plerumque bifurci, inferiores fere semper abortientes, cruribus tunc in apice truncato glandulifero bracteolis subuliformibus varie flexis coronatis; superiores, crure uno sæpius abortiente, plerumque uni-, rarius biflori, nutantes, pedicellis basi articulatis et tribracteolatis, bracteolis subulatis,



alternis vel sæpius approximatis, patulis. *Calycis* herbaceo-viridis tubus brevissimus ima basi gibberosus; laciniæ lanceolato-oblongæ, obtusæ, sub anthesi campanulatim conniventes, 2–2½ lin. longæ, dorso nervis tenuibus parallelis percursæ, intus e viridi flavescentes. *Petala* lineari-oblonga, calycis laciniis paulo breviora iisque dimidio angustiora, albida, tenerrima, una cum calyce (in fructu) marcescenti-persistentia. Coronæ tenuiter membranaceæ tubus filis biserialibus, iis seriei internæ basi deorsum appendiculatis, dimidio brevior. Gynophori cupularis stipes brevissimus, crassiusculus et simplex. *Stamina* petalis subbreviora; antheræ lineari-oblongæ, basi sagittatæ, lobis obtusis, in filamentis subulatis erectæ, apice obtusæ vel leviter emarginatæ. *Ovarium* basi attenuata sessile. *Ovula* 3, e funiculis longiusculis, medio placentarum trium insertis, demum ascendentibus pendula. *Stylus* staminibus altior, profunde trifidus, cruribus æquilongis erecto-patulis, apice capitellatim stigmatosis. *Capsula* ellipsoidea, basi calyce emarcido cincta, pendula, 3½–4½ lin. longa, crustacea, levigata, e badio flavescens, 3–2-sperma. *Semina* pro more capsulæ et totius plantæ sat magna, oblongo-subreniformia, compressa, funiculo crasso arcuato suspensa, testa fusca seriatim scrobiculata, latere convexiore membranaceo-marginata.

*Observatio.*—*Basananthe litoralis* habitu *Sauvagesiam erectam* simulat, dum *Basananthe nummularia* habitum *Violæ* æmulat, adeoque genus hoc affinitatem inter *Passifloreas* et *Violarieas*, ab Endlichero aliisque auctoribus, imprimis ex fructus structura indicatam, etiam habitu ambarum specierum indigitat.

## II. MACHADOA, Welw. gen. nov.

*Flores* hermaphroditi. *Calycis* tubus infundifuliformi-campanulatus, limbi 5-lobi lobis coriaceis obtusis, patentibus, imbricatis. *Petala* 5, basi calycis inserta et eo inclusa, ligulata, apice dentata. *Stamina* 5, hypogyna, filamentis filiformi-subulatis, basi breviter connatis, processibus totidem alterna; antheræ lineares, connectivo subulato breviter producto. *Ovarium* breviter stipitatum, oblongum; stylus brevis, integer, stigmatate capitato, trilobo; ovula ∞ placentis tribus biserialiter inserta. *Capsula* longius stipitata, e calyce erecto pendula, obovoideo-oblonga, obscure trisulcata, polysperma. *Semina* ovoideo-oblonga, compressa, testa scrobiculata; embryo non visus.

Herba glaberrima, radice crassa fusiformi, caule tereti, erecto, brevi, parce ramoso. *Folia* anguste lineari-lanceolata, utrinque angustata, integerrima. *Stipulæ* parvæ, subulatæ, petiolo adnatæ. *Cirrho* nulli. *Flores* inter minores, in racemos breves axillares pauciflores dispositi, pedunculis bracteatis, bracteis subulatis, pedicellis articulatis.

Genus *Modeccæ* absque dubio affine, attamen ab ipsa imprimis floribus hermaphroditis, styli indivisi stigmatate capitato, glandularum demum coronæ vices gerentium absentia et habitu alieno differt. Dicitur est memoriæ beati Joach. Januarii de Saldanha Machado, de horticultura inter Olisiponenses optime meriti.

Species unica:—

### MACHADOA HUILLENSIS, Welw. (Tab. X.)

*Habitat* in collinis breve dumetosis atque petrosis subsiccis territorii de Huilla, ad 5000 ped. circiter altitudinis, non procul a Lopollo, ubi socialem cum variis *Daphnoideis* et *Irideis* Decbr. 1859, c. flore et fructu necdum bene maturo legi. *Exsic.* Welw. Iter Angol. no. 865.

Herba perennis, erecta, omnino glabra. *Radix* crasse fusiformis, intus dense farcta, sublignosa, inferne fibris paucis simplicibus elongatis stipata, perpendiculariter terram penetrans. *Caules* e colo radice pauci, 1–3, recti, palmares vel pedales, penna corvina paulo crassiores, obiter sulcati, e livido virescentes, vix ramosi, juniores jam a basi, fructiferi solummodo apicem versus foliati. *Folia* alterna, remotiuscula, tenuiter carnosula, rigidula, e livido glaucescentia, integerrima, elongato-lineari-lanceolata, 4–5 pollices longa, medio ad duas lineas lata, apice longe acutata, basim versus in petio-



lum brevem angustata, secundum nervum medium parum prominentem longitudinaliter plicata, subtus inter nervum et marginem transverse venulosa, patula, hinc subfalcata. *Stipulae* breves subulatae, petiolo utrinque adnatae. *Flores* axillares, in racemo breviusculo depauperato erecti,  $3\frac{1}{2}$  lin. longi, breviter pedunculati, pedunculis cum pedicellis vix lineam longis, articulatis. *Calycis* extus e flavo rubescentis modice carnosus et subcoriacei lobi oblongi, obtusi, margine membranaceo cincti, duo interiores magis concavi et margine crispuli, sub anthesi erecto-patuli. *Coronae* sive glandularum in fundo calycis vestigium nullum. *Petala* ligulata, apice denticulata, albida, tenerrima, calycis lobis alterna iisque multo breviora. *Stamina* petalis paulo breviora; filamenta erecta, subulata, basi in anulum brevissimum connata, cum denticulis singulis, quam filamenta ipsa dimidio brevioribus, alternantia. *Antherae* lineares, basi obiter cordatae, sinu fixae et erectae, apice connectivo subuliformi superatae. *Ovarium* et *stylus* generis. *Capsula* e calyce erecto marcescenti-permanente pendula, pro more plantae sat magna, obovato-ellipsoidea, ultra pollicem longa et plus quam semipollicem lata, coriacea, flavicans, levigata, trisulcata, sulcis cum costis tribus parum prominulis alternantibus, apice obtuso styli residuo apiculata, polysperma. *Semina* ovoideo-oblonga, modice compressa, uno latere marginata, testa fuscescente, seriatim scrobiculata, perfecte matura non visa.

*Observatio.*—Habitu omnino erectum plantae nostrae, inter *Passifloreas* rarius obvium, quod attinet, hoc loco observare liceat quod, saltem in Africa tropica, plures plantarum ordines, qui in regionum inferiorum silvis umbrosis humidisque e speciebus fere semper scandentibus componuntur, in regionibus elevatis et in apricis solo macro, arenoso-petroso donatis, speciebus vel harum varietatibus habitu erecto insignibus repraesentantur. Sic, exempli gratia, *Ampelideae*, quarum species numerosae in silvis primitivis Districtus Golungo Alto et vicinis omnes scandentes sunt, in regione Huillensi, ad 6000 fere ped. supra mare elevata, plures species *caule omnino erecto* vix unquam scandente offerunt. Idem inter *Cucurbitaceas* de generibus *Heterosicyos* et *Acanthosicyos*, mox infra describendis valet, nec non de *Gloriosa abyssinica*, quae, in editioribus Districtuum Pungo Andongo et Huilla non rara, tantum non *Gloriosae superbæ*, Linn., formam vel, si mavis, varietatem *erectam* sistit; *Clematides* etiam, quae in regionibus inferioribus et silvaticis humidis omnes scandunt, in Districtibus elevatis speciebus erectis repraesentantur, et pariter *Dilleniacearum* genus *Tetracera* in Angolae inferioris silvaticis species sat late scandentes, in regione autem elevata interiore, speciem humilem, caule erecto vel ascendente insignem offert.

## Ord. CUCURBITACEÆ.

### Subordo CUCURBITEÆ.

#### I. ACANTHOSICYOS, Welw. gen. nov.

*Flores* dioici? Masculi solitarii vel fasciculati. *Calycis* tubus turbinatus, limbi quinquefidi lobi breves, crasse coriacei, sæpe inæquales, late ovati vel suborbiculares, apice cornei vel ungue corneo terminati. *Petala* quinque, coriacea, sulcata, obtusiuscula, ima basi coherentia. *Stamina* tria, calycis faucibus inserta; filamenta brevissima, libera; antherae exsertae, unica unilocularis, ceterae biloculares, connectivo dilatato, sinuato, loculis sigmoideo-flexuosis. *Ovarii* rudimentum nullum. *Flores* feminei ignoti. *Fructus* globosus, corticatus, polyspermus. *Semina* breviter oblonga, tumida, testa crustacea levi. *Frutex* Africae tropicae et subtropicae occidentalis, erectus vel ascendens, rigidus, a basi ramissimus, foliis ad squamas reductis aphyllus, *Ulicem* vel *Salsolam* quodammodo referens, ramis ramulisque divaricatis, sulcatis, spinis geminis (? stipulis in spinas abortientibus) horridus. *Flores*



tomentosi, in axillis foliorum squamiformium inter spinas subglomerati, mediocres, inexpansi tantum visi. *Fructus* diametri Aurantii vel majores, edules.

Species unica:—

*ACANTHOSICYOS HORRIDA*, Welw. n. sp. Tab. XI. A et B.

*Habitat* in desertis sabulosis maxime aridis ad austrum territorii Mossamedensis prope Cabo negro (16° L. a.) ubi, inter "Porto Pinda" et Pagum Nigritarum "Caroca" dictum, ad 10–15 mill. distantiam ab oceano, Septembre 1859 frequentem ast parce florentem vidi. Similibus locis hæc eadem stirps in terris Numacensibus (Namaqua Land) et in interioribus de Whalfish Bay a cel. peregrinatoribus Anderson, Baines, et Chapman, observata fuit. *Exsic.* Iter Angol. no. 806.

Plantæ juvenilis, nunc in horto Kewensi cultæ, cauliculus palmaris est, simplex et rectus, sed jam hæc ætate spinularum paribus, squamula parva suffultis, pollicem circiter inter se distantibus obsitus, dum basi adhuc foliis cotyledonariis spathulatis, crassiusculis, margine integerrimo leviter revolutis, pollice paulo longioribus onustus. Planta adulta, qualis in loco natali a me observata, plerumque 2–3-pedalis, caule erecto vel ascendente, sed hinc inde etiam 5-pedalis et altior evadit; dum nempe individua plura agmine densiore crescentia, ventorum vehementia arena volatili obteguntur, nihilominus vegetationem continuant, ramulis extimis suis stratum sabulosum perforant, statimque ramificant et cæspites plus minus densos et extensos efformant, qui demum, arenæ accumulatione sæpius repetita monticulos arenosos sistunt, 5–7 ped. altitudinis et 15–30 ped. circumferentiæ, undique ramulis spinosis matricis sepultæ horridos. Sed hoc de vivendi modo plantæ singularis dictum sit. *Caulis* patentim ramosissimus, tenacissimus, cylindricus, pennæ olorinæ crassitudine, profunde plurisulcatus, ceteroquin levigatus, pallide virescens, hinc inde flexuosus, succo viscido resinoso scatens, qui circa ramorum basin exsudans ibidemque inspissatus, gummi elastici speciem æmulat, colore tamen intense aurantiaco insignis. Rami et ramuli alterni, subvirgati, extimi pubescentes. *Folia* squamiformia, cauli adpressa, crustacea, ovata, vix lineam longa, apice cornea, plerumque cito decidua, in eorum axilla ramos emittunt, ad basim utrinque spina recta, subulata, sulcata, apice cornea, semipollicem longa, rigida et patente (stipularum vel cirrhorum vices gerente?) suffultos. *Ramuli floriferi* 2–5 pollices longi, erecto-patuli, tomento laxo undique obducti. *Flores* in axillis foliorum sæpe abortientium inter spinas geminas subsessiles, singuli vel plerumque glomerato-fasciculati, extus cano tomentosi, nobis solummodo in alabastris visi, quoad magnitudinem pro more ordinis mediocres. *Calycis* crasso-coriacei tomentosi lobi sæpius inæquales, duo vel tres eorum ovati, ceteris vel suborbiculatis apice obtuso cartilagineo-marginatis, vel obcordatis cum unguiculo corneo emarginaturæ inserto; rarius omnes 5 inter se inæquales, et tum a lata basi ovato-acuminati, vel apice obtuso corneo-unguiculati. *Corollæ* lutescentis petala basi (in alabastro saltem) subcoalita, late ovata, obtusiuscula, extus tomentella, intus levigata et obscure striata. *Staminum* filamenta carnea, flabelliformia, ad basim internam pilis tenuibus hyalinis articulatis barbulata; antheræ descriptæ. *Fructus*\* (pepo) globosus, aurantiacus, quoad magnitudinem secundum soli et expositionis diversitatem inter pomi Aurantiæ et ovi Struthionis molem varians, vertice depressiusculo calycis rudimentis apiculatus, cortice crustaceo 1 lineam circiter crasso, levigato sed verrucis distantibus hemisphæricis, in centro aculeo recto breviter conico acutiusculo armatis obsito, demum irregulariter rumpente, pulpa aurantiaca grate acidula, semina numerosa involvente, farctus. *Semina* latiuscule oblonga vel subellipsoidea, 6–7 lineas longa, 4–5 lineas lata, ex albido pallide flavescentia, faciebus turgida, circiter 2½–3 lin. crassa, basi suboblique truncata, margine obtuso, solum basim versus magis prominulo cincta; testa levigata, suberose crustacea; endopleura tenuissima, albescens,

\* Tab. XI. B. Fructus maturus exsiccat, una cum seminibus et pulpæ fragmentis nuper ab ill. peregrinatore Alfred B. Wollaston ex Namaqua Land adlatus fuit, et a clar. Frid. Currey, F.R.S., Secr. Linn. Soc., mecum benevole communicatus.



diaphana, demum a testa solubilis. Cotyledones semini conformes, oleoso-pingues, facie externa tumidulæ levigatæ, interna subplanæ ast sulcis 3-5 latiusculis obtusis longitudinaliter percursæ; plumula parum conspicua; radícula brevis, late conica, quidpiam compressa, apice suo hilum attingens.

*Observatio.*—Stirps omni respectu memorabilis et habitu suo ab omnibus hucusque cognitis Cucurbitacearum speciebus omnimodo discrepans, a Nigritis per ista deserta errantibus *Nara*, *M-nara* sive *Naras* dicitur, et ab ipsis ob fructus satis ampli pulpam succoso-carnosam grate acidulam nec non propter semina edulia summo jure magni æstimatur. Ob vivendi modum in arenosis, vitæque ipsius tenacitatem, qua climatis ardentissimi efficientiæ fortiter resistit, stirpis hujusce cultura etiam colonis Europæis Africæ tropicalis maximopere commendanda, nam planta ipsa, e seminibus sat facile educanda, ad solidandas arenas volatiles imprimis idonea videtur, dum ejus fructus hominibus sub cælo fervente degentibus jusculum grate refrigerans simulque pluribus animalibus pabulum jucundum præbent. Monendum tamen est pulpam hujusce peponis, majore copia ingestam, nauseam causare nec non dolores prurientes faucium excitare, quod quidem ego non expertus sum, sed hic juxta relationem peregrinatorum supra laudatorum refero.

## II. CORALLOCARPUS, Welw. gen. nov.

*Flores* monoici, masculi ad apicem pedunculi elongati aggregati, feminei sessiles vel breviter pedicellati, solitarii vel aggregati.

MASC. *Calycis* tubus late campanulatus; lobi 5, breves. *Corolla* 5-partita, segmentis ovato-oblongis. *Stamina* 3, tubo calycis inserta, filamentis brevissimis; antheræ glabræ, integræ vel 2-partitæ, unica unilocularis, ceteræ biloculares, loculis rectis, connectivo simplici vel denticulato, ultra loculos producto. *Ovarii* rudimentum nullum vel minutum.

FEMIN. *Calyx* et corolla maris. *Staminum* rudimenta nulla vel minuta. *Ovarium* ovoideum, rostratum, 1-3-loculare; stylus rectus, disco basi nullo, stigmate 3-, rarius 2-4-lobato. *Ovula* in loculis pauca, horizontalia. *Bacca* carnosæ, ovoidea vel ellipsoidea, obtusa vel rostrata, basi operculatim dehiscens, parte inferiore coriaceo-carnosæ, oligosperma. *Semina* obovoidea, tumida basi plus minus truncata. *Herbæ* Africæ et Asiæ tropicæ, scandentes vel prostratæ, subscabrulæ v. subtomentosæ. *Folia* rotundata vel cordata, lobata vel palmata. Cirrhi simplices. *Flores* minuti. Genus, quoad florum structuram et habitum, *Rhynchocarpæ* absque dubio affine, sed fructus dehiscentia valde distinctum, duas species Africanas et tres Asiæ tropicæ includit, hic infra post speciem typicam breviter enumerandas.

## CORALLOCARPUS WELWITSCHII, Hook. fil. MS. Tab. XII.

*Rhynchocarpa Welwitschii*, Naud., Ann. Sc. Nat. ser. 4, xviii. p. 198, t. 10 (planta culta).

*Habitat* non infrequens in dumetis arenosis maritimis Districtus Loanda, circa urbem Loanda et prope Cacuo, ad varios frutices scandens, per totum fere annum, maxime mensibus Januar. et Febr. florens et fructificans.

Herba glaucescens, radice juvenili fibrosa, mox circa ejus colum et caulis basim infimam fusiformi-vel napiformi-incrassata perennans. *Caulis* gracilis, succulentus, glaberrimus, 5-8-pedalis, inferne subangulatus, simplex, demum parce et distanter ramosus, late scandens, ramis carnosulis, rigidiusculis, fragilibus, subteretibus ramulisque flagelliformibus ad nodos geniculatis, glaucissimis, fructiferis non raro aphyllis et dependentibus. *Folia* petiolo 1-2-pollicari suffulta, lamina 2-2½ pollices longa, 1-3 poll. lata, quoad figuram et indumentum nec non respectu coloris sæpe in



uno eodemque individuo mirum in modum ludentia; nunc fere simplicia cordato-ovata, basi subinæqualia, margine repando-dentata vel breviter lobata, apice acuminata vel obtusiuscula; nunc palmato-3-5-loba, lobis lateralibus divaricatis, obtuse bilobulatis, medio magis producto et latiore breviter acuminato, vel obtuso et cuspidato; hinc inde in aliis individuis profunde quinquepartita lobis elongatis, lineari-lanceolatis, repando-dentatis, apice cuspidatis; nervo in facie superiore laminæ parum, subtus vero magis prominulo et pilis brevibus rigidis aspero; indumentum denique foliorum secundum plantæ expositionem et ætatem nunc pilis densis rigidulis scabrum vel papuloso-asperum et cinerascens, nunc (præsertim in umbrosioribus) velutino-pubescens et coloris glaucescentis; in ramulis demum extimis, hyeme sicca fructiferis, folia fere omnia abortiunt, ramulique ipsi aphylli, solum fructibus coralliformibus onusti, solito crassiores fiunt et fragiliores, nec non ad nodos evidentius geniculati et eximie glaucescentes. *Cirrho* simplices, elongati, demum arcte spiraliter torti. *Flores* crebri, in ordine ex minutissimis, e viridi pallide flavescentes, masculi et feminei coaxillares. *Fl. masculi* in pedunculo circiter pollicari crassiusculo, erecto-patuli, apice 3-6 cymulatum gregati, brevissime pedicellati; calycis campanulati lobi ovato-lanceolati, patuli; corollæ segmenta late ovata, obtusiuscula, margine tenuissime ciliata, erecto-patula, calycis lobis latiora et longiora; antheræ sessiles, una connectivo simpliciter apiculato unilocularis, ceteræ connectivo apice denticulato biloculares, loculis rectis, turgentibus. *Rudimentum* germinis vix ullum. *Fl. feminei* nunc solitarii et sessiles, nunc 2-3 gregati, uno alterove tunc quidpiam longius pedicellato, pedicello crassiusculo, firmo et erecto; calyx et corolla maris sed paullo majores. *Ovarium* oblongo-ovoideum 2-, rarius 3-, rarissime 1-loculare, loculis pauciovulatis. *Stylus* firmulus, sursum modice incrassatus, stigmati 2-3 vel imo obscure 5-lobulato, lobulis patulis obtusis, ciliolatis, intus stigmatosis. *Baccæ* elliptico-ovoideæ,  $\frac{1}{2}$ - $\frac{2}{3}$  poll. longæ, intense rubræ vel coccineæ, molliter carosæ, apice obtuso calycis et corollæ limbo exsiccato coronatæ, paullo supra basim a pedunculo nunc incrassato-dilatato operculatim secedentes. *Semina* in pulpa viscidula subhyalina nidulantia, obovoidea, tumida, fuscula, margine tenui, versus basim truncatam incrassato cincta, faciebus minute et seriatim transverse squamulata.

*Observatio.*—*Corallocarpi* generi denique ceu species subscribendæ sunt:—1, *Æchmandra epigæa* Arn.; 2, *Æchmandra conocarpa* Dalzell; 3, *Æchmandra velutina* Dalz., et probabiliter etiam planta Africæ australis subtropicæ herbarii *Burchellii* no. 2031, in herb. Kewensi deposita et foliis lanceolatis basi sagittato-lobatis insignis.

### III. HETEROSICYOS, Welw. gen. nov.

*Flores* dioici.

**FLORES MASCULI** solitarii, bini vel racemosi. *Calycis* tubus cylindricus, dentibus quinque minutis. *Corolla* rotata, profunde quinquepartita, segmentis oblongo-vel lineari-lanceolatis papilloso, tubum calycis subæquantibus. *Stamina* tria, tubo calycis inserta, filamentis liberis; antheræ inclusæ, lineari-elongatæ, leviter cohærentes, unica unilocularis, ceteræ biloculares, loculis longitudinaliter conduplicatis, connectivo apice villoso vel papilloso. *Ovarii* rudimentum globosum vel conicum.

**FLORES FEMINEI** solitarii. *Calyx* et *corolla* maris. *Staminum* rudimenta setiformia. *Ovarium* ovoideum, apice productum; *stylus* columnaris, apice clavatus, stigmatibus tribus subulatis incurvis; ovula  $\infty$ , horizontalia. *Fructus* ovoideus, oblongus vel subglobosus, oligospermus. *Semina* oblonga vel obovoideo-pyriformia, lineis duabus exsculptis circumdata; testa ossea.

*Herbæ* Tropico-Africanæ, parvulæ, erectæ, puberulæ, radice tubera napiformia emittente, collo bi-pluricipiti, caulibus flexuosis sulcatis. *Folia* breviter petiolata vel sessilia, integra, lobata vel 3-partita. *Cirrho* nulli. *Flores* inter minores, breviter pedunculati, penduli vel cernui.

Genus quoad florum structuram *Trichomeriæ* Hook. fil. (Benth. et Hook. f. Genera Pl.) arcte affine, ast præter alias notas inprimis habitu omnino erecto nec non cirrhorum absentia diversum.



1. *HETEROSICYOS POLYMORPHA*, Welw. n. sp. Caule erecto subramoso flexuoso; foliis breviter petiolatis 3-7-nerviis polymorphis, lanceolatis, ovato-lanceolatis vel late ovatis aut obcuneatis, basi breviter attenuatis vel subcordatis, apice integris acutis vel plus minus profunde 3-, rarius 5-lobis, lobis sursum spectantibus, intermedio reliquis latiore et longiore; corollæ limbo fusco-purpureo; bacca obovoidea vel subglobosa, levigata, 2-8-sperma.

*Habitat* nequaquam frequens in collinis breve herbidis petrosis apricis, Districtus Huilla circa Lopollo, socialis cum Daphnoideis, Thesiis atque Trideis pusillis; mensibus Novembri et Decembr. 1859 c. flore et fr. legi. *Exsic.* It. Angol. no. 804.

*Herba* 4, pumila, in vivo obscure viridis. *Radix* tuberosa, globosa vel napiformis, dense farcta, fibris paucis elongatis subsimplicibus stipata, tubere non raro ad medium usque epigæo. *Caules* ex collo radicis crasso sublignoso plures, 3-6 pollices alti, erecti, pennæ corvinæ vix crassiores, inter angulos obtusos sulcati, simplices vel ramo uno alterove patulo muniti, ad nodos  $\frac{1}{3}$ -1 pollicem inter se distantes angulis obtusis flexuosi, juniores pubescentes, demum glabrati, mox supra basim foliis vestiti. *Folia* petiolo brevi, lineam circiter longo, latiusculo, obiter canaliculato suffulta, undique sed præcipue subtus et ad nervos pilis brevibus rigidulis adpressis pubescenti-scabruæ, quoad figuram et circumscriptionem laminæ in speciminibus utriusque sexus, imo non raro in uno eodemque caule admodum polymorpha, nec minus quoad magnitudinem variantia; nunc integra, lanceolata, ovato-lanceolata vel imo cordato-ovata, apice plus minus acuminata et mucronulata, nunc late ovata, obcuneata, vel fere lyrata, basi abrupte attenuata vel subcordata, apice 3- vel rarius 5-loba, lobis sursum spectantibus, lateralibus non raro inter se inæqualibus, hinc dentiformibus, intermedio semper longiore latioreque, plerumque ovato-triangulari, omnibus acutiusculis herbaceo-mucronulatis; lamina angustiorum 3 pollices longa, semipollicem lata, latiorum  $2\frac{1}{2}$  poll. longa et sesquipollicem lata; in quibusdam individuis omnia folia integra lanceolata, in aliis omnia apice 3-5-loba, vel inferiora lobata, superiora integra et angustiora occurrunt. *Cirrhorum* vel stipularum vestigium nullum. *Inflorescentia* axillaris, tota puberula. *Flores* dioici; masculi cernui, in racemulos depauperatos 2-6 flores, basi nonnumquam bractea foliiformi, anguste lineari-lanceolata, elongata, quasi stipulam mentiente, munitos collecti, vel solitarii, pedunculo gracili foliis multo brevior, pedicellis vix lineam longis bracteolatis, bracteolis caducis. *Calycis* tubus 2- $2\frac{1}{2}$  lineas longus, sursum parum dilatatus. *Corolla* fusco-purpurascens, limbi segmentis oblongo-lanceolatis  $1\frac{1}{2}$ -2 lin. longis, horizontaliter patentibus, intus dense tenuiter papillosis. *Flores* feminei masculis similes, primum erecto-patuli, post fecundationem nutantes, tubo calycino magis elongato, supra ovarium constricto. *Stamina* et *ovarium* generis. *Bacca* obovoidea, late clavata vel subglobosa, e viridi flavicans, nunc nucis avellanæ majoris mole, nunc multo minor, levigata, non raro ex seminibus maturitate valde turgescens inæqualiter plurigibbosa, septis pro parte resolutis unilocularis, pulpa viscida parca farcta, 2-7-, rarius monosperma, indehiscens. *Semina* pro more plantæ sat magna, obovoideo-pyriformia, recentia albida, mox badiofuscula, basi obtuse conica subrostellata, circumcirca profunde bisulcata, testa dura leviuscula.

2. *HETEROSICYOS STENOLOBA*, Welw. n. sp. Caule erecto, subramoso, flexuoso, dense pubescente; foliis subsessilibus, isomorphis, omnibus profundissime tripartitis, segmentis elongatis, anguste linearibus, uninerviis, apice abrupte acutatis, intermedio lateralibus parum latiore sed multo longiore; floribus masculis nutantibus, solitariis vel rarius depauperato-racemulosis, corollæ limbo stramineo-flavescente.

*Habitat* in collinis parce dumetosis Distr. Huilla prope Lopollo, socialis cum priore specie, ast ea multo rarior. Cum florib. masc. Decembr. 1859 legi.

*Herba* gracilis, pallide virescens, radice napiformi perennans. *Caules* ex collo radicis duo vel plures,



erecti, flexuosi, 5–8 pollices alti, plurisulcati, dense pubescentes, pennæ corvinæ crassitudine vel imo tenuiores. *Folia* brevissime petiolata, nunc fere sessilia, utrinque pubescentia, ad basin usque tripartita, segmentis elongatis, divaricatis, anguste linearibus,  $\frac{1}{2}$ –1 lineam latis, 2–4 pollices longis, apice breviter acutatis, per totam longitudinem nervo unico subtus latiore et magis prominulo densiusque pubescente et asperulo percursis, margine pilis brevibus spinuliformibus patulis, ciliatis. *Flores* masculi axillares nutantes, plerumque solitarii, rarius racemulosi, pedicellis bracteolatis, quoad structuram et formam iis speciei præcedentis sat similes, sed corollæ stramineo-flavescentis limbi laciniis angustioribus acutioribusque. *Flores* feminei et fructus non visi.

*Observatio.*—Species habitu multo graciliore et præsertim foliorum isomorphorum figura ab antecedente (*H. polymorpha*) absque difficultate distinguenda, sed in paucis solummodo speciminibus masculinis a me lecta, proinde ulteriori peregrinatorum observationi commendanda.

### Ordo CACTACEÆ.

Trib. OPUNTIEÆ, Benth. et Hook. f. Gen. Pl. i. 846.

RHIPSALIS CASSYTA, Gärtn. Sem. i. 137 (Pfeif. Enum. p. 133).

*Habitat* omnino indigena in Angolæ interioris silvis primævis et rupestribus editis Distr. Golungo Alto et Pungo Andongo, inter 2400 et 3500 ped. altit., ex arborum ramis vel rupium fissuris longe pendula. Novembr.–Jan. floret, Febr.–Mart. fructus maturat. *Exsic.* Welw. Iter Angol. n. 876 et 878.

*Rhipsalis*, spec., Welw. Apontam. p. 555 !

*Caules* 4–9 ped. longi, cylindrici, glauco-virides, in juventute fasciculis setularum rubrarum obsiti, adulti glaberrimi, di-, trichotome vel fasciculatim ramosi, internodiis a pollicari ad pedis usque longitudinem variantibus, hinc inde radicanibus. *Flores* crebri, laterales, horizontaliter patentes, una cum calyce 3 lin. longi, 2 circiter lin. diametri, albi vel pallidissime flavescentes. *Stigma* fere semper 4-fidum, lobulis oblongis obtusiusculis. *Bacca* plene matura albida, pisi minoris mole, ceraceo-nitens, subpellucida, pulpa aquoso-viscosa farcta. *Semina* minuta, 12–20, oblique obovata vel plerumque subreniformia, testa atra nitidula, sub lente fortiore dense striolata.—Specimina Angolensia cum stirpe Americana, ex insula Jamaica Ind. occid. oriunda, in horto Kewensi Apr. 1866 læte florente et fructifera accuratius comparavi, nullamque inter plantam Americanam et Angolensem discrepantiam notabilem observare mihi licuit.—Plantæ juveniles, e seminibus enatæ, quales ad *Colæ acuminatæ* et *Adansoniæ* ramos muscosos in silvis primitivis Distr. Golungo Alto mihi sæpius obviæ, a planta adulta quoad aspectum magnopere differunt; rami nempe atque ramuli stirpis junioris solito crassiores, apice clavati et undique setulis rubris 2–3 lin. longis, fasciculatim gregatis, ad apicem ramulorum novellorum in comam congestis horriduli.

*Observatio.*—*Cactearum* in Africæ continente præsentia indigena inter phytogeographos acriter disputata, imo a R. Brown, Endlicher\* et Lindley† prorsus negata fuit. Hæc nostra quidem, *Rhipsalis Cassyta* nempe, etiamsi simul Americæ incola, certissime etiam Africæ calidioris indigena, in Caffrorum terris quoque a Drege aliisque peregrinatoribus reperta. Nec hoc unicum Floræ Africanæ cum Americana homogeneitatis exemplum, nam plures species Americanæ generum *Symphonia*, *Cacoucia*, etc. etc., et ipsa *Cyrtopera*

\* “Quæ a peregrinatoribus de *Cactis* in Arabia, Madagascaria etc. crescentibus legimus, fabulis adnumeranda sunt. *Cactææ* omnes in America nascuntur.”—*Endl. Enchir.* p. 497.

† “America is the exclusive station of the Order [*Cactaceæ*], no species appearing to be native of any other part of the world.”—*Lindl. Veg. K.* p. 747.



*longifolia* Reichb. f. (*Orchidea*!) in eodem loco cum *Rhipsalide Cassyta* sociales a me repertæ fuerunt, et genera non pauca, typice Americana, speciebus sat affinibus in Angola interiore aliisque Africæ tropicalis territoriis repræsentata inveniuntur. Quod autem hoc respectu mihi multo majoris momenti, et omni phytogeographorum attentione dignum esse videtur, est quod major numerus illarum specierum, in Africa tropicali et America simul obvenientium, non in ora maritima continentem Americanam spectante, nec in regionis litoralis silvaticis, sed in regione interiore elevata, silvisque primitivis, longe ab ora maritima remotis occurrit. Ipsa *Brasenia peltata* Pursh, nunc etiam Floræ Africæ tropicalis vindicata, nullibi in tot et tantis regionis litoralis lacubus a me observata, sed solummodo in lacu "Ivantalla" Distr. Huilla, circiter 5000 ped. supra mare elevato et plus quam 120 millia geograph. ab oceani Atlantici litore distante reperta fuit.

Trib. GARDENIÆ, Endl. G. Pl. 557.

MUSSÆNDA (Sect. *Belilla*), De C. Prod. iv. 370.

MUSSÆNDA SPLENDIDA, Welw. n. sp. (Tab. XIII.) Fruticosa, scandens, tota molliter pubescens vel villosa; foliis modice petiolatis, ovatis acuminatis, penninerviis; stipulis subfoliaceis, ovatis, bifidis, recurvis, intus glabris; cymis subbreviter pedunculatis, densifloris, trichotome ramosis, dense puniceo villosis; bracteis ad axillas patentibus subfoliaceis 3-5-fidis; floribus breviter pedicellatis; calycis tubo oblongo-cylindrico, lobis nunc omnibus æqualibus, nunc quatuor æqualibus lanceolatis, quinto maximo, late ovato molliter piloso puniceo; corollæ tubo calycis lobis 2-3-plo longiore, limbo horizontali leviter obtuse 5-lobo, fauce hirsuta, extus patentim villosa; bacca ellipsoideo-oblonga, villosa, calycis limbo coronata.

*Habitat* freq. in montosis dumetosis humidiusculis, inprimis juxta silvarum primævarum oras Districtuum Golungo Alto et Pungo Andongo, inter 2500 et 3500 ped. altit., a Januario usque ad Maium florens, Junio ad Augustum fructificans. *Exsic.* Welw. It. Angol. no. 1116.

*Caules* e radice lignosa plerumque plures, 5-10 pedes longi, basi ascendentes, vetustiores obtuse angulati, glabrati et purpurascens, juniores et rami vario modo curvi vel flexuosi, late scandentes, virides, teretiusculi, pilis mollibus rubescentibus patulis plus minus dense obsiti. *Folia* petiolata, membranacea, late ovata vel elliptico-ovata, 3-6 poll. longa, 1-3 poll. lata, basi nunc subcordata nunc rotundata, rarius breve attenuata, apice acuminata, margine integro ciliata, penninervia, in utraque pagina, sed subtus densius, pilis adpressis molliter pubescentia, supra læte viridia, subtus multo pallidiora, ibique nervo et costis magis prominulis venulisque crebris purpurascens picta; petioli  $\frac{1}{2}$ -2 pollices longi, iis foliorum superiorum sensim brevioribus, obiter canaliculati, patentim rubro-villosi; stipulæ e lata basi ovatæ,  $\frac{1}{3}$ - $\frac{1}{2}$  pollicem longæ, plus minus profunde bifidæ, rarius subintegræ vel trifidæ, recurvo-patentes, pilis longiusculis rubris ciliatæ, intus glabræ et atropurpureæ, longius persistentes. *Inflorescentia* cymoso-paniculata, cymis densifloris, initio breviter, mox longius pedunculatis, trichotomo-ramosis, undique patentim puniceo-villosis; bracteæ quoad consistentiam subfoliaceam, colorem et longitudinem stipulis subsimiles, sed 3-5-fidæ, laciniis angustioribus acutioribusque, post anthesim deciduæ. *Flores* in cymas densas congesti, alii subsessiles, alii breviter pedicellati, steriles (masculi) cum fertilibus in eadem cyma obvii. *Calycis* puniceo-villosi tubus florum centralium, sæpius sterilius, breviter obovoideus, limbi lobis omnibus inter se æqualibus; is florum exteriorum plerumque fertilium oblongo-cylindricus, limbi lobis nunc omnibus æqualibus, lanceolatis, erecto-patulis, nunc (plerumque unius floris in quaque cyma) quatuor æqualibus lanceolatis, quinto in folium maximum,



bracteiforme, petiolatum, late ovatum, nervis 5-7 percursum, molliter pilosum, intense puniceum, horizontaliter patens producto. *Corollæ* extus undique villo patente puniceo vestitæ tubus cylindricus, sursum modice ampliatus, calycis lobis duplo triplove longior, eo florum steriliū graciliore, limbi transversim vix  $\frac{3}{4}$ -pollicaris lobis obtusissimis, brevissime apiculatis, intus subglabris, pallide aurantiacis, fauce pilis paleæformibus rigidulis, dense congestis, erectiusculis, sulphureis obsita. *Antheræ* generis. *Ovarium* constanter biloculare; discus modice elevatus, glaber; stylus corollæ tubo æquilongus, pariter glaber, stigmatē incrassato obiter bilobo vix exserto. *Bacca* elliptico-oblonga,  $\frac{2}{3}$ - $\frac{3}{4}$  poll. longa, tenuiter coriacea, parum succosa, bilocularis, calycis limbo indurato superata, dense et patentim puniceo-villosa. *Semina* numerosissima, valde minuta, in pulpa viscida nidulantia, atra, lenticularia, testa subtiliter scrobiculata.

*Observatio.*—Species inter congeneres facile ornatissima, *Mussændæ erythrophyllæ* Schum. et Thon. (Beschiv. p. 136) affinis videtur, quæ tamen, secundum clar. auct. descriptionem a nostrate foliis subtus albo-tomentosis, stipulis angustis, calycis lobo phyllomorpha pariter tomentoso corollæque laciniis acutis recedit.

## Ordo RUBIACEÆ.

### Trib. CINCHONÆ, Subtr. EUCINCHONÆ.

#### CORYNANTHE, Welw. gen. nov.

*Calycis* tubus ovoideus vel subglobosus, limbi 5-fidi lobis lanceolatis, apice subulatis, erectis, persistentibus. *Corollæ* infundibuliformis tubus rectus, teres, sursum ampliatus; limbi explanati 5-lobi lobis late ovatis subacutis, dorso infra apicem appendice elongato-clavata, patula, corollæ fere longitudine, instructis. *Stamina* 5, corollæ faucis inserta, exserta, patentia. *Antheræ* sessiles, lineari-oblongæ, basi profunde bilobæ. *Ovarium* biloculare, ovula in loculis  $\infty$ , ascendencia. *Stylus* filiformis, rectus, stigmatē clavato. *Capsula* coriacea, lineari-oblonga, parum compressa, bisulca, calycis limbo indurato apiculata, bilocularis, loculicide bivalvis, polysperma. *Semina* compressa, ascendencia imbricata, nucleo minutissimo, ala lata membranacea, elongata, lineari-oblonga, basi attenuata profunde bifida cincto.

Arbor, excepto calyce hirtulo, glaberrima, in Angolæ interioribus editioribus inter 1200 et 2200 ped. elev. hinc inde silvas constituens, trunco stricto, coma ovato-pyramidata. *Folia* oblongo-lanceolata, nunc fere elliptica, modice coriacea, perennantia. *Stipulæ* solitariæ, elongatæ, caducæ. *Flores* parvi, albidii, in paniculam multifloram trichotome ramosam dispositi, ramis inferioribus verticillatis.

*Observatio.*—Genus “*Hymenodyction*” Wall. nostro hic proposito certe proximum, inflorescentia tamen racemosa bracteisque petiolatis suffulta a *Corynanthe* facili negotio discernitur. Genera “*Nauclea* et *Uncaria*,” etiam quodammodo affinia, floribus capitatis, supra receptaculum globosum aggregatis fructusque fabrica a nostro genere recedunt, quod insuper ab omnibus *Eucinchonearum* generibus hucusque descriptis “appendicibus elongato-clavatis, corollæ loborum dorso insidentibus” facile distinguitur.

Species unica :—

#### CORYNANTHE PANICULATA, Welw. n. sp. (Tab. XIV.)

*Habitat* in Angolæ interioris Districtibus elevatis, imprimis “Golungo Alto, Cazengo et Dembos,” ubi in montium declivibus borealibus non raro silvas densissimas atque umbrosissimas, ab incolis Lusitanis nomine “Matas de Mangué” jure celebratas efformat. Floret a Januario usque ad Maium, et a Martio usque ad Julium fructificat. Arbor ipsa a Lusitanis et nunc etiam a Nigritis Angolensibus “Mangué



branco" vel "Mangue do Monte" et hinc inde etiam "Paco de Golungo Alto" vocatur. *Exsic.* Welw. Iter Angol. n. 1508.

Arbor 25–40-pedalis, raro altior, corona ovato-pyramidata, dense frondosa, sempervirente, trunco recto, imo plerumque strictissimo, basi 2–5 ped. circumferentiæ; cortex pro more arboris sat tenuis, parum rimosus, griseo-fuscus, in juventute arboris et in adultæ ramis junioribus albidus, trunco tenaciter adhærens, saporis amaricantis. *Rami* vagi vel superiores oppositi, erecto-patuli, crebre ramulosi, ramulis obtusangulis ad nodos compresso-dilatatis, novellis atropurpureis. *Folia* petiolo circiter semipollicari canaliculato suffulta,  $\frac{1}{2}$  ad  $1\frac{1}{2}$  pollicem in ramulis distantia, oblongo-vel ovato-lanceolata, obtuse acuminata, basi breviter in petiolum attenuata, margine integerrima, tenuiter coriacea, supra lucido-viridia, subtus pallidiora, pinnatinervia, nervo medio valido, lateralibus sursum arcuatis laminae marginem vix attingentibus, omnibus atropurpureis. *Stipulae* intrafoliaceæ, solitariae, e lata basi ovato-lanceolatae, obtusiusculæ, cito caduæ. *Inflorescentia* terminalis. *Flores* paniculati; singuli nempe pedicellis brevissimis in cymulas sive umbellas spurias capituliformes 5–20-radiatas collecti, his demum in pedunculi communis (basi verticillatim, superne trichotome ramosi) ramulis gracilibus varie congestis, paniculam multifloram, densam, obtusiusculam efformantibus. *Calyx* ovoideus vel fere globosus, sub lente undique hirtulus, e viridi albidus; limbi 5-fidi lobi erecti, rigiduli, lanceolati, extus convexi, apice subulati, tubo ipso æquilongi, corollæ tubum longe exsertum laxè ambientes, indurescendo persistentes. *Corolla* infundibuliformis (tenuiter carnosæ, albæ), tubo recto, cylindrico, apicem versus quidpiam dilatato, raro semilinea longiore; limbi 5-fidi laciniæ late ovatae, concaviusculæ, apice breviter acuto cucullatae, dorso infra apicem appendice claviformi, ipsa lacinia duplo longiore, patente, auctæ, intus juxta lineam mediam pilis tenuissimis crispulis adpersæ, in alabastro induplicato-valvatæ, sub anthesi patentes. *Stamina*, *antheræ* et *ovarium* descripta; stylus firmus, cylindricus, crassiusculus, totam tubi corollini cavitatem explens; stigma oblongo-clavatum, ex antherarum in alabastro pressione longitudinaliter plurisulcatum, exsertum. *Capsula* rigide coriacea, in maturitate fusco-purpurea, 3 lineas longa et linea vix latior, bisulcata, in pedicello lineam longo erecta, bilocularis, ab apice hiantè loculicide bivalvis, valvis demum juxta sulcum bipartilibus; loculi 12–16-spermi. *Semina* descripta.

*Qualitates et Usus.*—Lignum nitido-albidum, densissimum, durum et sat durabile, in construendis domiciliis nec non in utensilium agrariorum fabrica tam inter colonos Lusitanos quam inter Nigritas multiplicis usus. Cortex arboris pulchræ *amaricans* et *subadstringens* est, et ob summam generis cum reliquis *Eucinchoneis* affinitatem, medicis in Angola artem suam nobilem exercentibus, inter *Cinchonæ succedanea tentanda* commendandus.

## Ordo JASMINACEÆ.

### Subordo OLEACEÆ.

#### SCHREBERA, Roxb.\*

Genus "*Schrebera*" primum a Roxburghio ad arborem Indiæ orientalis conditum, fere per semiseculum in plantarum enumerationibus aut specierum catalogis *monotypicum*, et quidem inter *Bignoniacearum* gregem militans, remansit, donec Endlicher (Gen. Pl. p. 714) illud inter *Bignoniaceas dubias* collocavit, qua forsane ratione ductus, Lindley in Veg. Kingd. *Schreberam* Roxburghii penitus negligens, genus hoc ne nomine quidem

\* *Schrebera* Roxburgh, Plant. Corom. ii. p. 1, tab. 101, nec al. auct. *Schrebera* Retz. est *Elæodendron glaucum* Pers. *Schrebera* Thunb. Nov. Act. Upsal. postea ab ipso auctore in Dissert. Nov. Pl. Gen. et in ejus Flora Cap. tamquam *Hartogia capensis* descripta exstat. *Schrebera* Linn., secundum De C. Prodr. viii. p. 675, est *Cuscutæ* species, in quadam *Myrica* crescens.



in *Bignoniacearum* enumeratione commemorat. Sed paullo post cl. Fenzl\*, genera quædam *Bignoniacearum* dubia novo examini subjiciens, Roxburghii genus *Jasmineis* subscribendum esse, præclare docuit, quam opinionem etiam Endlicher in Gen. Pl. Suppl. ii. p. 54, nec non cl. Alph. De C. Prodr. viii. p. 674, secuti sunt. Postea vero cl. Wight (Illustr. ii. p. 185) *Schreberam* iterum, et quidem tamquam Subordinem, *Bignoniaceis* adnumeravit, simulque aliquam generis cum *Acanthaceis* affinitatem suspectans. Durante hoc inter celeberrimos botanicos de generis loco in systemate certamine, altera species *Schreberæ* a cl. Schimper in Abyssiniæ montibus detecta fuit, quæ a cl. Hochstetter† ceu novum *Oleacearum* genus sub nomine "*Nathusia alata*" descripta et in herbariis Schimperianis distributa, etiam in Endlicherii Gen. Pl. Suppl. ii. p. 55, et in De C. Prodr. viii. p. 281 recensita invenitur, et quidem ab Endlicherio *Jasmineis*, a cl. Alph. De C. autem *Oleaceis* associata. Nuper demum hæc ipsa *Nathusia alata* Hochst. quoque in Africæ australis extratropicalis ditone Natalensi a cl. Gerrard aliisque peregrinatoribus variis in locis reperta, mox ab acutissimo Harveyo tamquam vera *Schreberæ* species recognita et ab ipso sub nomine *Schrebera Saundersiæ* descripta et depicta fuit‡. Eadem hæc species, etiam mihi in Angolæ et Benguellæ interioribus montosis sæpius obvia, latissime per Africam calidiorem distributa videtur, ast præter illam in Angola australiore duæ alteræ species ejusdem generis, ambæ foliis simplicibus integris (nec pinnatis) inter congeneres valde insignes, ceteroquin omnibus notis genericis *Schreberæ* sat congruæ occurrunt, modo hic infra latius exponendæ.

Collocationem *Schreberæ* in systemate naturali quod attinet, genus hoc *Jasmineas* inter et *Oleaceas* fluctuat, vel potius ambos hos ordines arcte conjungit. Florum structura, imprimis limbi in 5–8 lobos divisio, staminum insertio, antherarum connectivum amplum, embryo demum exalbuminosus, peridermio spongioso-tumido exceptus, nec non cotyledones plano-convexæ et carnosæ *Jasminearum* characteri respondent, dum ovula pendula, capsulæ dehiscentia loculicida, semina alata et radícula supera, habitus deinde, saltem in duabus speciebus eximie *fraxineus*, evidentem cum *Oleaceis* affinitatem indignant, sicque genus, characteribus omnibus simul consideratis, amborum ordinum indicatorum limites obruit, eosque iterum, sensu Jussiei, in unum contrahendos esse suadet.

Additis duabus speciebus novis Angolensibus, jam 1858 in Apontam. pp. 549 et 579 a me commemoratis, genus *Schrebera* nunc quatuor species bene inter se distinctas amplectitur, quæ commode sequente schemate disponuntur:—

SCHREBERA, Roxb. ....	{	A. <i>Folia simplicia</i> . . . . .	1. Glaberrima, calycis subhemisphærici limbo truncato vel breve denticulato, capsula verrucis orbicularibus scabra, =SCHREBERA GOLUNGENSIS.
		. . . . .	2. Pubescens vel hirta, calycis campanulati limbo lobato-dentato, dentibus obtusis ciliatis, capsula levigata, =SCHREBERA TRICHOCLADA.
		. . . . .	3. Folia 1–3-juga, petiolo alato, foliolis sessilibus, =SCHREBERA ALATA ( <i>Nathusia alata</i> Hochst.).
		B. <i>Folia pinnata</i> . . . . .	4. Folia 2–4-juga, petiolo exalato, foliolis petiolulatis, =SCHREBERA SWIETENIOIDES Roxb.

\* Fenzl, Denkschr. Bot. Gesellschaft Regensb. iii. p. 246.

† Hochstetter (Chr. Fr.), Nova Genera Plantarum Africæ tum australis tum tropicæ borealis, p. 15; Schimper, Plant. exsiccatae Abyss. Sect. I. *Adoenses*, no. 245.

‡ Harvey (Dr. W. H.), Thesaurus Capensis, vol. ii. p. 40, tab. 163.



*Schreberæ* omnes hucusque cognitæ *arboreæ* sunt, etiamsi hinc inde, præcipue in silvis secundariis, post silvas primitivas igne destructas enascentibus, sub forma fruticosa occurrunt; omnium denique flores suavissime et fortiter fragrantés, inprimis nocturno tempore aroma amœnissimum, illud *Caryophyllorum* æmulans, per lata spatia spargunt.

1. SCHREBERA GOLUNGENSIS, Welw. n. sp. (Tab. XV.) *Sch.* glaberrima, foliis simplicibus oblongis, nunc ovato-vel lanceolato-oblongis, abrupte acuminatis, basi obtusis vel breviter in petiolum angustatis, supra nitenti-viridibus, subtus subglaucovirescentibus; calycibus levigatis, subhemisphæricis, ore truncatis vel minute repandodenticulatis; stylo incluso; capsula obtusa, bisulca, verrucoso-scabra.

*Habitat* in silvis primævis densioribus Distr. Golungo Alto, præcipue in montibus schisto-micaceis de Serra de Alto Queta, ad 2500 ped. alt. Floret Decembr.–Jan., fructific. Maio–Jul. *Exsic.* Welw. Iter Angol. n. 933.

Arbor 20–30-pedalis et altior; truncus rectus, basi 2–3 ped. circumferentiæ, cortice albido-griseo rimis minutis crebris aspero, coma elongato-ovoidea lucide denseque frondosa. *Rami* patentes, elongati, inferiores fere horizontales et tarde dejecti; ramuli oppositi, graciles, angulati, glabri, ad nodos dilatato-compressi, novelli et florigeri gracillimi, purpurascens et lenticellis albicantibus variegati, hisque asperuli. *Folia* opposita, petiolata, simplicia, penninervia, respectu circumscriptionis sat variantia, plerumque oblonga, non raro ovato-oblonga vel fere elliptica, nunc late lanceolata, ea ad basim ramulorum novellorum superioribus semper duplo triplove minora, omnia constanter glaberrima, supra intense viridia et valde nitentia, subtus pallide virescentia, halitu glaucescente suffusa, costa prominente læte flava percursa, inter venas dense reticulato-venulosa; petioli 3–4 lin. longi, canaliculati, cum ramo articulati; foliorum majorum lamina 4–4½ poll. longa, 1½–1⅔ poll. lata, basi sæpius obtusa vel breviter attenuata, margine integra, apice plus minus oblique et abruptim acuminata, substantia tenuiter coriacea vel chartaceo-rigida. *Inflorescentia* terminalis, omnino glabra, cymuloso-paniculata, paniculæ depauperatæ ramis di-, trichotomis pedicellisque basi articulata minute bibracteolatis, cymulis sæpius trifloris. *Flores* circiter pollicares, omnium specierum mihi cognitarum fragrantissimi; calyx obhemisphæricus, fere cupuliformis, circiter 1½ lin. longus et latus, ore inæqualiter repando 5–6-vel rarius 7-denticulatus, nunc omnino edentulus, truncatus, corollæ basim laxè excipiens; corolla carnosula, primum viridi-flavescens, mox tota cinamomeo-fusca, limbi plerumque 6-fidi lobis ad internam faciem papillis minutis fusco-rubris dense gregatis velutino-puberulis, æstivatione quincunciali-imbricatis sed vix contortis; tubus intus ad basim pilis raris adpersus, ceterum nudus. *Stamina* 2 paullo infra faucem inserta, inclusa; filamenta brevissima, compressa; antheræ lineariblongæ, medio dorso fixæ, biloculares, loculis connectivum crassum marginantibus, eoque paullo brevioribus, longitudinaliter dehiscentibus. *Ovarium* ovoideum, biloculare; ovula in quoque loculo 4; stylus filiformis, rectus, inclusus, apice sensim in stigma breviter bilobum incrassatus. *Capsula* lignosa, pyriformis, 1⅔ poll. longa, pollicem lata, basi teretiuscula calyce persistente arcte adpresso (vix uti in ceteris speciebus varie fisso) excepta, apice obiter convexo styli basi indurata apiculata, longitudinaliter obtuse bisulcata, fusco-badia, undique verrucis orbicularibus magnitudine variis plus minus gregatis asperulis adpersa, bilocularis, ex apice loculicide bivalvis, valvis crassis navicularibus, medio septum fere sesquilineam crassum gerentibus, intus infra verticem gibbis. *Semina* in quoque loculo 4, ex apice septi pendula, compressa, deorsum (*i. e.* in directione radiculæ opposita) in alam scariosam oblique lato-lanceolatam obtusiusculam faciebus subtrinervem prolongata, una cum ala 1–1½ poll. longa, endopleura suberoso-spongiosa. *Albumen* nullum! *Embryo* rectus, 4–4½ lin. longus, 2 lin. latus; cotyledones elongato-ovatæ, obtusæ, basi emarginatæ, carnosulæ, extus leviter convexæ, facie interna plana applicatæ (nequaquam plicatæ!); radícula supera, oblonga, tumidula, obtusissima, circiter ¾ lin. longa, ad hilum spectans.



*Observatio.*—Semina in oculis quidem constanter quatuor inveniuntur, sed sæpius solummodo eorum duo embryo evoluta foecunda, reliqua duo vero plerumque in laminam subduram, oblongo-lanceolatam, intus suberoso-spongiosam et embryo omnino carentem, extus ad unam faciem acute carinatam, inter se concreta, vel saltem arcte conglutinata. Vid. tab. nostr. fig. 11.

2. SCHREBERA TRICHOCLADA, Welw. n. sp. *Sch.* ramulis novellis et florigeris petiolisque pubescentibus; foliis simplicibus, late ellipticis, elliptico-ovatis vel rarius obovatis, apice obtusiusculis vel breviter acutatis, basi abruptim attenuatis, supra glabratis, subtus juxta costam venasque pubescentibus; calycibus campanulatis puberulis, sub pube sulcato-striatis, ore lobato-dentatis, dentibus conspicuis, inæqualibus, deltoideo-ovatis oblongisve, margine dense ciliatis; stylo plus minusve exserto; capsula elongato-pyriformi, obtuse quadrangula, quadrisulca et levigata.

*Habitat* in silvaticis rupestribus Distr. Ambaca et Pungo Andongo, inter 3000 et 3500 ped. altit. Ab Octobr. usque ad Decembr. floret; fructiferam Junio 1857 legi. *Exsic.* Welw. Iter Angol. no. 936 et 934.

Arbor circiter 15-pedalis, patentim ramosa, coma laxa, rarius frutex 6–8-pedalis, ramis virgato-elongatis, obscure angulatis, cortice cinerascens vel fere albedo; ramuli novelli et florigeri constanter plus minusve cano-pubescentes, etiam fructiferi pubem conservantes, vel patulo-villosi aut hirtuli. *Folia* circumscriptione non minus quam in specie antecedente variant, sed plerumque elliptica vel obovato-oblonga, membranacea, herbaceo-viridia absque nitore, subtus secus costam et venas prominentes pubescentes; petioli 4–7 lin. longi cum ramulis articulati, constanter, et quidem etiam in foliis adultis, ceteroquin excepta costa omnino glabratis, pubescentes. *Paniculae* depauperatae 5–10-, rarissime 14-florae, in ramulis terminales; pedunculi, rami et pedicelli pubescentes, basi articulati, bibracteolati, bracteolis puberulis vel dense villosis-barbulatis. *Calyx* tubuloso-campanulatus, quam in *Schreb. Golungensi* duplo major, fere 3 lin. longus, dense pubescens, sub pube obscure sulcato-striatus vel omnino deglabratus et tunc evidentius plurisulcatus, ore grosse dentato, dentibus nunc deltoideo-ovatis nunc lobuliformibus oblongis, juxta margines et præcipue apice semper ciliato-barbulatis. *Corolla* ejusdem magnitudinis et structuræ ac in specie antecedente, primum albida, limbi 5–7-fidi lobis pilis clavatis crispulis roseo-purpureis, circa faucem densioribus, demum una cum tota corolla cinnamomeis, obsitis. *Antherarum* loculi connectivo crasso subcompressa æquilongi. *Ovarium* conico-ovoideum; stylus modice exsertus. *Capsula* fere bipollicaris, badio-flavicans, levigata (nec verrucoso-aspera), obtusissime quadrangula, inter angulos apicem versus magis salientes late sulcata, sulcis in vertice obtuso, obiter apiculato, cruciatim confluentibus. *Semina* quam in *Schreb. Golungensi* quidpiam longiora, perfecte matura vero mihi non obvia. Cetera generis.

*Observatio.*—Species, priori omni respectu sat affinis, sed certe distincta, et ramulis petiolisque et nervo mediano subtus constanter pubescentibus, nec non calycis late dentati capsulaeque levis configuratione ab illa absque difficultate distinguenda, ceteroquin ut videtur latissime per Africam austro-tropicam distributa, a clar. Kirk etiam (secundum specimen in herb. Kewensi, Zambesi Exped. 1863 Morumballa) e ditone Mossambicensi reportata.

### 3. SCHREBERA ALATA.

*Nathusia alata*, Hochst. Nov. Gen. Pl. Afr. p. 15, et in Schimper, Iter Abyss. Plant. Adoenses, no. 245; Endl. Gen. Pl. Suppl. ii. p. 55; DC. Prodr. viii. p. 281; A. Rich. Tent. Abyss. ii. p. 29; Welw. Apontam. p. 379.

*Schrebera Saundersiæ*, Harv. Thes. Cap. ii. p. 40, tab. 163.



*Habitat* arborea in silvis primitivis Distr. Pungo Andongo ad 3000 ped. circiter altit., nec non in silvis secundariis densioribus Distr. Huilla inter 4000 et 5000 ped. alt., hic sæpius tamquam frutex 8-pedalis. Decembr. c. fl.; Maio c. fr. necdum maturo lecta. *Exsic.* Welw. Iter Angol. no. 938.

*Distrib. geogr.*—Abyssinia, Angola, Port Natal.

*Observatio.*—Specimina Angolensia cum Abyssiniciis a cl. Hochst. descriptis, et simul cum Icone Harveyana supra laudata optime conveniunt, calyces in stirpe Angolensi quidpiam puberulos (nec omnino glabros) si excipias. Ceterum nec mirandum, stirpem per Africam tropicam cis- et transæquatoriam divulgatam, et imo ditionem Natalensem invadentem maximopere variare. In silvis primævis convallibusque solo humoso donatis arborea crescit, 15–30-pedalis, habitu fere omnino *Fraxini*, in silvaticis autem macrioribus solummodo frutex remanet, 5–8-pedalis, ramis elongatis tortuosis, hinc inde subscandentibus, et tunc *Jasmini* speciem non male fingens. Folia 3–5- vel, etsi rarius, 7-foliolata interdum in uno eodemque ramo obveniunt; petioli nunc latius nunc angustius alati; foliola magis minusve acuminata; calyces nunc ore truncati nunc evidenter dentati, stamina inclusa vel subexserta etc. non raro in speciminibus unius ejusdemque arboris invenienda; maxime autem species hæc respectu indumenti ramulorum, foliorum atque calycis florigeri variat, quæ organa nunc fere penitus glabra, nunc obiter puberula vel pubescentia, nunc undique sericeo-tomentella inveniuntur. Hanc ulteriorem formam, in editissimis petrosis Distr. Huilla mihi obviam, et aspectu sat singularem, hic proponere liceat tamquam

*β. tomentella.* Ramulis, foliis calycibusque dense sericeo-pubescentibus vel albo-tomentellis.

*Habitat* in Distr. Huilla montibus editis petrosis breve dumetosis inter 5000 et 5600 ped. alt. socialis cum *Protea*, *Xylopeæ*, *Dombeyæ* et *Tarchonanthi* speciebus, præcipue in summis jugis de “Morro de Lopollo.” Martio 1860 c. flore et fruct. immat. lecta. *Exsic.* Welw. Iter Angol. no. 939.

Frutex 5-pedalis, arbusculiformis, coma densius ramosa, præter indumentum sericeum formæ typicæ omnino fidelis. Etiam hac in varietate, primum facile pro specie distincta habenda, ramuli fructiferi et folia adulta indumentum pro parte dejiciunt, et calyces glabrescunt; fructus denique jam juveniles levigati sunt, quemadmodum in specie typica.

Ceteroquin folia pinnata hanc speciem strictim a duabus antecedentibus separant, petioli alati demum et foliola sessilia illam primo jam intuitu ab affini *Schrebera Swietenioide* Roxb., totius generis prototypo, distinguunt.

### Ordo APOCYNACEÆ.

Trib. ECHITEÆ, DC. Prodr. viii. p. 412.

#### PACHYPODIUM, Lindl.

*Pachypodii* genus, jam olim ab acutissimo R. Br. ob *Echitis* specierum Thunbergianarum ab Americanis notabilem discrepantiam, obiter indigitatum, demum a cl. Lindley in Bot. Reg. [1830] tab. 1321 institutum, nuper a cl. A. DC. (Prodr. viii. p. 423) locupletatum, ne dicam reformatum fuit, characteri nempe generico “*glandulas 5 hypogynas*” addente, in *Pachypodio* [*Echite* Thbg.] *succulento* ab eo observatas, quas cl. Lindley in generis sui definitione expressis verbis “*absentes sive nullas*” declarat\*. Tres sunt species

\* Glandulæ sive squamulæ quinque hypogynæ *Echitis succulentæ* Thunb. jam in icone hujus speciei, a cl. Jacquin in Fragm. Bot. tab. 117 exhibita, pro illo tempore perfectissima, sat clare depictæ inveniuntur.



generis hujusce, hoc modo ampliati, in Prodr. *l. c.* descriptæ, quibus quarta addenda venit, quæ a clar. Harvey in Thes. Fl. Cap. tab. 117 depicta et sub nomine "*Adenium Namaquanum*" descripta, omnibus characteribus ibi, etiamsi nimis fragmentarie, exhibitis, bene cum *Pachypodii* genere convenit, et ob antherarum structuram, glandularumque hypogynarum præsentiam certe a genere "*Adenium*" excludenda. Omnes hæ quatuor species, præter essentielles notas genericas, simul etiam indumento variarum partium plus minusve pubescente vel tomentoso, nec non corollæ lobis æquilateris et planiusculis inter se congruunt atque *Pachypodii* Sectionem primam *Eupachypodium* constituentes considerari posunt, dum quinta, hic infra a me proponenda, species nova, et quidem sat formosa, "glandulis in discum cupuliformem concretis, limbi corollæ lobis valde inæquilateris crispatisque, nec non stirpis totius glabritie" insignis, alterius ejusdem generis Sectionis typum offert, nomine "*Adeniopsis*" salutandæ. Erunt itaque *Pachypodii* Sectiones duæ sequente modo limitandæ:

- A. *Eupachypodium*: corollæ lobi planiusculi, æquilateri; glandulæ hypogynæ 5 [vel inconspicuæ?]; stirpes indumento variarum partium pubescente vel tomentoso. Cotyledones (ex A. De C.) *radicula breviores*.
- B. *Adeniopsis*: corollæ lobi inæquilateri, hinc crispati; discus cupuliformis 5-crenatus; stirps glaberrima. Cotyledones *radicula duplo longiores*!

PACHYPODIUM [ADENIOPSIS] LEALII, Welw. n. sp. (Tab. XVI.) *P.* trunco succulento, erecto, elongato-conico, crebre aculeato, apice 2-3-chotome ramoso, ramis glaberrimis; aculeis validis; pedunculis firmis, terminalibus, multifloris; calycis dentibus brevibus, triangulari-ovatis, acutis, glabris; corollæ amplæ glaberrimæ lobis late oblique ovatis, apicibus obtusiusculis retortis, latere altero plano continuo, altero convexiore undulato-crispato; disco annulari obtuse quinquelobo.

*Habitat* non infrequens in montosis petrosis aridis Distr. Bumbo (territorii Mossamedensis interioris) præcipue inter Quitibe et Bumbo, ad 1500 ped. altit. supra mare. Octobr. 1859 et iterum Junio 1860 c. fl. et fr. matur. legi. *Exsic.* Welw. Iter Angol. no. 1510.

Arbuscula cactiformis, 10-15-pedalis, succo aquoso-resinoso viscido scatens, tota aculeis rigidis geminatim proximatis, fere pollicem longis, rectis, patulis, satis pungentibus horrida, ast floribus admodum speciosis grateque fragrantibus et per totum fere annum obviis inter congeneres valde insignis. *Truncus* succulentus strictus, prope basim non raro 2-3 ped. circumferentiæ, epidermide levi, tenui, plumbeo-grisea, facile secedente et corticem herbaceo-viridem denudante vestitus, inferne simplicissimus, a medio apicem versus parce patentimque dichotome ramosus; rami juniores et ramuli floriferi, uti etiam aculei, lætissime sanguineo-purpurei et nitido-levigati. *Folia* sparsa, minima, vix lineam longa, rare et nonnisi ad ramulorum novellorum apices hinc inde obvia, oblongo-lanceolata, basi articulato-sessilia, membranacea, nervo crasso in acumen subulatum excurrente percursa, quasi aculeum bialatum fingentia, caducissima, juxta basim utrinque aculeis rectis, stipularum lateralium vices gerentibus(?), post folium delapsum persistentibus munita. *Aculei* recti, in trunco et ramis ramulisque per paria sparsi, tuberculis oblongis verniceo-nitidulis insidentes, acutissime subulati, basi sub lente puberuli, majores sesquipollicem longi, juniores erecto-patuli, vetustiores late patentis, in cujusve paris axilla aut aculeo altero brevioris aut gemmula e setis pluribus composita aucti, simulque inter eorum basim fossula circulari vel oblonga, folii delapsi cicatrice, instructi. *Inflorescentia* cymosa, in ramulis extimis terminalis, tota glaberrima; cymæ multifloræ, inordinate compositæ, amplæ, bene evolutæ non raro 6-7 pollic. diametri, pedunculo communi crasso, recto, longitudine vario,



basi aculeolis gregatis circumcirca stipato, subsimplici vel parcius dichotome ramoso, herbaceo-viridi; pedicelli crassi, longitudine inter  $\frac{1}{2}$  et 4 lin. in eadem cyma variantes, superne incrassati, basi bracteolis squamiformibus, deltoideis, plus minusve acutis, caducissimis, cicatricem transversam relinquentibus semiamplexi. *Calycis* brevis, intus eglandulosi lobi subæquales, deltoideo-ovati, breviter subulato-acuminati, rigiduli, erecti. *Corollæ* tubus purpurascens,  $1\frac{1}{2}$ – $1\frac{2}{3}$  poll. longus, rectus, medio circa stamina ampliatus, faucem versus angustatus, intus infra stamina pilis adpersus, superne nudiusculus, fauce omnino nuda; limbi horizontaliter patentis  $2\frac{1}{2}$ –3 poll. diametri transversalis lobi  $1\frac{1}{2}$  poll. longi,  $\frac{3}{4}$  poll. lati, in æstivatione *sinistrorsum* contorti, externe rosei, interne splendido-albi, inæquilateri, latere in alabastro occultato convexiore denseque undulato-crispato. *Stamina* medio tubi inserta, inclusa; filamenta brevissima, basi interna pilosula; antheræ sagittatæ, sinu fixæ,  $4\frac{1}{2}$ –5 lin. longæ, rigidæ, in appendicem lanceolatam polline destitutam acuminatæ, circa stigma inclusum pyramidatim conniventes, læte flavæ. *Discus* elevatus, urceolaris, ceraceo-carnosulus, obiter 5-lobus, lobis æqualibus obtusissimis. *Ovaria* duo, oblongo-ovoidea, glabra, disco longiora; ovula  $\infty$ ; stylus filiformis, stigmatem oblongo-cylindræo, vertice obtuso obscure bilobo, basi annulo prominente subcrenulato antheris adhærente cincto. *Folliculi* juniores erecto-patuli, maturi angulo recto divergentes, 3–5 poll. longi, compresso-cylindræi, medio modice ventricosi, superficie glabri purpurascens, ventre dehiscentes, intus nitidulo-albidi. *Semina* numerosa, pendula, obovoidea, compressa, dense imbricata, ad umbilicum comosa, coma duplo triplove breviora; testa fusco-badia, membranacea, scabrula; albumen parcum; cotyledones late ovatæ vel suborbiculares, basi cordatæ, planiusculæ, leves, margine integerrimæ; radícula oblonga apice conoidea, cotyledonibus fere duplo brevior, ad hilum spectans.

Speciem hanc, inter congeneres longe ornatissimam, dicatam velim viro clarissimo, Fernando da Costa Leal, in exercitu Lusitano legionis præfecto strenuo, Districtus Mosamedensis et inprimis Coloniae Huillensis defensori intrepido, nec non Mappæ geographicæ Angolæ nuper in lucem editæ pro magna parte auctori.

*Observatio.*—Genera “*Pachypodium* Lindl.” et “*Adenium* R. & Sch.,” etiamsi in DC. Prodr. loc. supra cit. sub diversis *Apocynacearum* tribubus militant, arcta affinitate junguntur, simulque omnium fere specierum habitu isomorpha, eademque vivendi ratione confirmata. Principalis tamen eorum differentia ex antherarum seminumque structura pendere videtur, dum reliquæ notæ genericæ, a diversis auctoribus indicatæ, in utroque genere sat variantes sive vacillantes sese denotant. In *Adenio* stamina exserta vel saltem faucibus approximata, antherarum apices longe appendiculati et plus minusve spiraliter torti; semina demum subcylindrica vel cylindrico-subangulata et utraque extremitate comosa dicuntur et talia tam in icone *Adenii multiflori* Klotsch. [Peters, Reise, Bot. i. tab. 44] quoad antheras, quam in icone eximia sed necdum edita *Adenii speciosi* Fenzl, ab amicissimo auctore benevole mecum communicata, quoad antheras et seminum comas, depicta sunt. In *Pachypodio* stamina inclusa, antherarum apices sensim in acumen subcartilagineum, rigidulum, strictum angustati, semina dein compressa, obovata et solummodo ad umbilicum comosa. Discus denique in *Adeniis* veris brevissimus, annularis, continuus et ore nudo truncatus adesse dicitur, dum *Pachypodii* species vel glandulas 5 inter se separatas, vel in discum cupuliformem ore 5-lobatum coalitas offerunt. Squamulæ faucem corollæ coronantes in *Pachypodiis* vix obviæ, in nostrate hic descripto certe absentes, levioris momenti videntur, nam in *Adeniis* nunc manifeste obviæ [*Ad. multiflorum* Kl. l. c.] nunc omnino deficientes, v. g. in *Ad. specioso* Fenzl.

Hiscæ omnibus perpensis species amborum generum hucusque cognitæ forsitan sequente



modo commode exponendæ, simulque ob antherarum et seminum structuram sedule observandam peregrinatoribus futuris commendandæ:—

ADENIUM, R. & Sch.

1. *A. obesum*, R. & Sch. [*Ad. Honghel*, Lindl.].
2. *A. Honghel*, Alph. DC. [nec Lindl.].
3. *A. multiflorum*, Klotsch.
4. *A. speciosum*, Fenzl.

PACHYPODIUM, Lindl.

1. *P. tuberosum*, Lindl.
2. *P. succulentum*, Alph. DC.
3. *P. bispinosum*, Alph. DC.
4. *P. Namaquanum*.

*Adenium Namaquanum*, Wyley in Harv. Thes. Cap. ii. tab. 117.

5. *P. Lealii*, Welw.

Speciebus utriusque generis in posterum exactius cognitis, et quoad antherarum seminumque structuram accuratius investigatis, ambo genera fortasse in unum conjungenda et tum *Pachypodium* atque *Adeniopsis* generi *Adenio* antiquiori ceu Sectiones subscribenda erunt, vix unquam vero, imo si reapse inter se diversa statuuntur, in diversas ordinis sui tribus divellenda.

Ordo GENTIANACEÆ.

Trib. I. GENTIANEÆ. Subtr. 2. CHLOREÆ, DC. Prodr. ix. p. 49.

FAROA, Welw. gen. nov.\*

*Calyx* subcampanulatus, ad medium quadrifidus, lobis erectis, obtuse carinatis. *Corolla* subhypocrateri-morpha, marcescenti-persistens, tubo sensim ampliato infra faucem obiter constricto, limbi quadrifidi lobis patentibus; faux squamulis quatuor, staminibus oppositis, semilunaribus, margine tenuissime fimbriatis clausa. *Stamina* quatuor, ad sinus loborum inserta, longe exserta, filamentis suberectis filiformibus; antheræ breves, late oblongæ, basi cordatæ, dorso ad sinum fixæ, demum incumbentes, immutatae. *Ovarium* obovoideum, basi in stipitem brevem angustatum, carpellorum marginibus introflexis subbiloculare, ovulis juxta suturas biserialibus. *Stylus* rectus, elongatus, filiformis, stigmate parvulo simplici, tenuissime papilloso vel brevissime bilobo. *Capsula* parva, oblonga, perianthio marcescente inclusa, bivalvis, septicida, semibilocularis, placentis juxta valvularum margines insertis. *Semina* numerosa, subglobosa, testa undique foveolata.

Herba parva, annua, glabra, radice pluricipite; caulibus erectis simplicibus vel apices versus trichotome ramosis, tetragonis. *Flores* parvi, gracile pedicellati, in cymas densas corymbiformes foliis 2 vel pluribus involucretas dispositi, violaceo-cærulei.

Genus ni fallor prope *Hippion* Spgl. [*Enicostema* Blum.] collocandum, cui ob flores

\* Dicitur est clarissimo Doctori T. C. P. Lapa e Faro, Medico mossamedensi experientissimo, mearumque in Districtu Mossamedes institutarum peregrinationum fautori humanissimo.



in foliorum axillis pseudo-verticillatim gregatos, corollæ faucem squamigeram, capsulæ structuram et semina foveolata aliquantulum affine videtur. A *Sebæa* generibusque huic vicinis tum habitu peculiari quum corollæ capsulæque fabrica interna longius distat.

Species unica :

FAROA SALUTARIS, Welw. n. sp. (Tab. XVII.)

*Habitat* frequentissima in pascuis humidiusculis arenoso-argillaceis totius fere Distr. Huilla, inter 4000 et 5500 ped. altit., præcipue circa Mumpulla et Lopollo. Ab Octobre usque ad Januarium floret et fructificat. *Exsic.* Welw. Iter Angol. no. 1523.

Herba elegantula habitu *Globulariam* vel, si mavis, *Iasionem* fingens, pascua editiora et dumeta brevius herbida tempore vernali in *Iridearum*, *Commelynearum* et *Indigoferarum* consortio mira individuorum copia eximie decorans. *Radix* annua [vel plurennis?]\*, cylindræa, firmula, in speciminibus vetustioribus sat longa, perpendicularis, fibris lateralibus subsimplicibus elongatis stipata, ad collum incrassatum multiceps, foliorumque primordialium rosula, in planta florente non raro jam emarcida, coronata. *Caules* ex eadem radice 3–5 usque 20, erecti, vel laterales basi ascendentes, 2–4 poll. alti, quadranguli, nunc simplices, nunc a medio bis terve trichotome ramosi, foliorum paribus 3–6, semipollicem ad pollicem usque inter se distantibus vestiti, e viridi purpurascens vel intensius purpurei, apice vel simul ad superiorum foliorum axillas capitulis florigeris ornati. *Folia* radicalia gregata, oblongo-lanceolata vel elongato-spathulata, trinervia, 1½–3 poll. longa, 3–4 lin. lata, obtusiuscula, basi sensim attenuata, caulina angustiora, lineari-lanceolata vel linearia, lata basi semiamplexicauli inter se connata, apice subobtusa, ½–1 poll. longa, rarius linea latiora, nervis lateralibus evanescentibus subtrinervia, patula, intense viridia, carnosula, summa florum capitula involucrentia. *Flores* modice pedicellati, constanter tetrameri, in foliorum axillis superioribus et summis cymoso-fasciculati, cymis multifloris, foliorum internodiis versus apices caulium ramorumque valde abbreviatis in corymbos densissimos capituliformes congestis, capitulis 6–10 lin. diametri, nunc solitariis nunc (in speciminibus robustioribus) pluribus 2–4 in eodem caule superpositis. *Pedicelli* strictiusculi, fere setiformes, floribus (circiter duas lineas longis) paullo longiores, una cum calyce et corolla violaceo-cærulei vel roseo-violacei, rarius violaceo-albidi, exsiccatione mox pallide albescentes. *Calycis* tubus subquadrangulus; lobi ovati, inferne membranaceo-marginati, dorso obtuse carinati, apice carina excurrente obtuse apiculati, corollæ tubo paullo breviores. *Corollæ* tubus sub prima anthesi a basi faucem versus sensim sed parum ampliatus, ovario demum increcente, inter hoc et faucem squamigeram plus minusve constrictus; limbi patentis lobi ovati, concaviusculi, obtusi, rarius subacuti, tubum longitudine subæquantes. *Squamulæ* faucis versus ejus centrum conniventes. *Filamenta* compresso-filiformia, violaceo-albida, una cum antheris intense purpureo-violaceis, exsiccatione albidis, longe persistentia. *Stylus* gracilis, stamina æquans vel iisdem paullo longior, stigmatate exiguo nunc simplici, dense tenuiterque papilloso, nunc brevissime bilobo terminatus. Cetera generis.

*Qualitates et Usus.*—Inter plures *Gentianaceas* in Distr. Huilla a me observatas et ob principium amaricanti-tonicum, quo pollent, sub forma decocti caulium et radice ceu remedium roborans, digestionis post febres intermittentes perturbatæ vigorem restaurans, adhibitas, hanc præsentem speciem ægro-

\* Plurima loco citato a me collecta specimina habitu suo plantam quidem *annuam* indicant, ast simul alia robustiora adsunt, quorum radix circa collum valde incrassata et fere lignosa vitam plurennem vel saltem biennem indigitat. Plures enim in eadem regione Huillensi plantarum tum *Monocotyledonearum* quum *Dicotyledonearum* species observavi, quæ habitu pusillo, gracili et radice tenuiter fibrillosa plantam annuam simulant, dum reapse perennantibus vel saltem per plures annos viventibus adnumerandæ sunt. Sic ex. gr. variæ species *Droseræ*, in spongiosis editis Distr. Huilla frequenter obviæ, omnino habitum plantarum annuarum fingunt, sed tamen gemmula, in radice collo intra foliorum radicalium rosulam emarcidam abscondita et quolibet anno sequente in plantam novam evoluta, vitam perennem ducunt.



tantibus præ ceteris salutarem expertus sum, qua ratione ductus plantam nomine specifico "*salutaris*" designavi.

*Observatio.*—*Sebæa involucrata* Klotsch, in Peters, Reis. Mossamb. i. p. 271, quantum e descriptione *l. c.* data concludere licet, forsan alteram *Farocæ* speciem sistit, a nostra tamen foliis involucratis magnis cordato-lanceolatis scariosis et præcipue calycis laciniis obovato-spathulatis statim dignoscendam, cujus autem specimina nondum videre licuit.

#### BELMONTIA, E. M.

**BELMONTIA GRACILIS**, Welw. n. sp. *B.* caule erecto, 4-gono, filiformi, simplici vel parce ramoso; foliis anguste lineari-lanceolatis linearibusve, internodiis brevioribus, canaliculatis, basi semiamplexicaulibus; calycis profunde 5-partiti segmentis lato-lanceolatis, longe acuminatis, margine late membranaceis, dorso alato-carinatis; corollæ tubo gracili, sursum ampliato, limbi 5-fidi lobis ovatis apiculatis patulis; antheris quam filamenta brevioribus, glandula elongato-claviformi superatis; stigmatibus oblongo-clavato, stylo recto vix brevioribus, apice subbilobo.

*Habitat* in pratis spongiosis Districtus Huilla, ad 5000 ped. altit. socialis cum variis *Utriculariis*, *Xyrideis* et *Eriocauloneis*, imprimis inter Lopollo et Monino, ubi mense Aprili 1860 c. fl. et fr. legi. *Exsic.* Welw. Iter Angol. no. 1524.

Stirps annua, reliquis generis speciebus multo gracilior. *Radix* brevis, tenuiter fibrillosa. *Cauliculus* filiformis, 3–5 pollices altus, erectus, nunc simplicissimus uniflorus, nunc ramulo uno alterove laterali bi- vel triflorus, foliorum paribus 3 vel 4, pollicem vel sesquipollicem inter se distantibus vestitus. *Folia* ima superioribus duplo breviora et angustiora, illa in medio caulis sita 5–6 lin. longa,  $\frac{1}{2}$  vel  $\frac{2}{3}$  lin. lata, patula, herbaceo-viridia. *Flores* parvi, longe pedunculati, lutei, subnutantes; pedunculi nudi, in speciminibus unifloris 2–3 pollices longi, erecti, cauliculum terminantes, iis ramulorum lateralium vix pollicaribus et erecto-patulis. *Calycis* segmenta a basi ad medium usque late membranaceo-marginata, demum subulatim acuminata, dorso carinato breviter alata, corollæ tubo paullo breviora. *Corolla* omnino *Belmontiæ cordatæ* var. *micranthæ*, quacum etiam glandularum minutarum glomerulis inter calycem et corollam obviis convenit. *Antheræ* in tubi parte superiore dilatata inclusæ, filamentis breviores, glandula gracili cylindrico-clavata, erecta, ceraceo-aurantiaca terminatæ. *Ovarium* oblongo-ovoideum, bisulcatum, biloculare, placentis latiusculis septulo contiguis. *Stylus* rectus, firmulus; stigma pro more floris sat magnum, elongato-clavatum, apice nunc obiter bilobum nunc integrum, fere styli longitudine, stamina vix superans. *Capsula* ovoidea, corolla marcescente vestita, bivalvis, bilocularis, placentis demum liberis induratis. *Semina* numerosissima, placentis immersa, quadrangulo-prismatica, testa tenuissime dense papillosa.

#### EXOCHÆNIUM, Griseb.

- EXOCHÆNIUM PRIMULÆFLORUM**, Welw. n. sp. *E.* annuum, pumilum, erectum; caule a basi trichotome ramoso, quadrangulo, ramis fastigiatis foliosis; foliis erectis lanceolatis vel lineari-lanceolatis linearibusve, acuminatis, trinerviis, basi semiamplexicaulibus; pedunculis axillaribus rectis inæquilongis, inferioribus elongatis, superioribus sensim brevioribus; calycis lobis anguste alato-carinatis, acuminatis, corollæ tubo sursum ampliato brevioribus; corollæ flavæ lobis ovatis, basi angustatis, apice apiculatis; stylo filiformi, recto, glanduloso-puberulo, stigmatibus cylindrico-clavato, simplici vel subbilobo.



$\beta$ . *nanum*. Cauliculis abbreviatis  $\frac{1}{2}$ –1-pollicaribus, cæspitulosis vel fere nullis, pedunculis tunc e foliorum radicalium rosula emergentibus, floribus non raro totius cæspituli altitudine longioribus, limbi corollæ lobis rotundatis, mucronato-apiculatis.

*Habitat* in spongiosis editioribus Distr. Huilla, inter 5000 et 5500 ped. altit., socialis cum *Droseris*, *Xyrideis* et *Cyperaceis* pusillis, imprimis in alta planitie inter Lopollo et Humpata. Martio floret et fructif. Var.  $\beta$  in ejusdem Districtus declivibus uliginosis hyeme exsiccantibus juxta viam versus Gambos c. fl. Apr. 1860. *Exsic.* Welw. Iter Angol. no. 1513 et 1514.

Pulchra planta, e longinquo in pratis breve herbis visa quasi *Primulæ acaulis* corymbos aureos mentiens, hinc inde cæspites 25–30-floros obferens. *Radix* e fibris tenuibus abbreviatis dense fasciculata. *Caulis* paullo supra basim in ramos plures 3-chotomos, fastigiatos, subpatulo-erectos divisus, non raro cæspites multifloros 3–6 poll. diametri, sed solummodo 2 ad 5 pollices altos exhibens. *Folia* radicalia caulinis breviora et obtusiora, cito marcescentia, caulina 1–1 $\frac{1}{2}$  poll. longa, 1–2 lin. lata, in aliis specimenibus angustissima vix lineam mediam lata, sensim longe acuminata. *Pedunculi* axillares vel in ramorum ramulorumque dichotomiis solitarii, erecti, basi subalato-quadranguli, inferiores 1–2 pollices longi, superiores sensim breviores, supremi brevissimi, vix lineam longi. *Flores* sulphureo-flavi vel non raro splendide aurantiaci, erecti, incluso calyce ad  $\frac{3}{4}$  poll. longi; limbi 9 lin. diametri, 5-fidi (rarissime 4-fidi), tubo sursum dilatato dimidio brevioris, lobis late ovatis, nunc brevius nunc longius apiculatis. *Stamina* in parte inferiore tubi inclusa; antherarum glandula apicalis cylindraceo-clavulata, fere loculis æquilonga, eæ ad basim antherarum sitæ minutæ, subglobosæ, loculis toties breviores. *Stylus* plerumque staminum longitudine, sed etiam iis brevior vel paullo longior, una cum stigmate clavulato-incrassato apice vix bilobo puberulus. *Capsula* ventricoso-ovoidea, corolla marcescente vestita, styli residuis apiculata, bivalvis, bilocularis; placenta centralis, spongioso-carnosula, quadripartibilis, demum libera. *Semina* placentæ immersa, minutissima, subquadrangulari-prismatica.

*Observatio*.—Characteribus genericis bene cum *Exochænio* convenit; ab *Exochænio grandi* Griseb. radice autonoma nec parasitica, caule a basi fastigiatim ramoso, floribus erectis nec horizontaliter nutantibus, alis calycis basim versus evanescentibus nec dilatatis, tubo corollæ calycem longius superante etc. nec non habitu discernitur.

2. *EXOCHÆNIUM DEBILE*, Welw. n. sp. *E. annuum* (?), *nanum*, flaccidulum, rhizomate subcarnoso, crassiusculo, albido, repente, fibrillis fragilibus stipato; cauliculis erectis, debilibus, quadrangulis, simplicibus vel parce tri-dichotome fastigiatim ramosis; foliis internodiis subbrevioribus, oblongo-vel ovato-lanceolatis plerumque acutis, summis hinc inde linearibus; pedunculis axillaribus vel terminalibus, brevibus, fructiferis subelongatis; corollæ albæ tubo calyce longiore, sursum ampliato, limbi laciniis tubo subtriplo brevioribus, obovato-oblongis, apice rotundato vix apiculatis; stigmate elongato-clavato, glanduloso-pubescente, quam stylus longiore, apice obtusiusculo bilobo.

*Habitat* sparsim in limosis humidis breve herbis Distr. Pungo Andongo, ad margines lacus magni dicti "Lagoa de Quibinda," ad dextram fluminis Cuije. Cum fl. et fr. Martio 1857. *Exsic.* Welw. It. Angol. no. 1511.

Herbula perparva, forsitan parasitica, habitu *Sebææ pusillæ* (*Lagenias pus.* E. M.) non absimilis, 1–2 pollices alta. *Rhizoma* carnosulum, oblique descendens, fibrillis admodum fragilibus elongatis limum humidum perrepens, e collo caules paucos debiles vix bipollicares, simplices vel fastigiatim ramosos emittens. *Folia* in uno eodemque specimine varia, plerumque lanceolata et acuminata, rarius ovata et obtusiuscula, summa hinc inde anguste lanceolata vel linearia. *Cymulæ* fastigiatæ, paucifloræ, hic depauperatæ bi-unifloræ. *Flores* una cum calyce 6–7 lin. longi, erecti. *Calycis* alæ breves, ejusdem



segmenta basi late membranaceo-marginata, apice subulata et divergentia. *Corolla* alba, tenera, tubo calycem constanter superante, faucem versus modice ampliato; limbi 5-fidi lobi campanulatim patuli, tubo duplo subtriplove breviores, apice rotundato-obtusi, absque ullo mucrone vel apiculo. *Stamina*, antherarum fabrica et stigma nec non capsula et semina fere omnino speciei antecedentis, a qua tamen præsens rhizomatis natura, corolla *alba* duplo minore, tubo corollino elongato et limbi lobis rotundato-obtusis inapiculatis sine difficultate distinguitur.

*Observatio*.—Quoad herbulæ durationem incertus permaneo; habitus quidem et caulicorum tenuitas plantam *annuam* indigitant, ast rhizoma crassiusculum et subcarnosum forsitan stirpem biennem vel imo per plures annos durantem sustentat. Conf. *Observ.* ad calcem *Faroæ salutaris* pag. 46.

### 3. EXOCHÆNIUM GRANDE, Griseb. DC. Prodr. ix. p. 55.

*Habitat* freq. in spongiosis pratisque silvaticis uliginosis dense herbidis totius Distr. Huilla, ad 4500–5000 ped. alt., plerumque cum *Droseris*, *Strigis* et *Scleriis* etc. socialis, inter rhizomata aliarum plantarum, inprimis *Cyperacearum*, parasiticum. A Decembri usque ad Febr. flor. et fructif. *Exsic.* Welw. Iter Angol. no. 1516.

*Observatio*.—Stirps in DC. Prodr. *l. c.* a clar. Grisebach cum signo ? ceu annua enumerata certe *annua* est et quidem absque dubio parasitica, radicis pro more parvulæ fibrillis carnosulis, albidis, subsimplicibus, tortuosis, rigidulis et fragillimis aliarum plantarum, inprimis *Cyperacearum* rhizomatibus adnascens. Flores plerumque horizontaliter nutantes. Corollæ limbus subbilabiatus. Staminum et styli longitudo reciproca maximo-pere variat; in quibusdam floribus stylus antheris multo brevior et filamenta antheris longiora inveniuntur, in aliis stylus elongatus stamina longe superans simul cum filamentis abbreviatis, antheris subæquilongis, adest. Antherarum loculos in pluribus a me examinatis speciminibus inter se liberos *nec pariete interno concretos*, et quidem rimis lateraliter *nec extrorsum* dehiscentes inveni. Stylum in plerisque floribus simplicem *nec bicruram* vidi et stigma elongato-clavatum sive oblongo-spathulatum, compressiusculum, glanduloso-pubescentem, stylo ipso duplo longius. Ex hic allatis controversiæ resolvuntur, quæ in plantæ descriptione apud auctores occurrunt, neque mirandum cur cl. E. Meyer (Commentar. p. 183) *stylum antheris brevior* dicit, dum cl. Griseb. *l. c.* ipsum *elongatum, corollæ tubum subexcedentem* describit.

Ceterum genera *Lagenias*, *Belmontia* et *Exochænium* nimis affinia vixque notis validis inter se differe videntur, et, ni fallor, potius ceu totidem *unius ejusdemque generis sectiones* consideranda, a genere *Sebæa*, uti hodierno die constitutum, nonnisi staminibus inclusis et antherarum glanduliferarum fabrica tute distinguenda.

## Ordo BIGNONIACEÆ.

### Subordo SESAMEÆ, Endl. G. Pl. 709.

#### SESAMOTHAMNUS, Welw. gen. nov.

*Calyx* parvus, obliquus, 5-dentatus, persistens. *Corolla* hypocraterimorpha; tubus elongatus, ampliatum, curvus, basi in calcar elongatum horizontale productus; limbus planiusculus, inæqualiter subbilabiatis quinquefidus, lobis rotundatis, tribus quam ceteri majoribus; faux nuda. *Stamina* 4, subdidynama,



infra faucem corollæ inserta, rudimento 5<sup>ti</sup> nullo; antheræ sessiles, lineari-oblongæ, apiculatæ, basi cordatæ, loculis rimis lateralibus dehiscentibus. *Ovarium* cylindricum, oblique sessile, basi gibboso-incrassatum, quadriloculare; stylus elongatus filiformis, stigmatibus duobus obovato-ellipticis; ovula juxta loculorum angulum centalem plurima, uniseriata, horizontalia. *Capsula* ampla, lignosa, plano-compressa, obovato-oblonga, transversim septicide bivalvis, valvis planis, septis ab axi placentifera solutis incomplete quadrilocularis, loculis polyspermis. *Semina* in loculis numerosa, compressa, uniseriata, horizontalia, valvis parallela, transverse oblonga, late alata, nucleo obovoideo, alis membranaceis, planis. *Embryo* exalbuminosus, nucleo conformis. *Cotyledones* planæ, obovatæ, vertice cordato-emarginatæ, oleoso-carnosulæ; radícula recta, conica, acutiuscula, ad hilum spectans; plumula inconspicua.

Frutex Africae trop. occidentalis, glabrescens, glaucescens, trunco brevi difformi, e basi tumida ramosissimus, ramis erectis, virgatis, spinosis. *Folia* decidua, parva, in axillis spinarum fasciculata, obovato-spathulata, petiolis basi articulatis. *Flores* in racemos breves axillares dispositi, magni, pedicellis brevibus crassis suffulti, ex albido rosei.

*Observatio.*—Genus *Sesamo* proximum et affine, attamen corollæ tubo gracili elongato, basi longe calcarato, ovario basi gibboso, nec non caule lignoso, spinis firmis horrido ab omnibus *Sesameis* hucusque descriptis egregie distinctum, simulque Africae calidæ *Nanodendra* admodum singularia, et usque huc jam ex *Apocynearum*, *Asclepiadearum*, *Gnetacearum*, *Ampelidearumque* familiis cognita, novo nunc socio e nobili *Bignoniacearum* ordine illustrans.

Species unica:

#### SESAMOTHAMNUS BENGUELLENSIS, Welw. (Tab. XVIII.)

*Habitat* sporadica in montosis rupestribus parce dumetosis Districtus Mossamedes (Subdistr. Bumbo) inter Cazimba et Quitibe ad 1000 ped. circiter altitud. supra mare. Octobr. 1859 c. floribus vix bene apertis, Junio 1860 cum fructu maturo legi. *Exsic.* Welw. Iter Angol. no. 1509.

Stirps secundum ætatem habitu admodum varians; juvenilis frutex gracilis, strictus, caule ad basim digiti crassitudine, 4–5-pedali, subsimplici vel parce ramoso, juxta totam longitudinem spinis alteris armato, apicem versus florifero, per majorem anni partem aphylo; progrediente ætate vero caulis, basi sensim circuitu increscens, truncum efformat non raro 4–6 pedum circumferentiæ sed humilem, modo supra basim in ramos breves, brachii crassitudine, erectos vel obliquos divisum, ex quibus demum ramuli crebres, erecti, virgati, hinc inde breve ramulosi, spinulis horridi, 4–6 pedes alti, ortum ducunt; truncus basalis ramique primordiales tunc spinis omnibus dejectis, cortice albido-cinereo vel pallide fuscescente, transversim crebre et minute rugoloso sed parum aspero vestiuntur (vid. Tab. XVIII. fig. 1). *Spinæ* a basi lata, longe decurrente, anguste conicæ,  $\frac{1}{3}$ – $\frac{1}{2}$  pollicem longæ, apice truncatæ (!), juniores erecto-patulæ, vetustiores horizontaliter patentes vel imo quidpiam declinatæ. *Folia* in spinarum axillis fasciculata, nonnisi post flores evoluta, integra, membranacea, rigidula, pro magnitudine stirpis parvula, majora vix pollicem longa, 4–6 lin. lata, glaucescentia, obovato-spathulata, penninervia, margine integerrima, in petiolum basi articulatum sensim angustata, jam paullo ante fructus maturitatem decidua; petiolorum autem bases infimæ post folia delapsa persistentes, sensim in tubercula parva ovato-conica apice truncata increscunt, demumque indurescunt et lanugine albida intertexta, acervulos capituliformes, axillis spinarum insidentes, efformant, in omnibus ramis ramulisque plantæ, excepto trunco basali, obvios; nec tamen omnia hæc in quolibet acervulo axillari modo hic indicato congesta tubercula (i. e. petiolorum bases transformatæ) semper eodem in statu permanent, sed eorum adultiora, circa acervulorum basim sita, progrediente ramuli ætate, sensim prolongantur et pariter in spinulas excrescunt, quarum non raro 2–4 in ipsis spinarum axillis, acer-



vulos istos quasi stipantes, inveniuntur\*. *Flores* pulchri, carnosulo-rigiduli, infra ramulorum apices in racemos abbreviatis 3-7-flores, erecto-patulos, e spinarum axillis oriundos, collecti; pedunculus communis crassus, subsucculentus, cylindricus, e viridi violascens, basi cicatricibus foliorum delapsorum stipatus, hinc inde squamulis auctus, demum lignescens; pedicelli ejusdem fere ac pedunculus ipse, crassitudinis, 2-4 rarius 5 lin. longi, apice incrassati, medio opposite bibracteolati, bracteolis anguste ovatis sive lanceolatis, vix lineam longis, strictim erectis, in axilla sua gemmulam glandiformem foventibus, in fructu una cum gemmula abortiva persistentibus. *Calycis* laciniae ovato-deltaeae, breviter acutae, 4 anteriores inter se subaequales, postica reliquis paullo brevior et angustior. *Corolla* subhypocraterimorpha, calyci oblique insidens, quasi equitans; tubo  $2\frac{1}{4}$ - $2\frac{1}{2}$  pollices longo, medio  $1\frac{1}{2}$ -2 lin. crasso, albido-roseo, sursum arcuato, cylindrico, infra faucem dilatato, basi quidpiam ampliata et calcari elongato-conico, obtusiusculo,  $1-1\frac{1}{4}$  poll. longo, horizontaliter protenso, cavo munito; limbi planiusculi, fere  $2\frac{1}{4}$  poll. diametr., ex albido rosei, intus nivei nitiduli, lobi subbilabiatim dispositi†, late ovato-suborbiculares,  $\frac{1}{2}-\frac{3}{4}$  poll. lati, duo (labium superius fingentes) reliquis paullo angustiores brevioresque, omnes obiter vel vix concavi, margine integerrimi. *Stamina* 4, infra faucem corollae inserta, vix apicibus exserta, subdidynama; duo, labio inferiori respondentia, ceteris paullo longiora eorumque filamenta brevissima, superiorum duorum antherae sessiles; filamentis tamen omnium quatuor longe in tubo, hic pilis minimis adperso, *adnato-decurrentibus*. *Antherae* turgidae, 3 lin. circiter longae, dorso ad emarginaturae sinum fixae, loculis appositis rima laterali dehiscentibus, connectivo ultra loculos in apiculum subuliformem producto. *Ovarium* subcompresso-cylindricum, gibbere basali calcar versus spectante, calycis fundo oblique insidens; discus vix ullus, saltem in alabastris a me examinatis inconspicuus. *Stylus* gracilis, longe exsertus; stigmatibus lobi hiantes. *Capsula* rigida, nitidulo-fusca, compressa, elongato-obovata vel obovato-oblonga, uno latere plerumque paullo ventricosa, apice obtusiusculo styli basi indurata apiculata, 3- $3\frac{1}{2}$  poll. longa,  $1-1\frac{1}{2}$  poll. lata, juxta facierum medium et margine circumcirca obtuse sulcata, nervis elevatis venulas laterales dichotomas emittentibus longitudinaliter percursa, transversim septicide bivalvis, elastice dehiscens, ob septa, valvis parallela, nunc ab axi centrali placentifera soluta et apice abortiva, inferne imperfecte *quadri-* superne *bilocularis*. *Semina* una cum alis  $\frac{2}{3}$ , majora imo  $\frac{3}{4}$  poll. diam. transversali, quoad directionem in loculis horizontalia, ast quoad faciem nuclei et alae verticaliter, *i. e.* valvis septisque parallele seriata, dense imbricata; alae planae, tenuiter membranaceae, pallide fuscescentes sive badiæ, pellucidæ, rigidulæ, levigatæ, margine integerrimæ; nucleus turgidulus, 3- $3\frac{1}{2}$  lin. longus, brunneus. Cetera ex caractere generis.

**SESAMUM (EUSESAMUM) ANGOLENSE, Welw. Apont. p. 588 †.** *S.* caule erecto, firmo, 3-5-pedali, glabriusculo, superne parce ramoso, foliis oblongo-lanceolatis vel oblongo-linearibus lingulatisve, breve petiolatis vel subsessilibus, inferioribus oppositis, superioribus et floralibus alternis, basi in petiolum angustatis, apice rotundato-obtusis vel emarginatis, margine repando undulatis, supra intense viridibus, glabriusculis, reticulato-rugulosis, subtus, nervis purpureis exceptis, albo-tomentosis; floribus brevissime pedicellatis, speciosis, violaceo-purpureis, nutantibus, 2- $2\frac{1}{2}$ -pollicaribus, fauce bilabiatim campanulata diametri ultrapollicaris; capsula lineari-oblonga, in

\* Ex supra dictis colligere licet, *spinas* ipsas *primordiales* plantae nostrae nequaquam pro *ramulis abortivis* habendas, sed potius ceu *petiolorum transformationes* considerandas esse; cui metamorphosi, uti observationes repetitae in loco natali institutae me edocuerunt, etiam *spinæ* (et *rectæ* et *uncinatæ*) variarum specierum scandentium ex generibus *Cle-rodendron*, *Combretum* etc. etc. originem suam debent.

† Limbi dispositio bilabiata minus in flore expanso sed evidentius in alabastris æstivatione observanda, ubi lobi tres majores *interiores*, infimo *intimo*, et duo minores *extimi* inveniuntur, uti in *Labiatis*.

‡ Nomen et habitus plantae atque locus natalis.



rostrum breve demum bifidum acuminata, undique pilis raris albis adspersa; seminibus planiusculis, rugulosis, sulco utrinque acute marginato cinctis.

*Habitat* in dumetosis silvaticis arenosis Distr. Pungo Andongo, juxta ripas rivorum Lutete et Luxillo, nec non prope Lombe, inter 3000 et 3500 ped. altit. Ab Octobr. ad Decembr. florentem et partim fructif. vidi. Loca humidiuscula amat. *Exsic.* Welw. Iter Angol. no. 1645.

Caulis strictim erectus, penna olorina crassior, in solo pinguiore hinc inde usque 6-pedalis, obtuse quadrangulus, inter angulos sulcatus, junior pubescens, demum glabratus, plerumque obscure purpurascens, a basi foliosus, apicem versus in ramos paucos  $\frac{1}{2}$ –1-pedales, erectos, oppositos vel sæpius alternos divisus; internodia inferiora 2-pollicaria, superiora circiter pollicaria. *Folia* quoad indumentum sat constantia, subtus semper tomento laxiusculo albido, demum exsiccatione griseo obducta, nervo mediano latiusculo venisque saturate purpureis obiter pubescentibus percursa, inferiora 4–3 poll. longa,  $1\frac{1}{4}$ –1 poll. lata, superiora sensim minora, præcipue angustiora, floralia sæpius  $1\frac{1}{2}$ –1-pollicaria, lingulato-spathulata et apice obtuso vel emarginato mucronata. *Flores* inter congeneres maximi, secundi, in racemos laxos elongatos, caulem et ramos terminantes, dispositi, magnitudine in eadem stirpe versus racemi apicem sensim decrescentes, majores  $2\frac{1}{2}$  vel imo 3 pollices longi; bracteis inferioribus foliis caulinis homomorphis, iis florum superiorum fere linearibus et apice longius mucronato-recurvis; calyx brevis, persistens, laciniis ovato-acuminatis, piloso-pubescentibus, 3 lin. longis, inter se subæqualibus; corolla lætissime violaceo-purpurea, tubo basi curvato, in alabastro densius, sub anthesi tenuiter pubescens, limbi bilabiati latissime hiantis lobis obtusis, ciliatis, intermedio labii inferioris magis producto. *Ovarium* dense piloso-hispidum. *Capsulae* quoad magnitudinem, configurationem et rostri longitudinem iis *Sesami indici* satis similes, sed maturitate fere glabratae vel pilis albis distantibus obsitæ. *Semina* nigricantia, breviter obovata, 1 lin. longa, plano-compressa, utraque facie rugulosa, totoque ambitu sulco latiusculo pariter ruguloso et utrinque acute marginato notata.

Species florum amplitudine nec non foliis subtus albo-tomentosis ab omnibus hucusque descriptis sat distincta, simulque planta pulcherrima, *Digitalem* luxuriantem æmulans, cultura in hortis dignissima.

*Observatio.*—Species altera, ut videtur etiam indescripta, quam nomine *Sesami calycini* in herb. Angol. designavi, huic supra descriptæ proxima et habitu valde affinis, sed omni respectu duplo vel imo triplo minor, 2– $2\frac{1}{2}$ -pedalis, foliis angustioribus, apice subacutis vel acutatis, corollis roseis 10–15 lin. longis (nec 2–3-pollicaribus) etc. discrepans, præcipue autem foliis subtus non incano-tomentosis, sed glabriusculis, lepidoto-glauciscentibus et calycis laciniis lanceolato-linearibus, longe acuminatis, 4 lin. longis glandulisque petiolaribus evidenter stipitatis differt. Crescit hæc species in arenosis parce et breve dumosis inter Præsidium Pungo-Andongo et Sansamanda, mense Januarii 1859 c. fl. et fr. lecta.

*Exsic.* Welw. Iter Angol. no. 1644.

*Caules* fere teretes, atque etiam fructiferi undique pilis albis adpersi. *Folia* quam in *Ses. Angolensi* duplo breviora et angustiora, floralia acuminata, omnia supra glabrescentia, intense viridia, subtus nervo mediano venisque atque venulis transverse anastomosantibus elevatim prominulis et intense purpureis percursa, ceteroquin lepidibus argenteis dense gregatis glauciscentia. Lepides hæc iis quæ in caulibus, foliis atque floribus variarum specierum *Pedalinearum* occurrunt, exacte similes itidemque, sed minus copiose muciparæ. Conf. *Linariopsidem prostratam*, hic infra descriptam.



## Subordo PEDALINEÆ.

*PTERODISCUS AURANTIACUS*, Welw. n. sp. *Pt.* subsucculentus, foliis oblongo-lanceolatis vel obovato-spathulatis, obtusis, margine repando-sinuatis dentatisve, in petiolum longiusculum, circiter pollicarem, basi utrinque glandula ampla auctum angustatis, supra glabriusculis, subtus lepidoto-glauciscentibus; corollis vix pollicem longis, aurantiacis, tubo cylindrico, limbi subbilabiatim patentis lobo infimo majore, omnibus intus pilis crispulis adpersis, extus, uti tubus, lepidotis; fructus compresse tetragono-ovoidei alis semiorbicularibus, transverse plicato-radiatis, basi rotundata liberis, apice inter se confluentibus.

*Habitat* rarior in sabulosis maritimis Distr. Mossamedes, ad ripas fluminis Bero, ubi Julio 1859 c. fl. et fr. legi. *Exsic.* Welw. Iter Angol. no. 1658.

Herba radice crassa fusiformi perennans, tota carnosula. *Caulis* decumbens, sesquipedalis, inferne glaber, epidermide crassiuscula albida, facile secedente, obtectus, superne et ad ramos oppositos vel rarissime alternos dense sed minute albido-lepidotus. *Folia* opposita, patula, fragilia, majora, petiolo 1–1½ poll. longo excepto, 2–2½ pollicaria, ⅔ vel 1 poll. lata, margine obiter repanda vel remote dentata aut inæqualiter crenulata, apicem caulium ramorumque versus sensim minora; glandulæ\* ad petiolorum basim pro more magnæ, depresso-globosæ, atropurpureæ, e nucleo compactiore et excipulo crenato arcte adpresso, sive squamulis in excipulum connatis consistentes. *Pedicelli* circiter 3 lin. longi, densissime lepidoti. *Flores* una cum calyce profunde 5-partito 10–14 lin. longi, rigiduli, intense aurantiaci, extus undique lepidibus minutis argenteis (iis quæ ad folia et ramos novos occurrunt, similibus sed rarioribus) obsiti; tubus circiter ½-pollicaris, faucem versus parum ampliatus, mox in limbum subbilabiatim ⅔-lobum, patentem abiens, lobis rotundatis 3–4 lin. longis, intus crispulopilosis, tribus (labium inferius fingentibus) paullo longioribus, eorumque medio lateralibus ampliore. *Filamenta* basi compresso-dilatata; antheræ circumscriptione late cordiformes, connectivo apiculatæ, loculis subreniformibus, connectivo infra apiculum insertis, inferne liberis, rimula dorsali apertis. *Stigma* bilobum, lobis ovatis (nec subulatis!), superiore erecto, parce vel vix stigmatoso, inferiore reflexo et ad totam superficiem internam dense stigmatoso. *Fructus*, qui obiter aspectus *Combretacearum* quarundam fructos alatos valde simulat, in pedicello parum accreto nutans, siccus, lignose durus, badio-fuscus, compresse ovoideus, obscure quadrangulus, late quadrialatus, faciebus elevatim laxe reticulatis, alis scariosis, semiorbicularibus vel reniformibus, 5 lin. latis, basi protracta liberis, apice cruciatim connatis. Cetera generis.

Species a *Pterodisco specioso* Hook. et *Pt. Gayi* Decne.† (unicis hucusque descriptis) foliis longe petiolatis et floribus aurantiacis, quam in *Pt. specioso* triplo minoribus, vix pollicaribus facili negotio distinguenda, in territorio Mossamedensi admodum rara, sed probabiliter in terris ad austrum confinibus frequentius invenienda.

*LINARIOPSIS*, Welw. gen. nov.

*Calyx* quinquepartitus, lacinia superiore reliquis inter se æqualibus brevior et angustior. *Corolla* tubulosa, tubo vix vel parum incurvo, intus ad staminum insertionem annulo piloso vestito, sensim in faucem subcampanulatam ampliata, limbi bilabiatim quinquelobi lobis rotundatis, infimo protracto.

\* Glandulæ, lente fortiore scrutatæ, e nucleo dense carioso, vertice non raro areola notato, ambitu squamulis pluribus brevibus, obtusis, inter se connatis vel arcte adpressis involucreto, constant, et absque fere dubio flores abortivos indigitant.

† Decaisne, Revue du groupe des Péralinées, Ann. Sc. Nat. 3<sup>m</sup>e Série, Botanique, t. iii. p. 321.



*Stamina* quatuor, didynama, fertilia; rudimentum quinti vix ullum; antheræ oblongæ, basi cordatæ, dorso supra sinum fixæ, introrsæ, longitudinaliter dehiscentes. *Ovarium* conico-ovoideum, in disco parum concavo sessile; stylus filiformis, stigmatate parvo bifido, lobis angustis subacutis. *Fructus* calyce persistente parum aucto, laxe patulo stipatus, nucamentaceus, siccus, indehiscens vel tarde apice hians, oblongus vel subobovoideus, quadricostatus, inter costas seriatim tuberculosus, apice obtuso breviter alato-rostratus, absque omni spina, *unilocularis*, *dispermus*. *Semina erecta*, obovata, compressiuscula, a medio ad basim truncatam usque alato-marginata, testa membranacea, laxiuscula, *levigata*, endopleura tenui; embryo semini conformis; cotyledones planoconvexæ, obovatæ, apice emarginatæ, carnosæ.

Herba montium Benguellæ interioris juga altiora incolens, mucilagine copiosa scatens, radice crassa perennans, caulibus prostratis, a basi ramosis, villosopubescentibus; foliis oppositis breve petiolatis, ovatis, subtus glauco-pruinosis et dense lepidotis; floribus axillaribus solitariis, breve pedicellatis, pedicellis *bibracteolatis* glanduliferis; calyce laxo, pilosulo; corolla violacea intus purpureo-striata, extus pubescente; fructu parvulo, erecto, tuberculis longitudinaliter seriatis depressis obsito, ceteroquin omnino inermi.

Genus *Pedalia* quidpiam affine, sed fructu uniloculari et seminibus erectis ab ipso et simul ab omnibus *Pedalinearum* generibus hucusque descriptis satis distinctum.

Species unica:

#### LINARIOPSIS PROSTRATA, Welw. n. sp.

*Habitat* in collinis arenoso-humosis, breve herbidis, juxta rivos Distr. Huilla, præsertim inter Mumpulla et Humpata, ad 4000–5000 ped. altit. Octobr. 1859 cum fl. et fr. legi. *Exsic.* Welw. Iter Angol. no. 1659.

Herba socialis, habitu quibusdam *Linariæ* speciebus e sectione *Elatinoides* non absimilis, undique plus minusve pubescens vel villosa, ast nequaquam succulenta. *Radix* fere digitum crassa, cylindracea vel fusiformis, fibroso-carnosa, pluriceps. *Caules* prostrati, circiter semipedales, teretiusculi vel obscure quadranguli ramisque oppositis elongatis parce ramellosis dense pubescenti-canescens vel breviter patentim pilosi, apice adscendentes, undique distiche foliosi, internodiis 3–5 lin. inter se distantibus. *Folia* omnia opposita, penninervia, majora 5–7 lin. longa, 3–4 lin. lata, inferiora breve petiolata, ovata, basi rotundata, apice obtusiuscula, margine ciliato repanda vel remote dentata; superiora subsessilia, angustiora magisque approximata; omnia supra pallide viridia, pilis raris, lepidibus intermixtis aspersa, tactu asperula, subtus lepidibus densissime gregatis argenteis\* glauco-pruinosa sive albicantia, plus minusve, præcipue juxta nervos venasque pubescentia. *Flores* semipollicares, foliis floralibus, caulinis homomorphis, vix vel parum longiores; pedicelli circiter lineam longi, in fructu incrassati, infra medium bibracteolati, bracteolis minimis, subfiliformibus, in axilla glandulam breve stipitatam gerentibus. *Calycis* profunde 5-partiti lacinia linearilanceolata, obtusiusculæ, 1½ lin. longæ, pilosulæ, ciliatæ, subpatulæ, in fructu demum paullo auctæ eumque laxe involucrantes. *Corolla* vix semipollicaris, in alabastro dense cano-pubescentis, demum puberula et lepidibus raris adspersa, sordide violacea, intus, excepto annulo piloso staminum basim ambiente, glabra, purpurascens, striis longitudinalibus intensius purpureis et circa faucis os punctis atropurpureis picta. *Filamenta* basi dilatata, purpureo-punctata; antherarum loculi glanduloso-punctati, basi liberi. *Discus* ovarii basim cingens concaviusculus, luteus, margine tumidulo, in fructu persistens. *Stylus* staminibus longior, incurvus, inclusus, deciduus; stigma pro more parvulum, lobis brevibus angustis. *Nux*

\* Lepides hæc, lente fortiore examinatæ, frustula sistent obtuse quadrangula, e 4 vesiculis argenteo micantibus, depresso hemisphæricis, inter se connatis, composita. Lepides in quibusdam *Sesami* speciebus (v. g. in *Ses. calycino* supra commemorato) observata, exacte ejusdem ac in *Pedalineis* structuræ sunt, ast mucilagine minus spissa farctæ.



2½–3 lin. longa, 1½ lin. diametri transversalis, oblongo-subcylindrica vel obovoidea, glabriuscula, dura et tenax, costulis quatuor cruciatim oppositis hinc inde interruptis percursa, inter costulas tuberculis depressis, magnitudine et circumferentia inæqualibus, plerumque longitudinaliter seriatis obsita, apice obtuso costulis duabus oppositis magis prominulis et confluentibus breviter alato-rostrata, carpellorum marginibus introflexis, solummodo basi prominentibus, unilocularis. *Semina* duo, e fundo loculi erecta, 1½ vel vix 2 lin. longa, vertice rotundato-obtusa, basi latiuscule truncata, ibidemque ala brevi, sursum versus evanescente, marginata. *Testa* badia, omnino levigata, embryonem laxè vestiens. *Radicula* cotyledonibus multo brevior, crassiuscula, obtuse conica. Cetera generis.

*Qualitates et Usus.*—Herba omnibus in partibus mucilagine limpidissima simulque insipida dives, et (etiam per annos jam exsiccata et conservata) aquæ frigidæ vel tepidæ immersa, hanc mucilaginosam reddit limpidamque conservat, qua ratione herbæ hujusce infusum, aut simplex aut succo *Citri* mixtum vel *Saccharo* dulcificatum, in *Tussi*, *Gonorrhœa*, *Dysenteria* etc. potum admodum salubrem, nunc lenientem vel emollientem, nunc refrigerantem ægrotantibus præbet, sæpius decocto *Malvæ* vel *Althææ* et similibus præferendum.

## Ordo LABIATÆ.

### Trib. OCIMEÆ, Subtr. PLECTRANTHÆ.

#### ALVESIA, Welw. gen. nov.

*Calyx* per anthesim brevissimus, subcupularis, bilabiatus, labiis rotundatis, inferiore latiore emarginato; tubus post anthesim valde auctus, membranaceus, ovoideus, inflatus, ore clauso. *Corolla* tubo brevi cylindrico, incluso, abrupte in faucem oblique subcampanulatam, sensu verticali compressiusculam ampliata; limbi bilabiati labio superiore trilobo, lobo superiore reflexo, lateralibus brevissimis, latioribus, rotundato-obtusissimis, antrorsum spectantibus vel breviter reflexis, labio inferiore porrecto, concavo, obtuso, integerrimo. *Stamina* 4, exserta, declinata, filamentis apice adscendentibus; antheræ biloculares, loculis divaricatis. *Ovarium* gynophoro subbrevis cylindrico impositum, quadrilobum; stylus filiformis, declinatus, stigmatibus minuto bidentato. *Nuculæ* perfectæ subsolitariae, lato-obovoideæ, granulatae, basi calycis vesiculoso-ampliati absconditæ.

Suffrutex 3–5-pedalis, *Rosmarini* facie, pubescenti-tomentosus, caule ramisque obtuse 4-gonis, sulcatis, ramulis strictis foliosis. *Folia* parva, oblongo-lanceolata, acuta, integerrima, supra glabriuscula, subtus tomentosa, penninervia. *Verticillastri* in racemos densos ramosos dispositi, laxè tomentosi, pedicellis brevibus. *Flores* rosei. *Calyces* fructiferi in pedicellis apice deflexis penduli.

Genus ob corollæ labii superioris configurationem et calycem fructiferum admodum ampliatus, vesiculoso-inflatum, inter *Plectrantheas* valde distinctum, dicatum velim clarissimo Bento Antonio Alves, viro humanissimo, inter horticultores Lusitanos eminenti, etiam Floræ Lusitanæ studioso, mihique olim in variis per agrum Olissiponensem peregrinationibus botanicis amœnissimo socio, amico constanti et fidelissimo.

Species unica:

#### ALVESIA ROSMARINIFOLIA, Welw. n. sp. (Tab. XIX.)

*Habitat* in collinis dumetosis silvisque parum densis arenoso-humosis Distr. Huilla, inter 4000 et 5000 ped. altit., prope Mumpulla et Lopollo, fere semper in *Protearum*, *Daphnoidearum* atque *Thesiorum* consortio. Febr.–Apr. florentem, Junio adhuc parce fructificantem legi. *Exsic.* Welw. Iter Angol. no. 1636.

Suffrutex pulcher, hinc inde, solo et expositione faventibus, frutescens, caule eodem per plures annos



virente et florente. *Caules* plerumque plures ex eadem radice, basi lignosi, erecti, 3-4-, rarius 5-pedales, obtusanguli, obscure rubentes, pube brevi densa tomentelli, jam a basi ramulis creberrimis abbreviatis, dense foliosis, strictiusculis, sterilibus obsiti, superne parcius ramosi; rami oppositi elongati, æque ac caules inferne ramulis brevibus foliosis abortientibus onusti et apice florigeri. *Folia* opposita, pro magnitudine stirpis parvula, majora 1-1½ poll. longa, 2-3 lin. lata, lanceolata vel oblongo-lanceolata, rarius hinc inde fere linearia, breviter acuta, margine reflexo integerrima, supra læte viridia nitidula, subtus canescenti-tomentosa, penninervia, nervo medio et secundariis angulo acutissimo ab ipso egredientibus subparallelis, supra impressis, subtus prominulis. *Verticillastri* sæpius 6-flori, bracteis ovatis, obtusiusculis, quam pedicelli subbrevioribus, deciduis stipati, in racemos densos, ovato-pyramidatos, demum elongato-cylindricos, plerumque ramosos dispositi. *Inflorescentiæ* partes omnes plus minusve dense tomentosæ et rubore amœnissime roseo suffusæ. *Pedicelli* florigeri 2-3 lin. longi, fructiferi parum longiores, apice deflexi. *Calyx* sub anthesi 2 vel vix 3 lin. longus, externe dense tomentosus, interne nudus, labiis margine densissime ciliato-fimbriatis. *Corolla* 9-11 lin. longa, extus, tubo incluso excepto, laxè tomentosa vel lanuginosa, intus nuda. *Filamenta* juxta basim adnatam tenuiter pilosa, ceterum, uti antheræ, ovarium et stylus totus, glabra. *Calycis* fructiferi tubus admodum ampliatus, vesiculoso-inflatus, 1½ pollicem longus vel paullo longior, diametro pollicari, elliptico-ovoideus, deglabratus vel tenuiter puberulus, e viridi purpurascens venulisque obscurioribus laxè reticulatis percursus, labiis parum vel vix auctis sed nunc arcte clausis obtuse apiculatus. *Nuculæ* perfectæ, reliquarum abortu solitariæ, rarissime duæ, late obovatæ vel omnino globosæ, undique glandulis minutis punctiformibus, parum prominentibus obsitæ, in gynophoro parum vel vix aucto, fundo calycis insidente, sessiles. Cetera generis.

*Qualitates.*—Stirps quidem fere inodora, sed ob frondem gracilem discolorem florumque racemos amplos colore læte roseo superbientes *Adonistis*, imprimis Europæ australioris, ubi probabiliter sub divo prosperabit, magnopere commendanda.

#### Trib. STACHYDEÆ, Subtr. BALLOTEÆ.

ACHYROSPERMUM ÆTHIOPICUM, Welw. n. sp. *A.* caule herbaceo, erecto, elato, 4-6-pedali, obtuse tetragono, pubescente, parce ramoso; foliis petiolatis, late ovatis vel ovato-ellipticis, basi cuneata et apice longe acuminato integris, margine grosse dentato-serratis, utrinque glabriusculis vel præcipue juxta nervos venulasque hirtulo-pubescentibus; verticillastris sub 6-floris, in spicam densam subtetragono-cylindricam, 2-4 pollices longam approximatis; bracteis late ovatis, abrupte acuminatis, ciliatis, calyce subbrevioribus; calycis tubulosi pubescentis fauce intus puberula, dentibus 2 inferioribus reliquis paullo brevioribus; corollæ albæ, excepto limbo extus pubescente glaberrimæ, labio superiore emarginato-subbilobo, inferioris lobo medio lateralibus duplo latiore, rotundato-obtuso, concavo; styli breviter bilobi lobis æqualibus acutiusculis; nucularum paleis anguste spathulatis, apice obtuso ciliato-barbulatis.

*Habitat* in silvaticis umbrosis humidis Distr. Pungo Andongo ad 3200 ped. circiter altit., præ ceteris circa cataractas loco dicto Calundo, ubi Maio 1857 c. fl. et fructu necdum bene maturo legi. *Exsic.* Welw. Iter Angol. no. 1633.

Herba procera, *Stachydis* speciem luxuriantem simulans, plerumque 4-5-pedalis, hinc inde imo 7-pedalis. *Caulis* rectus, basi penna olorina crassior, obtuse 4-gonus, puberulus, superne teretiusculus ramisque abbreviatis densius pubescens vel pilis patentibus hirtus. *Internodia* inferiora 4-5 pollices inter se distantia, superiora sensim breviora. *Folia* membranacea, petiolis debilibus patula, majora una cum petiolo 1-1½-pollicari ad 9 pollices longa, 3½ poll. lata, basi cuneata sensim in petiolum angustata



ibidemque integra, margine dentibus deltoideis acutatis sursum spectantibus serrata, apice longe acuminata, acumine ipso edentulo, in utraque facie, exceptis nervis venisque puberulis, glabriuscula vel, inprimis superiora et summa ad petiolum nervosque et venas pilis rigidulis crebrioribus, nunc adpressis nunc patulis, adpersa. *Verticillastri* circiter 6-flori, dense spicati; spicæ in caulis ramulorumque apice terminales, solitariae, juveniles obtuse 4-goni, florigeræ cylindraceæ, bene evolutæ ad 3–4 pollices longæ, apicem versus quidpiam attenuatæ, obtusiusculæ. *Folia* floralia bractæformia, subscarioso-membranacea, sessilia, late vel hinc inde fere orbiculato-ovata, apice abrupte acuminata vel cuspidata, extus puberula, margine ciliata, versus apicem spicæ angustiora et sensim acuminata, quam calyces paullo breviora, vel ipsos æquantes. *Flores* cujusvis verticillastri plerique sessiles, vel eorum unus aut duo brevissime pedicellati; pedicelli inæquilongi, basi bracteolis ovatis vel lanceolatis longe ciliatis stipati. *Calyx* membranaceus (albidus!) tubulosus pubescens, intus pube rara adpersus, limbum versus modice ampliatus, subbilabiatis  $\frac{3}{2}$ -dentatus, dentibus ovatis, acutis, ciliatis, patulis, inferioribus duobus quam superiores paullo brevioribus. *Corollæ* albæ tubus vix incurvus, inclusus, glaber; limbi extus pubescentis labium superius obcordato-emarginatum vel obiter bilobum, inferius 3-lobum, lobis lateralibus brevibus rotundatis, intermedio iis duplo majore, rotundato-obtuso et concavo. *Stamina* ascendentia, exserta; filamenta medio tubi inserta sed ad faucem usque adnata, nuda, ima basi in appendiculas membranaceas, tenuissime barbuiatas, squamulas mentientes producta; antheræ loculis confluentibus uniloculares. *Stylus* staminibus fere æquilongus, apice paullo dilatato breviter bilobus, lobis æqualibus, patulis, acutiusculis. *Gynophorum* subquadridentatum. *Nuculæ* (solum immaturæ visæ) dorso et vertice paleis membranaceis crebris, imbricatim congestis, spathulatis, apice rotundato ciliato-barbatis, ipsis nuculis sesqui- vel duplo longioribus, comosæ. *Aroma* plantæ vix ullum.

*Observatio.*—Generis ob nuculas paleis sat conspicuis coronatas in ordine valde singularis, tres species hucusque descriptas invenio, silvas humidias insularum Java, Luzon et Madagascaria incolentes; nostra hæc, silvarum primævarum Africæ æquinoctialis civis, ab *Achyrospermo densifloro* Bl., cui ex descriptione cl. auctoris (Bijdrag. 840) affinis videtur, caule elato 3–6-pedali (nec 6–8-pollicari), spicis cylindraceis 2–4-pollicaribus (nec ovatis sesquipollicaribus), calycis fauce intus pubente (nec nuda) aliisque notis distinguitur; ab *Ach. phlomoide*, Bl. cui *spica laxa* et *bractæ unifloræ* adscribuntur, nec non ab *Ach. fruticoso* Benth., *foliis obtusis crenatis* et *spica laxa* insigni, longius distat.

#### Trib. SCUTELLARINEÆ.

TINNEA, Kotschy et Peyr. in Kotschy, Plant. Tin. p. 25\*.

Generis distinctissimi character, a clar. auctoribus *l. c.* egregie quidem sed secundum unicam speciem iis cognitam expositus, nunc, speciebus pluribus ex itinere Angolensi reportatis et cum typica comparatis, commode notis sequentibus ampliandus vel modificandus erit:

*Calyx* tubuloso-campanulatus vel globosus, bilabiatus, labiis integris, fructifer inflato-ampliatus, ventricososo-ovoideus, labiis ad basim usque fissis bivalvis, valvis singulis scaphiformibus. *Corollæ* bilabiatae transversim modice compressæ labium superius inferiore duplo brevius, subintegrum vel sinu acuto bilobum, lobis obtusis, rectiusculis vel parum recurvis. *Ovarium* subsessile vel breviter stipitatum, plus minusve profunde quadrilobum. *Stylus* inter ovarii lobos centralis, stamina subæquans, apice subbilobus, lobo superiore brevissimo sterili vel obsoleto, inferiore majore acutiusculo dense stigma-

\* Kotschy (Dr. Theod.), Plantæ Tinneanæ, Vindob. 1865, apud Gerold, fil. gr. Fol. pp. 54 cum tabb. xxv.



tosio. *Nuculæ* clavato-obovoideæ, stipitatae, basi intus areola oblonga concaviuscula notatae, facie interna levigata gibbæ, dorso ala lata, elliptica vel orbiculari, e spinulis aridis radiantibus, pilorum arachnoideorum ope inter se dense contextis formata, scutellatae. Cetera omnia conformia.

Herbæ elatae vel suffrutices, Africam æquinoctialem cis et trans æquatorem incolentes, caulibus erectis, parce vel densius ramosis, pubescentibus vel incanis; foliis breve petiolatis, oppositis vel ternis, vel non raro alternis in eadem stirpe simul obviis, ovalibus, integerrimis, membranaceis, glanduloso-punctatis; bracteis latiusculis, herbaceis vel coloratis; floribus axillaribus solitariis, in pedunculis bibracteolatis subsecundis, juxta caulis ramorumque extremitates nunc laxiuscule dispositis vel dense approximatis, fusco- vel violaceo-purpureis, grate fragrantibus.

Genus ab auctoribus in opere citato *Verbenaceis* adscriptum, sed ob calycem fructiferum (in una specie imo jam sub anthesi) ad basim partitum, omnino bivalvem, ovarium evidenter et, saltem in speciebus Angolensibus, sat profunde quadrilobum, nec non propter nuculas sat longe stipitatas dorsoque alato-scutellatas, inter calycem inflatum perfecte liberas et iis generis *Perilomia* H. B. K. omnimode analogas, ne dicam similes, potius inter *Labiatas* collocandum, quibus etiam a cl. Dr<sup>e</sup> Thomson\* et nuper a cl. Dr<sup>e</sup> Hooker† associatum fuit. Unam insuper specierum Angolensium jam anno 1862 loco infra citato inter *Labiatas Scutellarineas* enumeravi, simulque herbæ floriferæ et fructiferæ manipulum in Expositione internationali Londinensi una cum aliis plantis medicinalibus Angolæ exhibui. Tribui *Scutellarinearum* genus hoc subscribendum esse mihi videtur, quoniam calyx bilabiatus labiis integris demum ad basim fissis, simul cum nuculis dorso alatis nonnisi hac in *Labiatarum* tribu occurrit.

Species tres: una (*Tinnea æthiopica* Kotschy et Peyr. *l. c.*) Africam cisæquatorialem incolens; et duæ novæ Angolenses, nunc exponendæ.

1. TINNEA ANTISCORBUTICA, Welw. n. sp. *T.* caulibus herbaceis 3–5-pedalibus, strictim erectis, obtuse tetragonis, inter angulos sulcatis, dense pubescentibus, apicem versus ramosis, a basi foliosis; foliis oppositis aut ternatis vel rarius alternis; bracteis dense imbricatis, late ovatis, apiculatis, roseo-purpureis, calyces florigeros tubuloso-campulatos sericeo-puberulos excedentibus; calycis fructiferi glabriusculi vel sparse pubescentis valvis antice alato-marginatis.

*Catete bulla* [nomen vernaculum Nigrit.]. “Planta herbacea vivaz da familia das *Labiadas*, do grupo das *Scutellarineas* etc.,” Welw. Synopse explicat. 1862, p. 28.

*Habitat* non infrequens in silvarum primævarum subumbrosis editioribus Districtuum Golungo Alto et Pungo Andongo, inter 2000 et 3000 ped. altitud., imprimis copiose in declivibus de Serra de Alto Queta prope Sange, ubi ab autochthonibus, qui foliorum pulverem vel infusum tamquam remedium antiscorbaticum adhibent, “*Catete bulla*” nuncupatur. A Novemb. ad Maium flor., Febr. ad Jun. fructificat. *Exsic.* Welw. Iter Angol. no. 1632.

Herba perennis, radice lignescente multicipite. *Caules* gregarii, 5–15 ex eadem radice, stricti, plerumque 4–5-pedales, evidenter quadranguli et inter angulos obtusos late sulcati, basi simplices, apice in ramos subbreves erecto-patulos floriferos divisi, plus minusve cano-pubescentes, per totam longitudi-

\* “*Labiatarum novum genus*; the four seeds are protected by an enveloping calyx, and feathered white in a beautiful manner; on the grassy banks of Madi, 3° 15' N. Frequent in forests, No. 705.” (Dr. Thomson in Appendix G to Speke's ‘Journal of the Discovery of the Source of the Nile,’ London, 1863, p. 645.)

† Botanical Magazine, tab. 5637.



nem foliis, superioribus sensim minoribus, vestiti. *Internodia* inferiora circiter bi-, superiora 1-pollicaria, ea axis floriferi valde contracta. *Folia* opposita vel ternata, vel rarius et inprimis in superiore caulis parte alterna, petiolo brevi vix  $2\frac{1}{2}$  lin. longo suffulta, majora, demto petiolo, 2– $2\frac{1}{2}$  poll. longa, 1– $1\frac{1}{2}$  poll. lata, penninervia, latiuscule ovata, basi rotundato-obtusa, vel breviter in petiolum canaliculatum angustata, apice obtusiusculo abruptim in apiculam acutata, margine integro ciliolata, superne obscure viridia, glabriuscula vel rugulis minutis asperula, subtus paullo pallidiora, secus nervos venasque pubescentia, inter venas dense glanduloso-punctata, versus apicem caulis sensim minora, brevissime petiolata, obtusiora longiusque apiculata. *Bracteae* membranaceae, roseo-purpureae, foliis multo tenuiores, sub anthesi dense imbricatae, subsessiles, late ovatae vel suborbiculares, 6–8 lin. longae, 4–7 lin. latae, basi subtruncato-rotundatae, apice obtuso apiculatae, utrinque mollissime pubescentes, margine dense ciliatae, calyces ipsis breviores occultantes. *Pedunculi* patentes, vix lineam longi, pubescentes, bracteolis duabus oppositis filiformibus pilosulis stipati. *Calyx* sub anthesi tubuloso-campanulatus, transversim compressus, 4–5 lin. longus, extus dense pubescens, intus tenuiter puberulus, utrinque roseo-purpurascens. *Corolla* 10–12 lin. longa, obscure purpurea, in alabastro pilis albidis adpersa, demum glabrata, resinoso-punctata, fauce et limbo transversim subcompressa, labio superiore obtuse bilobo quam inferius trilobum duplo brevior. *Stamina* labio superiore parum longiora, antheris solis exsertis; filamenta compressa, basi et ad latus internum albido-pilosa, sursum versus sensim dilatata, apice carnosio-incrassato obtuso recurva, laetissime flava; antherae biloculares, loculis ovoideo-globosis subdisjunctis, polline albido turgidis, longitudinaliter apertis. *Ovarium* in gynophoro turgido obscure crenato substipitatum, fere ad medium usque quadrilobum, lobis clavatis, erectis, levibus. *Stylus* staminibus paullo brevior, medio quidpiam dilatatus, apice brevissime bilobus, lobo uno minuto perbrevis, altero crassiore, longiore, intus stigmatoso. *Calyx* fructifer valde auctus, scariosus, ventricosus-inflatus, ovoideo-oblongus, nutans vel pendulus, 8 lin. circiter longus, 5 lin. latus, extus pube tenui hinc evanescente vestitus, intus glabriusculus, et longitudinaliter nervis pluribus crebre venulosis et prominulis percursus, valvis singulis antice in marginem semilunarem, lineam latam, planiusculum, mox leviter revolutum extensis. *Nuculae* (*Schizocarpia* Kotschy, l. c.) abortu saepius tres, scutellis dorsalibus oblongo-suborbicularibus, albidis, quoad structuram supra descriptis, 3–4 lin. longis, juxta margines laxè inter se cohaerentibus absconditae, quoad fabricam internam iis speciei sequentis omnino similes, et descriptioni atque iconi speciei typicae conformes.

2. *TINNEA ERIOCALYX*, Welw. n. sp. *T.* caulibus suffruticosis, 1–2-pedalibus, erectiusculis, *teretibus*, inferne cano-puberulis, superne albido-tomentellis, simplicibus vel parce ramosis, a basi foliosis; foliis oppositis vel alternis, rarius subverticillatim ternis; bracteis laxè imbricatis vel remotiusculis, cordato-ovatis vel saepius cordato-suborbicularibus, apiculatis, subcrassis, rigidis, herbaceo-viridibus, calyces floriferos globosos, densissime lanuginosos vel albo-tomentosos aequantibus; calycis fructiferi ovoideo-globosi et dense lanuginosi valvis antice retusis, brevissime vel vix alato-marginatis.

*Habitat* in collinis breve dumosis, siccioribus et petrosis, juxta silvarum margines Distr. Huilla, frequens circa Lopollo ad 5000 ped. altit. Jan. 1860 c. flore, Martio c. fr. lecta. *Exsic.* Welw. Iter Angol. no. 1635.

Suffrutex, basi ad altitudinem 3–4 poll. lignescens. *Caules* ex eadem radice plures, saepius sesquipedales, erecti vel basi ascendentes, teretes vel rarius obscure angulati, absque omni sulco, molliter cano-pubescentes, apicem versus nunc albo-tomentosi nunc lanugine nivea obtecti, simplices vel parcius ramosi, ramis suboppositis vel saepius alternis erecto-patulis. *Folia* internodiis  $\frac{1}{2}$ – $1\frac{1}{2}$ -pollicaribus dissita, alterna semper magis approximata, petiolo 1–2-lineari suffulta, majora  $1\frac{1}{2}$  poll. longa, 6–11



lin. lata, ovata, basi rotundata vel breviter cuneata in petiolum angustata, margine integra, apice obtusiusculo vel obtuso apiculata, vel rarius sensim in apiculam brevem acutata, utrinque glanduloso-punctata, supra læte viridia levigata vel minutissime rugulosa aut pube rara adspersa, subtus flavovirentia, puberula, vel densius pubescentia, nunc, imprimis locis siccioribus, cano-tomentosa, nervo costisque supra parum, subtus evidentius prominulis, superiora brevius petiolata et obtusiora, sensim in bracteas abeuntia. *Bracteæ* brevissime petiolatæ, basi plus minusve emarginatæ vel cordatæ, apice rotundato apiculatæ, herbaceo-virides, utrinque laxè vel densius tomentosæ, circiter 6 lin. longæ, 5–6 lin. latæ, quam folia quidpiam crassiores et rigidiores, in fructu persistentes. *Flores* subsecundi. *Pedicelli* circiter lineam longi, villosi, infra medium bracteolis 2 oppositis, ipsis duplo longioribus, lineari-lanceolatis, laxè villosis stipati, in fructu vix accreti. *Calyces*, in alabastro perfecte globosi, dense floccoso-tomentosi, sub anthesi ad 5 lin. longi, labiis truncatis transversim hiantes, jam hac periodo ad basim usque bipartibiles. *Corolla* violaceo-purpurea, ejusdem ac in specie antecedente magnitudinis, limbi labio superiore æque ac in illa, obtuse bilobo. *Ovarium* fere ad medium usque quadri-lobum, glabrum; styli lobulus superior hac in specie non raro obsoletus. *Calyx* fructifer duplo subtriplove auctus, inflatus, clausus, nutans vel pendulus, ovoideo- vel ellipsoideo-globosus, extus dense lanuginoso-tomentosus, ad basim usque bivalvis; valvæ subcoriaceo-rigidæ, subæquales, intus glaberrimæ, nervis pluribus prominentibus percursæ, inter nervos elevatim venulosæ, superior primum decidua. *Nuculæ* abortu non raro tres, elongato-clavatæ, 3–4 lin. longæ, interna facie gibbæ et levigatæ, nonnisi stipitem basi excavata inter se laxè cohærentes, dorso ala arachnoidea, albicante, elliptica, 4–5 lin. longa, 3–4 lin. lata scutellatæ, bilocellatæ, locello altero minore vacuo. *Semen* obovatum, compressum, locelli angulo paullo infra apicem appensum; testa membranacea, badio-flavescens, laxa, infra radiculam in filum tenue, spiraliter tortum, stipitem penetrans, prolongata. *Embryo* rectus, semine dimidio brevior sed parum angustior; cotyledones obovatæ, carnosulæ, leviter convexæ, applicatæ; radícula infra, brevis, obtuse conica.

### Ordo POLYGONACEÆ.

#### Subordo I. POLYGONEÆ.

Trib. PTERYGOCARPEÆ, Meisn., DC. Prodr. xiv. p. 3.

**OXYGONUM ACETOSELLA**, Welw. n. sp. *O.* annuum, glabrum, glaucissimum, carnosulum; caule a basi ramoso, ramis decumbenti-ascendentibus, inferne parce ramulosis, semicylindricis vel subcompressis angulatis; foliis lanceolatis vel lanceolato-oblongis, abrupte acuminatis, basi in petiolum longiusculum alatum sensim angustatis, margine repando- vel sinuato-dentatis; ochreis tenuiter membranaceis, truncatis, ore integerrimis vel minute remoteque denticulatis; racemis terminalibus, virgato-elongatis, gracilibus, interruptis; pedicellis fasciculatis glabriusculis, fructiferis bracteam superantibus; acheniis oblongis, trigonis, juxta angulos subacutos membranaceo-alatis, alis margine obiter repando-denticulatis vel subintegris.

*Habitat* frequens in collinis arenosis maritimis ex Mossamedes versus Cabo negro, imprimis loco dicto "Praia da Amelia." Junio 1859 cum flore, insequente Julio c. fructu legi. *Exsic.* Welw. Iter Angol. no. 1757.

Herba prostrata, caule abbreviato, jam a basi in ramos plures 2–5 poll. longos, hinc inde ramulosos, demum oblique ascendentes diviso. *Folia* majora ad sesquipollicem longa, medio semipollicem lata, margine nunc simpliciter repanda, nunc repando-dentata vel rarius obiter sinuata aut inciso-dentata, exsiccatione utraque facie minutim verruculosa. *Ochreæ* in vivo pallidissime virentes, in sicco albidæ, horizontaliter truncatæ, ore integerrimæ vel rarius denticulis tenuibus remotis obsitæ, nunquam



setoso-ciliatæ. *Racemi* terminales, vel tardius ob rami prolongationem axillares, rectiusculi, semi-pedales usque pedales, rarius paullo longiores, rachi triquetra. *Bracteæ* 3-5-floræ (floribus pluribus masculis, paucis vel unico hermaphroditis) in racemis novellis continuæ, imbricatæ, demum ad  $\frac{1}{3}$  vel  $\frac{3}{4}$  pollicis inter se distantes, ore nudæ vel sparsim et minute denticulatæ. *Calycis* limbus tenuiter membranaceus, lacteus, profunde 5-fidus, segmentis patulis obovatis, rotundato-obtusis, concaviusculis, marcescenti- longe persistentibus. *Stamina* 8; filamenta subulata; antheræ didymæ pallide cyaneæ. *Stylus* profunde trifidus; stigmata capitellata. *Achenium* (solummodo submaturum a me visum) vix 4 lin. longum, anguste ovoideum, triquetrum, angulorum alis inter se æqualibus, in vivo ex albido virentibus, margine subintegris vel tenuiter remote crenulatis sive repando-denticulatis, faciebus inter angulos longitudinaliter trinerviis.

*Qualitates et Usus.*—Stirpis omnes partes, sed præcipue folia tenuiter succulenta, sapore grate acidulo præditæ sunt, et a colonis Mossamedensibus hinc inde foliis *Rumicis acetosæ* substituuntur, quapropter planta ipsa ab illis “*Azedas bravas*” i. e. “*Rumex acetosa sylvestris*” nuncupatur.

Species *Oxygono Dregei* Meisn., DC. Prodr. xiv. p. 38, affinis videtur, quæ tamen a nostrate imprimis foliis *integerrimis* et ochreis ore setoso-ciliatis distinguenda.

#### Subordo II. BRUNNICHIEÆ, DC. Prodr. l. c. p. 183.

BRUNNICHIA AFRICANA, Welw. n. sp. *Br.* caule frutescente, late scandente, patentim ramoso, ramis elongatis angulatis, inter angulos plurisulcatis, ramulisque horizontalibus virgatis glanduloso-pubescentibus, remote foliatis; foliis membranaceis, breve petiolatis, oblongo-ovatis vel ovato-ellipticis, basi cuneatim attenuatis rariusve subrotundatis, apice oblique acuminatis vel cuspidatis, margine integerrimis, utrinque glabris; ochreis manifestis, brevibus, truncatis, ore scarioso-membranaceis, tenuiter crispatis, demum laxiusculis; cirrhis apice bifidis, cruribus uncinatis vel demum spiraliter intortis; racemis ad ramulos laterales et apicales terminalibus, aphyllis, interruptis, bracteis 2-5-floris; pedicellis plano-compressis, fructiferis accretis, subsecundis, nutantibus, calyce nunc semipollicari 5-7tuplo longioribus, secundum totam articuli superioris longitudinem utrinque ala membranacea, sesquilineam lata, ex apice tubi calycini decurrente, sanguineo-purpurea, in articulo inferiore sensim angustata marginatis.

*Habitat* in Distr. Golungo Alto editioribus (2000-2400 ped. alt.) ad oras silvarum primitivarum, præcipue juxta cataractam “de Capopa” prope “Sange,” ubi stirpem, in statu fructifero ob fructos pendulos læte sanguineos sat ornatum, una cum *Leea sambucina*, *Bombace Buonopozensi* et specie indescrupta generis tropico-americi “*Trymatococcus*” sociatam Septembri 1835 c. fl. et fr. legi. *Exsic.* Welw. Iter Angol. no. 1754.

Frutex gracilis, caule 10-15 pedes longo, remote ramoso, ramulis patentissimis, debilibus, cirrhorum ope sese firmantibus, late, sed vix alte scandens. *Petioli* 3-6 lin. longi, canaliculati, basi plerumque decurvi, eadem ac caulis et rami pubescentia, e papulis cylindræis, brevibus, patulis, rubentibus, subviscosis, dense gregatis constante, obducti. *Foliorum* adultorum lamina  $1\frac{1}{2}$ -2 poll. lata,  $2\frac{1}{2}$ - $3\frac{1}{2}$  poll. longa, supra læte viridis et lucidula, subtus pallide virescens, exsiccatione nitenti-rufescens et, excepto nervo mediano subtus modice prominente puberulo, utrinque glabra. *Cirrhi* graciles, supraaxillares [pedunculi abortientes?], foliis duplo triplove longiores, cruribus arcuato-divaricatis, excepta basi puberula levigati. *Racemi* floriferi 3-6 poll. longi, fructiferi pedales et longiores, rectiusculi vel ascendentes, rachi compressa, minutim glanduloso-pubescente. *Florum* fasciculi circiter semipollicem inter se distantes, bracteis ovato-acuminatis, carnosulis, membranaceo-marginatis, plerumque 3-floris.



*Calyx* sub anthesi obfusiformis, herbaceo-viridis, lobis crassiusculis, rigidulis, interna facie amœne roseis, tribus externis quam duo interiores latioribus, omnibus æquilongis et acute acuminatis, erecto-patulis. *Calyx* fructifer trigono-ovoideus, inter angulos longitudinaliter pluricostulatus, fusco-purpureus, inclusis lobis nunc induratis et erectis semipollicem longus, coriaceus, *achenium* maturum arcte includens, demum una cum pedicelli articulo superiore tunc fere 3 pollices longo et modo supra indicato ala splendide sanguinea alato deciduus. *Stamina*, *ovarium* etc. generis.

*Observatio*.—Unica *Brunnichia* species hucusque descripta, et proinde generis typus, est *Brunnichia cirrhosa* Banks (DC. Prodr. l. c. p. 185), Americam borealem incolens, a qua stirps præsens Africana pubescentia glandulosa, in ramis, petiolis et racemorum rachi manifesta et constante, foliis demum basi cuneatis vel rotundatis (*nunquam cordatis*) et non minus pedicellis fructiferis calyce 5–7tuplo (nec duplo) longioribus aliisque notis distinguenda.

### Ordo PROTEACEÆ.

#### Trib. PROTEÆ.

#### FAUREA, Harvey.

Generi "*Faurea*" a beato Harvey jam 1847 in memoriam G. Faure, botanophili Capensis instituto, nuper a clar. Meisner in DC. Prodr. xxiv. p. 344 quidpiam locupletato, sed ad unicam tunc solum cognitam speciem circumscripto, nunc, specie altera vel duabus aucto, notulæ sequentes commode addendæ erunt:

*Antheræ* nunc sessiles, nunc, imo in ipsa specie typica, filamentis brevissimis, compressis, latiusculis, apice plus minus manifeste biauriculatis insertæ, glandula parvula obtuse conica *apiculatæ*, vix unquam omnino muticæ. *Squamulæ hypogynæ* non semper acutæ, sed non raro rotundato-obtusæ, vel truncatæ aut emarginatæ vel demum apice breviter bilobæ. *Ovulum* prope loculi medium suturæ affixum.

Locum *Faureæ* systematicum inter *Proteacearum* tribus quod attinet, genus hoc contra cl. Endlicheri et Meisneri opinionem, qui illud *Persooniearum* tribui subscribunt, potius *Proteeis* associandum et quidem pone *Proteam* ipsam collocandum esse videtur. A *Persoonieis* calyce *labiatim* fisso nec *4-sepalo*, antheris calycis *laciniis concavis* nec *sepalorum medio* vel *basi* insertis, stigmate *verticali* demum et ovario constanter *uniloculari* discrepat, dum omnibus hisce notis optime cum *Proteeis* concordat et ipso generi *Protea* adeo affine invenitur, ut ab eo, si inflorescentiam spicatam excipias, non nisi calyce *unilabiatim* reflexo nec *bilabiatim* fisso discerni queat.

Habitu suo *Faureæ* quasdam *Heliciæ* species in Asia tropica occurrentes, etsi ob florum structuram et fructum follicularem ad tribum longe diversam spectantes, non male fingunt.

Ceteroquin *Faurea* inter *Proteaceas* Africanas facile genus unicum *reapse tropicum* habendum; nam genera *Protea* et *Leucospermum*, quæ itidem singulis speciebus laudati continentis circulos tropicos, et quidem ad Abyssiniam usque invadunt, in ditone Capensi magno specierum numero prædominant, dum *Faurea*, in Africa austro-tropica tam occidentali quam orientali pluribus speciebus earumque formis sive varietatibus numerosis representata, in territorio Capensi, *proprie sic dicendo*, deest; nam Flora terræ Natalensis, ubi species *Faureæ* typica (*F. saligna*) primum detecta fuit, pro magna parte caractere omnino tropico eminet, et ipsa hæc *Faurea saligna* intra circulos tropicos ab Angola ad Zambesiam usque late diffusa reperitur.

Inter generis quoad foliorum figuram et imprimis eorum indumentum sat polymorphi formas varias, quæ Angolæ australis atque Benguellæ interioris montosa, ultra 4000 ped. elevata inter 13° et 16° lat. austr. inhabitant, præcipue sequentes duæ notis constantioribus distingui possunt, hinc infra, etiamsi non sine aliqua hesitatione, ceu species novæ



propositæ, quibus dein *Faurea saligna* Harv., in eodem territorio cum antecedentibus non infrequenter obvia, caractere specifico quidpiam ampliato vel modificato, comparationis gratia addere liceat.

1. FAUREA SPECIOSA, Welw. n. sp. (Tab. XX.) *F.* ramulis floriferis villosito-tomentosis; foliis molliter coriaceis breve petiolatis, oblongis vel ovato-oblongis, basi breviter attenuatis, apice obtusis rariusve acutiusculis, margine integerrimo planis, utrinque, nec non rhachi et bracteis plus minusve dense villosito-vel lanuginoso-tomentosis vel supra demum subglabratis; spicis robustis, foliis longioribus vel saltem æquilongis; calycis 9–12 lin. longi dense tomentosi lobis dorso vix sulcatis; squamulis hypogynis late abbreviato-ovalibus, apice rotundato-obtusis truncatisve vel subdenticulatis; ovario undique pilis elongatis, sericeis, penicillatim dispositis, dense barbato.

*Habitat* in Districtus Huilla silvestribus petrosis vel arenosis editioribus, inter 4000 et 5000 ped. alt., imprimis circa Lopollo et Humpata. Ab Aprili usque Junium florens, Maio ad Julium fructificat. Species uti videtur per Africam austro-tropicam late diffusa, etiam a cl. Kirk et Meller in Distr. Mossambicensis interioribus, inter 2000 et 3000 ped. elevatis, reperta ibidemque (secundum specimina in herb. Kewensi) non minus quam in territorio Huillensi quoad foliorum indumentum varians, propter eorum circumscriptionem vero nec non ob spicas robustas florumque magnitudinem etc. absque dubio præsentis speciei subscribenda. *Exsic.* Welw. Iter Angol. no. 1622 et 1622b.

Frutex firmus, 6–8-pedalis, nunc arbor parva 10–15-pedalis; trunco ad basim  $\frac{1}{3}$ – $\frac{2}{3}$  ped. diametro, cortice profunde rimuloso, aspero, e fusco cinerascete tecto, laxo ramoso, ramis vagis, erecto-patulis, arcuatis, ramulis curvatis vel varie tortis, rigidis, pro more robustis, foliorum delapsorum cicatricibus latis, protuberantibus exasperatis, primum tomento laxo, villis longioribus patulis intermixto obtectis, demum villo sensim delabente, plus minusve pubescentibus. *Folia* bene evoluta una cum petiolo 2–3 lin. longo 4–6 poll. longa, 2–3 poll. lata, plerumque ad utramque faciem tomento plus minusve denso, e villis longiusculis ruditer contexto, in facie superiore demum rarescente, sed saltem juxta nervos remanente obtecta, utrinque pallide viridia, pinnatim nervosa, nervo mediano subtus valde prominente, lateralibus crebris, obliquis, tenuibus, mox paullo supra ortum bifurcatione repetita in venulas anastomosantes sed marginem laminæ nunquam attingentes divisas. *Spicæ* florigeræ ad ramulorum apices in axillis foliorum summorum singulæ, vel internodiis ultimis valde abbreviatis binæ, rarius plures, simplices, strictiusculæ, 5–9 pollices longæ, cylindræ, sub plena anthesi transversim sesquipollicem crassæ, obtusiusculæ. *Rhachis* sulcata, firma, circiter  $1\frac{1}{2}$  lin. crassa, villosito-tomentosa, infra flores ad altitudinem semipollicis usque squamis scariosis ovato-lanceolatis, acuminatis, sursum versus sensim remotioribus et angustioribus vestita. *Flores* e flavo aurantiaci, dense congesti, sub anthesi horizontaliter patentibus, singuli bractea squamiformi ex ovato acuminata, concava, subpatula, extus dense villosa, apice pilorum fasciculo superata, tarde decidua suffulti. *Calyx* fere pollicem longus, rectiusculus vel modice sursum arcuatus, dense cano-tomentosus, tubo cylindræo medium versus parum angustato, intus nudo, lætius aurantiaco et ob filamenta adnatim decurrentia pluristriato, lobis cochleariformibus 2– $2\frac{1}{2}$  lin. longis in alabastro clavatim cohærentibus, crassiusculis, rigidis, demum una cum tubo, styli erumpentis ope longitudinaliter fissis atque reflexis, deciduis. *Antheræ* oblongæ, sessiles vel subsessiles, calycis lobis paullo breviores iisque impressæ, basi obiter bilobæ, apice manifeste apiculatæ. *Squamulæ hypogynæ* e lata basi abbreviatim ovals, vel imo semiorbiculars, apice obtuso nunc integræ, nunc subtruncatæ aut emarginatæ vel uno alterove denticulo munitæ et non raro in eodem flore inter se heteromorphæ, in vivo flavæ, carnosulæ, exsiccantes subinduratæ et longius persistentes. *Ovarium* ovoideum, sessile, undique pilis elongatis, rigidulis, albidis, sericeo-nitentibus, primum in comam rectiusculam collectis, mox penicillatim dispositis dense obsi-



tum. *Stylus* filiformis, calyce vix brevior, in alabastro juxta medium curvatus, post anthesim leviter sursum arcuatus, rigidescens; stigma subcylindrico-prismaticum, obsolete 4-sulculatum, ad 2 lin. longum, stylo paullo crassior, a medio apicem versus modice clavulato-incrassatum, basi obiter strumulosum, apice obtusiusculum. *Nux* subglobosa, omnino sessilis, pisi minoris magnitudine, undique pilis sericeis ipsa multo longioribus, et inter pilos tomento brevi fulvo obtecta, ad plenam fere maturitatem stylo, tunc delabente, caudata, pericarpio crassiusculo tenuiter suberoso intus levigato. *Semen* subglobosum, seminum *Cannabis sativæ* circiter magnitudine, plane maturum tamen non mihi obvium.

*Observatio.*—Species hic proposita ad numerosam speciminum seriem in diversis locis lectorum examinata, quoad spicarum magnitudinem et formam, nec non respectu floris partium inter se proportionem sat constans videtur, quoad foliorum indumentum vero admodum ludit, ita ut varietates, notis constantioribus satis distinctæ, vix et ne vix quidem statui possint. Ast ipsum hoc foliorum indumentum magis quantitate quam qualitate variat, nam semper e villis longiusculis crispatis, plus minusve rigidulis, nunc laxius nunc densius intertextis constat, et in ipsis foliis, quæ primo aspectu penitus glabra vel imo in facie superiore nitidula apparent, accuratiore examine saltem juxta nervum medianum vel ad costarum axillas invenitur. Colorem foliorum fere constanter pallide viridem vidi, nisi in stirpibus in locis valde umbrosis obviis, quorum folia, uti hoc in pari casu generatim occurrit, virore magis saturato tinguntur, simulque magis glabrescunt, circumscriptione vero etiam hac in varietate semper ad formam ovalem tendunt.

2. FAUREA DISCOLOR, Welw. n. sp. *F.* ramulis floriferis cano-pubescentibus; foliis tenuiter coriaceis, breve petiolatis, lanceolatis vel lanceolato-oblongis, basi sensim attenuatis, apice acuminatis vel rarius obtusiusculis, margine recurvis, supra pruinoso-canescens, mox deglabratis, lucenti-viridibus, subtus per omnem ætatem dense cano-tomentellis; spicis folia superantibus; rhachi bracteisque et calyce 5–7 lin. longo sericeo-canescens, hujusce lobis dorso obiter sulcatis; squamulis hypogynis deltoideis vel semiorbicularibus; ovario undique et dense pilis sericeis ipso triplo longioribus barbato.

*Habitat* in Distr. Huilla silvis claris mixtis ad 4500–5000 ped. altit. una cum *Acaciis*, *Proteis*, *Parinariis* variisque *Combretaceis* socialis sed parcius obvia. Aprili et Maio florentem vidi. *Exsic.* Welw. Iter Angol. no. 1594 et 1595.

Frutex plerumque humanæ altitudinis, rarius arbuscula 8-pedalis, laxè comosa. *Ramuli* juniores et floriferi dense cano-pubescentes, adultiores glabri, longitudinaliter rugulosi. *Folia* adulta discoloria, supra nempe, pubescentia juvenili nunc deglabrata lucidulo-viridia, subtus autem ob tomentum breve sed densum, subvelutinum et persistens incana,  $2\frac{1}{2}$ – $3\frac{1}{2}$  poll. longa,  $\frac{2}{3}$ –1 poll. lata, margine integra et obiter recurva, breviter calloso-apiculata. *Spicæ* in ramulis extimis terminales, circiter 4– $4\frac{1}{2}$  poll. longæ, iis speciei antecedentis graciliores et angustiores. *Rhachis* (pedunculus) infra flores squamis paucis distantibus vel sæpe nullis obsita. *Bracteæ* abbreviatæ, a basi dilatata breviter acuminatæ, patulæ. *Calycis* 4–5 lin. longi modice arcuati plus minusve canescens lobi  $1\frac{1}{2}$  lin. longi, dorsi sulcis pubescentia nunc copiosiore nunc sparsiore obtectis, ast saltem in calyce deflorato semper observandis. *Antheræ* apiculatæ. *Squamulæ hypogynæ* in individuis acutifoliis deltoideæ apice indivisæ, in speciminibus foliis obtusiusculis donatis autem breviores, subsemiorbiculares. *Ovarii* barba ipso triplo vel rarius quadruplo longior, sericeo-splendens, strictiuscula. *Stylus* pro more generis calycis longitudine, barbam longe superans, juxta medium arcuatus, tarde deciduus, stigmatè tenuiter clavulato, obscure prismatico, obtusiusculo, basi nunc parum nunc evidentius strumulato. *Fructus* non visus.



Species, vel saltem varietas insignis, quoad spicarum formam et partium floris inter se proportiones antecedenti, quoad foliorum figuram autem sequenti magis affinis, ab utraque tamen foliis ad faciem inferiorem constanter pube brevi, densa, ex albo-cinerascente cano-tomentellis\* distinguenda, nihilominus posteriori peregrinatorum observationi denuo commendanda.

3. FAUREA SALIGNA, Harvey, in Hook. Lond. Journ. 1847, p. 373, tab. xv. *F.* ramulis floriferis glabriusculis; foliis lanceolatis, longe acuminatis, in petiolum alatum sensim attenuatis, utraque facie glabris, supra nitidulis; rhachi, bracteis et calyce 4–5 lin. longo sericeo-pubescentibus vel rarius deglabratis; lobis calycinis profunde bisulcatis; squamulis hypogynis lanceolatis, acuminatis vel apice obiter bilobis; ovario pilis sericeis longiusculis, in fructu rarescentibus barbato.

*Habitat* in Distr. Huilla silvaticis ad 5000 ped. alt., imprimis inter Lopollo et Menino juxta rivorum ripas, vel hinc inde in ipsis torrentium alveis una cum *Salicibus* socialis. Novembri usque ad Januarium et iterum Aprili florentem vidi, Maio c. fr. legi. Primum a cl. Sanderson et Burke in territorii Natalensis interioribus lecta, demum ex iisdem terris a cl. Zeyher et Drege in eorum herbariis divulgata, nuper etiam a cl. D<sup>re</sup> Kirk e territorio Mossambicensi (fid. herb. Kew.) reportata. *Exsic.* Welw. Iter Angol. no. 1592 et 1593.

Frutex elongato-ramosus 5–8-pedalis, hinc inde arbor gracilis 12–20-pedalis, trunco vix unquam diametro 4 poll. excedente, inferne tum longe ramis denudato, his atque ramulis erecto-patulis, plus minusve intense purpurascens. *Folia* 3–5, rarius 6 vel 7 pollices longa, plerumque 6–9 lin. lata, vix unquam sesquipollice latiora, recta vel obiter falcata, callo parvulo vel fere lineam longo, atro-rubente apiculata, margine integro plana vel obsolete repanda, laxeve undulata, jam prima ætate, excluso petiolo hinc inde sparsim puberulo, ad utramque faciem omnino glabra, levigata, læte viridia et utrinque vel saltem supra lucidula. *Inflorescentia* omnis quoad pubescentiæ densitatem valde varians, sed non nisi rarius penitus deglabrata. *Spicæ* graciles, 3–4½ poll. longæ, rectiusculæ, foliis summis fere semper paullo breviores, ad ramulorum apices singulæ vel internodiis contractis in eodem ramulo 2 pluresve gregatæ. *Rhachis* infra flores squamis paucis, remotiusculis, acuminatis, erecto-patulis, non raro jam sub anthesi deciduis munita. *Bracteæ* rigidulæ, patulæ, concavæ, eæ florum inferiorum late ovatæ, abrupte acuminatæ, superiorum abbreviatæ, apice obtuso cuspidatæ vel fere truncatæ. *Calyx* (saltem in speciminibus Angolensibus) circiter 4 lineas longus, vix unquam lineis 5 longior, lobis lineam longis, dorso longitudinaliter sulcis duobus latiusculis, pro more profundis sed obtusis percursis. *Squamulæ hypogynæ* quam in speciebus antecedentibus angustiores magisque acutatæ, longiores quam latæ, quondam in uno eodemque flore heteromorphæ, una vel duabus apice acuto integris, reliquis tenuiter bilobis. *Antheræ* rarius omnino sessiles sed plerumque filamentis brevissimis sed distinctis insertæ et manifeste apiculatæ. *Nux* ovoidea, 2 lin. longa, 1½ lin. prope medium lata, obtusa, barbæ pilis nunc sparsioribus et plerumque rufescentibus hirta, stylo indurato-rigescente prope medium arcuato, ad plenam fere fructus maturationem persistente caudata, vel demum ejusdem basi remanente apiculata, epicarpio crassiusculo suberoso. *Semen* ad cavitatis latus prope medium fixum, obovoideum, testa membranacea subscariosa brunnea, laxissima vel pro parte omnino soluta.

Ceterum etiam hæc species, quemadmodum duæ præcedentes, nunc foliis longius

\* "The existence or absence of pubescence in the adult leaves cannot always be depended upon in distinguishing species; but the short tomentum, especially of their under surface, is of greater consequence than the spreading hairs."—R. BR., "On Proteaceæ" etc. in *Transact. of the Linn. Soc.* vol. x. p. 25.



(4–7 lin.) petiolatis simulque angustioribus [qualis forma typica], nunc breviter vel brevissime petiolatis (petiolis vix 1–1½ lin. longis) et tum latioribus variat, quæ ulterior forma præsertim in individuis arborescentibus solo sicciore enatis observatur.

### Ordo RAFFLESIACEÆ.

#### Subordo I. HYDNOREÆ.

HYDNORA AFRICANA, var. *longicollis*, Welw. (Tab. XXI.) *H.* perigonii tubo ultra ovarium longe producto, limbi tri-rarius quadrifidi laciniis tubo brevioribus, ramentis heteromorphis, extimis densa serie approximatis, elongatis, liberis, compresso-planis, apice longe acuminatis bi-trilobisve, reliquis absque ordine sparsis, discum versus sensim brevioribus, semiadnatis, apice libero subulatis vel omnino papillæformibus; disci pulvinulis ovato-oblongis, obtusiusculis, basi dilatata subemarginatis, pulvere griseo farinaceo, mox in mucum deliquescente, obductis; annuli staminigeri medio tubi adnati lobis ovoideis erectis, ad utramque faciem antheris elongatis, varie curvatis, inæquilongis, arcte adnatis dense obtectis.

*Habitat* in District. Mossamedes sabulosis maritimis, ex Giraúl usque ad Cabo Negro, ad radices *Euphorbiarum* frutescentium nec non *Zygophylli orbiculati* (supra descripti) parasitica. Per totum fere annum, imprimis autem mensibus Martii ad Julium usque floret et fructificat. *Æsicc.* Welw. Iter Angol. n. 530.

*Caulis* succulentus, perennis vel saltem per plures annos durans, plerumque omnino aut pro majore parte in arena volatili, basim trunci matricis ambiente, sepultus, vetustior circiter pedalis, inferne ad  $\frac{2}{3}$  poll. crassus, decumbens vel ascendens, sparse remoteque ramosus, extus obscure fusco-rubens, intus carne densa pallide latericia farctus, 5–7-angulatus, secundum omnes angulos tuberculis uniseriatis, plus minusve approximatis, subglobosis, apice obtuso minus magisve evidenter concentricè rimulosis obsitus, quorum nonnulla sensim intumescencia simulque elongata formam obconicam induunt et demum in perigonia sese evolvunt, dum reliqua per totam caulis durationem fere immutata permanent, vel parum elongata in ramenta subcompressa, rigida, obtusiuscula collabuntur. *Perigonium* carnosum, rigidum, non raro ad limbum usque in arena absconditum, longitudine varium, 3–7-, imo 8-pollicare, basi rotundato-angustata vel paullo constricta, sessile vel brevissime pedunculatum, extus undique leproso-asperulum, cinnamomeo-brunneum, rugis transversalibus, ad tubi partem cum ovario connatam crassioribus, dense approximatis, notatum. *Tubus* circiter  $\frac{2}{3}$  poll. diametro, infra annuli staminigeri insertionem modice attenuatus, intus levigatus vel obiter striis longitudinalibus parallelis percursus et plus minusve læte rubescens. *Limbi* lacinia (plerumque tres, sed hinc inde quatuor, vid. tab. fig. 3) tubo semper et plerumque multo breviores, crasso-triquetræ, arcuatae, apicibus brevissime et obtuse acuminatis convergenti-patulæ, intus ex aurantiaco rubræ, et juxta marginis late induplicati faciem totam ramentis supra descriptis, omnibus introrsum directis, echinulatae, earum discus glaber, sed pro majore parte pulvinulo jam supra notato obtectus, cujus superficies initio albido-pulverulenta mox post anthesim in mucum viscidulum, odore vehementer stercorario ingratum, strato mucoso *Phallorum* sporidia involventi adeo similem, deliquescit. *Annulus* staminiger tubo ad semipollicis vel imo pollicis distantiam supra stigma insertus. *Antheræ* lætissime flavæ et admodum turgidæ, spurie biloculares. *Stigma* in vivo sordide albidum, in flore 3-fido tri-, in 4-fido quadrilobum, lobis abbreviatis, horizontalibus, creniformibus, rotundato-obtusis, tenuissime denseque striolatis, striis nunc obliquis, nunc, uti in stigmate quadrilobo observavi, lorum peripheriæ subparallelis, concentricè curvatis. *Pericarpium* globosum, diametro circiter bipollicari, dure corticatum, extus undique areolis irregulariter pentagonis, parum distantibus, exasperatum, interna facie levigatum, et sulcis te-



nuibus verticalibus, æqualiter distantibus, plus minus manifestis [placentarum in prima juventute forsan parietalium, uti vidisse contendit cl. Endlicher\*, vestigiis?], notatum. *Semina* numerosissima, ad placentas deliquescentes densissime gregata, globosa sive obovoidea, seminum *Papaveris somniferi* magnitudine vel recentiora ipsis majora, epidermide crassiuscula, carnosopulposa, minutim scrobiculata, demum collabente involuta, testa brunnea tenuiter membranacea, albumini duro arte adhaerente, primum in pulpa viscidula semitransparente, pericarpium cavitatem omnino replente, nidulantia, post pulpæ exsiccationem quoad volumen diminuta, in globum subcompactum, cavitate paullo minorem, undique liberum inter se conglutinata.

*Observatio.*—Formam hic descriptam primum ab *Hydnora capensi* Thunb. specificè diversam credidi, maxime quoniam apud varios auctores plantæ Capensis tubus limbo multo brevior et parum supra ovarium protractus simulque annulus staminiger stigmati valde approximatus dicuntur vel sic picti exhibentur; postea tamen, speciminibus pluribus in diversis locis lectis inter se comparatis, proportionibus allatas plus minusve variabiles et probabiliter ex majore vel minore soli, in quo plantæ crescunt, profunditate ac densitate derivandas agnovi et plantam Angolensem *Hydnoræ capensi* qua varietatem subjungere malui.

*Qualitates et Usus.*—Omnes plantæ partes, sed imprimis caules [ab aliis “rhizomata” dicti] succo rubente, admodum adstringente scatent, qua ratione a Nigritis et colonis Mossamedensibus ad retia piscatoria variasque telas tingendas adhibentur. Ceterum *Hydnoræ* qualitates eminenter stypticæ, in sanandis ulceribus nec non in corrigendis membranæ mucosæ affectionibus morbosis probabiliter satis proficientes, medicorum Angolensium futuræ experientiæ atque observationi admodum commendandæ.

## Subordo II. APODANTHÆ.

*PILOSTYLES ÆTHIOPICA*, Welw. n. sp. (Tab. XXII.) *P.* floribus in involucri erumpentis primum globosi demum irregulariter rupti fundo sessilibus, singulis vel binis, basi decussatim paucibracteatis; sepalis petalisque 5–6-meris, obovato-oblongis vel suborbicularibus, margine eroso-denticulatis; petalis sub disco crasso 5–6-angulato insertis, basi tuberculato-callosis, puberulis; stylo late conico, basi disco cincto, stigmate hemisphærico, minutim ruguloso-striolato, integro vel brevissime 2–3-lobo.

*Habitat* parasitica ad ramulos *Berliniæ paniculatæ* Benth.†, arboris e *Cæsalpiniearum* tribu, in Districtus Huilla montosis editis de Morro de Monino, intra 5000 et 5500 ped. altit., Aprili–Maio florens. Flores masculi frequentius quam feminei occurrunt, sed nunquam in eadem arbore simul cum femineis a me visi. *Exsic.* Welw. Iter Angol. no. 529 (masc.) et 529b (fem.).

Arboris ramuli bi- vel triennes, quibus planta nostra innascitur, primum paullo intumescunt simulque circumcirca rimulis longitudinalibus, sæpius interruptis, in fundo materia latericia, tenuissime granulosa repletis, exasperantur. Ex his rimulis paullo post tubercula plus minusve gregata vel plerumque seriata, initio hemisphærica, mox globosa, 2–2½ lin. diametri, dure corticata, undique sulcis minutis concentricis vel squamulis tenerrimis pallide latericiis asperula, intus cava et levigata prorumpunt, quæ demum, jove pluvio stimulata, e vertice dimidiatim vel irregulariter dehiscentia, florem unum [vel rarius duos] in eorum cujusque fundo sessilem et quidem jamjam omnino evolutum denudant‡.

\* Conf. Endl. Gen. Plant. p. 75, Observ.

† Transact. Linn. Soc. vol. xxv. p. 311.

‡ Tubercula hæc, quæ florum cunabula sive involucra sistunt, et utero *Angiogasterum*, simulque *spathæ Balanophorearum* analogæ videntur, post eorum dehiscentiam nunc bilabiatis hiantia, nunc, parietis lateribus dejectis, sub forma patellæ, in centro suo florem vel fructum gerentis, persistunt, et ramulo matricali imo post florem vel fructum



*Flores* dioici, roseo-sanguinei, carnosuli, excepta nimia exiguitate, *Rafflesias* habitu omnino æmulantes, primum globosi  $1\frac{1}{2}$ –2 lin. diametro, sub plena anthesi parum latiores et vertice depressi, ope calli brevissimi carnosii intus albidi centro fundi involucri rupti affixi, e perigonii verticillis duobus biserialiter arcte imbricatis columnam stamineam vel pistillum ambientibus et basi bracteis paucis amplexis constantes. *Bracteæ* 3–5, orbiculatæ vel late obovatæ, basi quidpiam incrassata, sessiles, decussatim imbricatæ, concavæ, margine toto eroso-denticulatæ, perigonii verticillo inferiore arcte adpressæ eoque breviores et eodem ac flos ipse colore sanguineo ornatae, in fructu persistentes.

**MASC.** *Sepala* [vel si mavis bracteæ superiores, reapse juxta spiram ascendentem insertæ, sed ob hujus axim adeo abbreviatum in verticillum, calycem simulantem, approximatae] petalis semper isomera, plerumque 6, sed non raro, et quidem in floribus eundem ramum obsidentibus, 5, rarissime 4, e lata basi obovato-oblonga vel suborbicularia, margine pariter ac bracteæ tenuiter denticulata, petalis æquilonga vel iis paullo breviora, bracteas superantia. *Petala* sub disco crassiusculo angulato inserta, sepalis alterna, hisque quoad circumscriptionem et marginis denticulos similia, sed basim versus magis angustata et intus paullo supra basim callo tuberculiformi subspongioso, tenuissime puberulo [pulvinulis in disco laciniarum *Hydnoræ* obviis analogo?] obsita, ceterum ut flos omnis glaberrima, sub anthesi erecto-patula, pressione quidem facile secedentia, sed plerumque non nisi cum flore toto decidua. *Discus*, coronam faucis æmulans, carnosus, latiusculus, viscosus, angulis obtuse triquetris, prominenti-subascendentibus, petalis isomeris et cum iis alternis, sinibus petala recipientibus rotundato-obtusis. *Columna* staminea inclusa, cylindræa, ima basi disco cincta, sub apice quidpiam dilatata, composita est e stylo centrali [abortivo] firmo, carnosio-farcto, centro pervio, apice, stigmatis loco, pileo fungiformi, depresso hemisphærico, margine fimbriato, et e tubo staminifero, stylum totum, excluso pileo, arcte vaginante sed ab eo libero, juxta faucem truncatam pileo proximam antheras ferente, infra antheras ad discum usque longitudinaliter et minute costulato-sulcato. *Antheræ* numerosæ, circa tubi oram simplici serie adnatæ, contiguæ, uniloculares, poro apicali mox extrorsum versus dilatato dehiscentes, effætæ demum et collapsæ tubi oram sub forma membranæ annularis breviter reflexæ cingunt. *Pollen* globosum, glabrum, albidum, levissimum et admodum viscosum, imo post antheras effætæ harum plagis externis et adhuc majore copia fimbriis pilei, tubum antheriferum supereminens, adhærens atque hocce modo obiter aspicienti alterum, *i. e.* secundum antherarum verticillum sive anulum fingens. *Ovarii* vestigium vix ullum, styli axis vero non raro perforatus.

**FEM.** *Calyx* et *corolla* maris, flos totus tamen sub anthesi quidpiam magis elongatus. *Ovarium* inferum, uniloculare, placentis parietalibus quatuor, multiovulatis, nonnunquam fere omnino inter se confluentibus; ovula oblongo-ovoidea, funiculo brevi, latiusculo, laterali, placentis affixo. *Stylus* amplus, brevis, late conicus, basi disco obtusangulo cinctus (intus tenuissime lamellosus?); stigma hemisphæricum, lata basi styli truncati apici insidens, ab ipso etiam colore obscuriore distinctum, undique rugulis striisve minutis notatum, plerumque simplex, rarius bi- vel trilobulatum, lobulis tum erectis mamillæformibus. *Fructus* baccatus, globosus, perigonii phyllis nunc subscariosis arctiusque imbricatis omnino obtectus. *Pericarpium* carnosum, crassiusculum, uniloculare, indehiscens. *Semina* plurima, minima, sphæroidea vel subovoidea, in pulpa mucosa viscida transparente laxè nidulantia; testa tenuiter crustacea, reticulata, pallide rubra; nucleo cellulis minimis subglobosis (homogeneis) lætius rubentibus dense repleto. *Flores* et *fructus* recentes sub pressione fortiore succum roseo-sanguineum, chartam eodem colore sat persistente tingentem exsudant.

*Observatio.*—Uti ex supra expositis patet, character genericus *Pilostylis* in posterum

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delapsam arctissime adhærent, ast nequaquam ab ipsius matricis cortice, sed pro majore parte, nisi omnino, e membrana colorata, matricis ramulum sub epidermide, mycelii fungorum *cladophilorum* ad instar, obducente demumque obdurante formata inveniuntur.



valde modificandus et ampliandus erit, quod autem non nisi specierum omnium a variis auctoribus hucusque propositarum reiterato examine fieri potest. Omnes species cognitæ, (forsitan solummodo paucarum vel imo unius ejusdemque speciei varietates?) in *Leguminosarum* ramulis parasitantur, omnesque crescendi modo, habitu, florum magnitudine et colore plus minusve rubescente aliisque notis satis inter se congruunt, dum characteres specifici, ab auctoribus indicati, et inprimis a stigmatis figura desumpti, parum constantes videntur. Discus (sive corona faucis) in utroque sexu speciei nostræ pari modo manifestus, sed in reliquarum specierum descriptione non indicatus, neque in generis characterem commemoratus, forsitan in omnibus speciebus accuratius examinatis inveniendus. Genus "*Sarna*" Karst. (Linnæa, xxviii. 725. 1) absque dubio *Apodantheis* nec *Balanophoreis* adsociandum, et ab ipsa *Pilostyle* nullo characterem differre videtur. Generis "*Apodanthes*" Poit. dignitas et a *Pilostyle* differentia fere solum ex pericarpium cavitate tetragona, characterem forsitan non satis constante, pendent, et insuper ob flores masculos necdum cognitos dubiosæ remanent.

### Ordo MOREÆ.

**MORUS EXCELSA**, Welw. n. sp. (Tab. XXIII.) *M.* dioica, trunco robusto elato, ramis patentibus, ramulis petiolis nervisque foliorum subtus glabris puberulisve; foliis sublonge petiolatis, oblongis vel ovato-ellipticis, acuminatis apiculatisve, basi rotundatis, margine subundulatis integerrimis vel obiter repandis et apicem versus obscure dentatis, glabris, subtus pallidioribus, subtilissime pubentibus glabratisve (iis arboris juvenilis basi subcordatis, margine toto serrato-dentatis, supra setuloso-asperis, subtus laxè velutino-tomentosis) nervis utrinque costæ ad 15; stipulis lanceolatis subulato-acuminatis puberulis; amentis pedunculatis cylindricis, masculis 5–8 poll. longis, femineis 1–2-pollicaribus; perianthio masculo turbinato-campanulato, sericeo, quadridentato vel quadrilobo; perigonii feminei foliolis lineari-oblongis pubescentibus, apice rotundato cucullato-inflexo barbulatis; stylo excentrico, filiformi, simplici, undique supra medium stigmatoso.

*Habitat* frequens in silvis primævis elatioribus minus densis Distr. Golungo Alto, Dembos, Cazengo etc. ad 1300–2800 ped. altit., præsertim in declivibus humidioribus de Serra de Alto Queta circa Sange. Octobr.–Nov. floret, Dec.–Februar. fruct. maturat. A Nigritis dicitur "*Mucamba-camba*." *Exsic.* Welw. It. Angol. no. 1559.

*Mucamba-camba*, *especie de Morus*, Welw. Synopse, p. 8.

Arbor speciosa, excelsa, copiose lactescens, inter silvarum primævarum Angolæ gigantes laudanda, bene adulta 100–120-, imo hinc inde 130-pedalis et altior. *Truncus* rectus, cylindricus, circumferentiam 20–30-pedalem attingens, cortice pro amplitudine arboris haud profunde rimoso, griseo, in individuis vetustioribus ad 40–60 ped. ejus altitudinis ramis denudatus, apice coma late extensa, depresso-hemisphærica coronatus. *Rami* vagi, horizontaliter expansi, aliquanto tortuosi, griseo-fuscescentes; ramuli varie curvi, glabrati, stipularum cicatricibus semicircularibus exasperati, novelli purpurascens, lenticellis elongatulis albidis obsiti et plus minusve puberuli vel hinc densius pubescentes. *Folia* annua, sed tarde decidua, penninervia, quoad circumscriptionem semper integra (*i. e.* nunquam lobata), respectu indumenti vero secundum arboris ætatem maxime varia; ea stirpis juvenilis quam in adulta multo majora quidem, et inprimis longiora sed brevius petiolata, petiolis circiter semipollicaribus, villosopubescentibus, lamina 6–7 poll. longa, 3–5 poll. lata, basi obiter vel profundius cordata, margine



circumcirca dense serrato-dentata, apice abrupte in acumen fere semipollicare terminata, supra setulis sparsis aspera, subtus plus minusve dense velutino-tomentosa: in arbore adulta florifera foliorum petioli 1-1½ poll. longi, glabriusculi; lamina 4-5 poll. longa, 2-3 poll. lata, basi rotundata, apice brevius acuminata vel cuspidata, margine obiter repando solum a medio apicem versus breve denticulata, supra intense viridis et glaberrima, subtus pallide virens, omnino glabra vel, inprimis juxta nervos, tenuiter puberula, rarius pube densiore, non nisi sub lente fortiore conspicua, subvelutina; costa sive nervus medius supra vix, subtus valide et obtuse prominens; nervi laterales utrinque 13 usque 17, sæpissime 15, alterni, sub angulo acuto divergentes, recti, inter se strictim paralleli, quam costa multo tenuiores, simplices, paullo ante marginem in venulas soluti, una cum costa nunc flavicantes, nunc e flavo purpurascens. *Stipulae* circiter 8-10 lin. longæ, caducissimæ. *Flores*, a me quidem semper dioici observati, non nisi in arboribus vetustioribus (saltem 15-20 annorum) obvii, ad ramulorum novellorum basin prorumpentes. *Amenta* mascula et feminea cylindrica atque pendula; *mascula* graciliora, elongata, non raro ad 7 vel 8 pollices longa, densiflora, 3-4 lin. diametro, pedunculo 3-5 lin. longo, cylindrico et pubescente; perigonium flaccide membranaceum, albidum, campanulatim patulum, nunc 4-dentatum dentibus deltoideo-ovatis, nunc profundius 4-lobum, lobis ovatis obtusiusculis; filamenta longe exserta, una cum antheris alba; rudimentum ovarii constanter obvium, squamuliforme, oblongum, compressum, e centro floris erectum. *Amenta feminea*, non nisi in statu maturescente (syncarpia) observata, masculinis 3-4-plo breviora, sed iis crassiora, 7-8 lin. diametro, densa, carnosio-turgidula sed parum succosa, e viridi flavicantia, stylis longius exsertis nunc jam exsiccatis rigidulis undique horridula; perigonii, basi pilorum circulo stipati, foliola carnosio-tumida, vix inter se cohærentia, apice obtuso, incrassato pilisque brevibus barbato, cucullatim inflexa; achenium breve stipitatum, compresso-obovoideum; stylus lateralis, achenio saltem 3-plo longior, filiformis, subflexuosus, a medio ad apicem breviter acutatum stigmatosus. *Semen* obovato-oblongum, linea 1 parum longius, lenticulari-compressum, umbilico prope verticem laterali, testa badia, crustacea, fragili; embryo generi conformis; albumen respectu embryonis voluminis parcum.

*Qualitates et Usus.*—Lignum recens albidum vel ex albido leviter flavescens, demum badio-fuscescens, venis latiusculis varie curvatis et undulatis obscurioribus variegatum, ob tenacitatem longamque durationem inter Angolæ autochthones et colonos Lusitanos multiplicis usus. Syncarpia numerosos passerum greges lauto pabulo sustentant; amenta mascula exsiccando chartam colore læte sulphureo tingunt.

**DORSTENIA (KOSARIA) VIVIPARA, Welw. n. sp.** *D.* radice globoso-tuberosa, carnosio-farcta; caule simplici, spithameo, gracili, erectiusculo vel ascendente, cylindrico, obiter pubescente, ad nodos inferiores viviparo; foliis longiuscule petiolatis, ovatis, margine ciliolatis, basi breviter angustata integris, a medio ad apicem obtusiusculum usque obtuse dentatis, glabriusculis vel sæpius, inprimis subtus juxta nervos, puberulis; receptaculis in foliorum superiorum axillis solitariis, longe et gracillime pedunculatis, 6-9-radiatis, radiis patulis, rectis, lanceolatis, margine ciliatis.

*Habitat* gregaria sed paucis locis in umbrosis humosis juxta rivulorum ripas Distr. Pungo Andongo, frequens juxta rivum Candange-camatuta, ad 3200-3500 ped. alt. supra mare. A Decembr. usque ad Febr. floret et fructificat. *Exsic.* Welw. It. Angol. no. 1565.

Herba tenera, debilis, flaccidula, pallide virens. *Tuber* globosum, pisi majoris vel nucis avellanæ minoris mole, dense farctum et, uti omnis planta, copiose lactescens, quolibet anno perit, stirps autem ope tuberculorum in axillis foliorum infimorum sese evolventium demumque radicantium perennat. *Caulis* carnosulus, fragilis, subflexuosus, primum erectiusculus, mox decumbens vel ascendens, ad nodos inferiores tuberculiferos radicans. *Folia* penninervia, tenuiter membranacea, ovato-acuminata, basi breviter angustata, dempto petiolo gracili subpollicari 1½-2 poll. longa, ⅔-1 poll. lata; dentes ad



utrumque laminæ latus pauci, distantes et obtusi, sed constanter obvii. *Stipulæ* obsoletæ. *Pedunculi* patentés, gracillimi, leviter pubescentes, florigeri petiolis breviores, fructiferi iis semper longiores. *Receptacula* parva, parum succulenta, deorsum convexa, fere campaniformia, in juventute pubescentia, fructifera glabrata, herbaceo-viridia, demptis radiis 3 vel vix 4 lin. diametro, radiis singulis ad 2 vel 3 lin. longis, puberulis vel glabratis, margine semper breviter ciliatis, a lata basi sensim acuminatis, sinibus obtusis et integris separatis. *Semina* globoso-triquetra (vix ac ne vix quidem uncinata), testa tenuiter crustacea albida, papillis minimis undique exasperata.

Species, ut videtur, distinctissima, nulli cognitarum arctius affinis, inter Africanas etiam caule viviparo et totius plantæ teneritate insignis.

**DORSTENIA (KOSARIA) BENGUELLENSIS**, Welw. n. sp. *D.* radicis tubere depresso globoso vel placentiformi; caule centrali, firmulo, erecto, simplici, spithameo sive pedali, cylindrico, succulento, dense pubescente, inferne aphylo; foliis a medio caulis apicem versus sparsis, sensim majoribus magisque approximatis, subsessilibus vel brevissime petiolatis, penninerviis, lanceolatis, oblongo-lanceolatis ellipticisve, basi parum angustatis, margine toto dentatis, apice obtusiusculis, utrinque pubescenti-hirtulis scabrulisve; stipulis lineari-lanceolatis, brevibus, fugacibus; receptaculis in foliorum superiorum axillis solitariis, breve pedunculatis, erectis, concaviusculis, deorsum convexis, sordide flavicantibus, subglabris, ore orbiculato truncato 7-11-radiatis, radiis patentibus, lineari-spathulatis, apice puberulo obtusis.

*Habitat* rarior et sporadica in pascuis parce dumetosis, arenoso-humosis, breve herbidis Distr. Huilla circa Lopollo, inter 4500 et 5200 ped. altit. Legi Decbr. 1859 c. fl. et fr. *Exsic.* Welw. Iter Angol. no. 1566.

*Tuber* plerumque placentiforme, 1-1½ poll. diametri, carnosofarctum, copiose lactescens, basi circumcirca fibris elongatis, tenuibus, breve fibrillosis stipatum. *Caulis* (plerumque unicus, raro duo) e tuberis centro erectus, ½-1-pedalis, pennæ anserinæ circ. crassitudine, succulentus (exsiccatione valde contractus), cylindræus, e viridi purpurascens vel omnino purpureus, undique dense pubescens, ad ⅓ ejus altitudinem aphyllus vel squamulis paucis distantibus obsitus. *Folia* medii caulis ½-1-pollicem inter se distantia, summa latiora et fere fasciculatim approximata, subcarnosa et rigidula, erectopatula; petioli ⅓-1 lin. longi compressi; lamina foliorum majorum 10-14 lin. longa, 3-5 lin. lata. *Receptacula* pauca (1-4 in quoque caule), pedunculis 2-3 lineas longis, crassiusculis, firmis suffulta, ore, demptis radiis 3-4 lin. diametro; radii singuli 3 lin. longi, medio vix semilineam lati, denticulo uno alterove interjecto separati, fere ligulæformes, apicem versus modice dilatati, rotundato-obtusi et puberuli, stellatim expansi, ceterum, uti receptaculum, sordide flavicantes et carnosuli. *Pericarpia* apice breviter bivalvia, post seminis ejaculationem valvas arcte claudunt, parietum succulentorum incremento adhuc per aliquot tempus continuante crassiora fiunt et elongantur demumque flosculorum masculorum planum perforant et longe super illud, stylis suis adhuc apiculata, eminent. *Semina* iis speciei antecedentis omni sub respectu valde similia.

*Observatio.*—Caulis in omnibus speciminibus loco citato a me lectis simplex est, sed in eorum paucis folia medii caulis foliorum parvulorum fasciculum in axillis gerunt, qui forsitan tardius in ramulum evoluturus.

**DORSTENIA (SYCHINIUM) PSILURUS**, Welw. n. sp. *D.* rhizomate cylindræo, repente, nodoso, carnosofarcto, ad nodos fibris longis gracilibus et hinc inde tuberculis clavatis stipato; caule erecto, simplici, 1-2½-pedali, teretiusculo, subsucculento, inferne glabriusculo et laxius, apicem versus densius foliato et pubescente; foliis longiuscule petio-



latis, membranaceis, penninerviis, glabriusculis vel præcipue subtus juxta nervos hirtulis, in petiolum attenuatis, sæpius in eodem specimine polymorphis, basi semper cuneatis, integris, nunc ovato-ellipticis, acuminatis, margine dentatis, nunc obovatis vel obcuneatis, apicem versus plus minus profunde inciso-dentatis vel 3- plurilobatis, lobis inæqualibus, erectis vel patulis, elongato-triangularibus, acuminatis; petiolis angustis, inferioribus elongatis stipulisque parvis lineari-lanceolatis pubescentibus; receptaculis axillaribus, subsolitariis, longe graciliterque pedunculatis, verticalibus, lineari-lanceolatis, bibruribus, crure uno brevioribus deflexo, abrupte appendiculato, altero erecto longiore, apice simplici vel rarius bifurco, sensim in appendicem ipso crure duplo triplove longiorem, subulatam, rectam prolongato.

*Habitat* in convallibus umbrosis ad rupium latera Distr. Pungo Andongo ad 3200 ped. circiter altitudinis, præcipue in silva primæva dicta "Mata de Pungo" prope vicum Pungo Andongo. Floret Nov.-Jan., Decbr. ad Mart. fructificat. *Exsic.* Welw. Iter Angol. no. 1564.

*Rhizoma* horizontaliter repens vel oblique descendens, circiter pennæ anserinæ crassitudine, quidpiam flexuosum et hinc inde nodoso-tumidum, ad nodos præter fibras longas tenues unum vel plura tubercula elongato-claviformia, duriuscula sed succulenta, 1-2-pollices longa, deorsum emittens. *Caules* e rhizomatis collo, plerumque solitarii, rarius 2-3, erecti, teretes, parum succulenti, basi glabriusculi, a medio apicem versus sensim densius pubescentes, pube pilis brevibus patulis hyalinis intermixta, subviscida. *Folia* inferiora 2-3 pollices a se invicem distantia, petiolis bipollicaribus, canaliculatis, pubescentibus, versus caulis apicem sensim brevioribus, summis vix lineam longis, patulis suffulta, tenuiter membranacea, demto petiolo 4-6 pollices longa, 2-3 poll. lata, supra læte viridia, glabriuscula vel pilis brevibus raris adpersa, subtus juxta nervos hirtula multoque pallidiora, quoad figuram in eodem specimine maxime variantia, plerumque obovato-acuminata vel obcuneata, basim versus in petiolum attenuata ibidemque integra, a medio laminæ versus apicem dentata, incisa vel lobata, dentibus lobisve terminalibus tum erectis, quam laterales divergentes longioribus, omnibus plus minusve acuminatis vel acutatis sæpiusque apiculo parvo obtuso terminatis; non raro simul cum hisce formis in eodem caule etiam folia elliptico-lanceolata vel ovato-elliptica, margine remote grosse dentata, apice in acumen longiusculum elongato-triangulare producta inveniuntur. *Stipulae* anguste lanceolatae vel lineares, longe acuminatae, petiolis multoties breviores, dense pubescentes, hinc margine ciliatae. *Pedunculi* erecti, graciles, eorum longiores bipollicares; receptacula herbaceo-viridia, parum carnosum, in pedunculo verticalia, una cum appendice terminali 3-5 poll. longa, subsemicylindrica, sub prima anthesi latere quidpiam compressa, formam lanceolato-linearem fingentia, fructifera demum [ob ovaria turgida] longitudinaliter torulosa. *Flores masculi* semper monandri a me visi; perigonii tenuissimi limbus breve et irregulariter 3-4-dentatus vel fere obsoletus; filamentum e fundo tubi erectum, liberum, latiusculum, subcompressum; anthera exserta, didyma, rubro-purpurea. *Ovaria* quam flores masculi multo pauciora, ad utrumque latus costæ receptaculi stipiti brevi seriatim inserta, stylis solis supra florum masculorum planum breviter porrectis; stylus plerumque bicurvis, cruribus tum intus stigmatosis, rarius indivisus et apice subdilatato fimbriato-papillosus. *Pericarpia* globosa, in receptaculi contextu arachnoideo-celluloso nidulantia, etiam maturitate vix supra planum antheriferum eminentia. *Embryonis* uncinati radícula abbreviato-conica, quam cotyledones obovatae, plicato-venosæ, inæquales, in stipitem angustatae, multoties brevior.

*Qualitates.*—Rhizoma omne et præcipue tubercula oleo æthereo suavissime aromatico pollent et etiam exsiccata aroma per plures annos fere immutatum conservant. Stirps proinde verisimiliter eadem ac plures *Dorsteniæ* Brasilienses virtute diaphoretica et roborante, vel forsitan adhuc efficacioribus gaudet, sicque medicis Angolensibus, in dysenteria morbisque affinis sanandis, ceu remedium indigenum magnopere commendanda.



## Ordo GNETACEÆ.

GNETUM AFRICANUM, Welw. n. sp. *G. fruticosum*, dioicum; caule cylindraco, gracili, volubili, alte lateque scandente, remote ramoso, ramis ramulisque patentissimis vel retroflexis pendulisve, herbaceo-viridibus, levigatis, valde tenacibus, ad nodos parum incrassatis; foliis breve petiolatis, chartaceo-rigidulis, penninerviis, ovali-vel elliptico-oblongis, rarius lanceolatis, basi sensim vel abruptius attenuatis, nunc subrotundatis, apice abruptim sensimve in acumen 3-5 lin. longum, lanceolatum vel lineare, plerumque obtusum, hinc inde acutiusculum protractis, margine integris vel remote subcrenatis, utrinque levigatis, sub lente fortiore dense pellucido-punctatis, supra læte viridibus nitidulis, subtus pallide virentibus; amentis masculis ad ramulos abbreviatos laterales et apicales terminalibus, solitariis, longius pedunculatis, simplicibus, rhachide compressiuscula, apice conico-subulata, verticillis remotis, globoso-capitatis, involucris cupuliformibus ore truncato subnudis; amentis femineis drupisque non visis.

*Gnetum*, spec. Welw., Apontam. (1858), p. 545, cum observ.

*Habitat* in Districtus "Golungo Alto" editioribus (2200-2400 ped.) umbrosis silvarum primitivarum de Serra do Alto Queta, ubi Januar. et Martio florentem vidi, sed stirpem femineam observare non licuit. *Exsic.* Welw. Iter Angol. no. 1224 & 1225.

*Trunculus* in speciminibus a me observatis circiter digitum crassus, cylindraco, subflexuosus, inferne cortice tenui cinerascete hinc inde rimulis angustissimis distantibus notato, tectus, mox ad duos vel tres pedes supra basim trichotome divisus, ramis lateralibus oppositis et intermedio caulem prolongante iterum repetito-trichotomis. *Internodia* inferiora vix bipollicaria, demum sursum versus sensim longiora, in caulis parte superiore ad 6-8 pollices longa, ad nodos modice tumida. *Rami* inferiores circiter pennæ corvinæ crassitudine, superiores et ramuli vix fili emporitici crassitudine, omnes angulo recto patentes vel retrofracti, hinc inde volubiles, extimi flagelliformes, sicque stirpem inter arborum vicinarum frondes late scandentem suspendentes vel ex altiorum arborum coronis longe penduli, pallide herbaceo-virides, rigiduli et tenacissimi, ad imam basim non raro corniculis duobus oppositis, brevibus, rigidis, patentibus, stipulas aculeiformes fingentibus sed reapse ex petiolorum basi remanente et indurata foliorum delapsorum oriundis, muniti. *Folia* perennia, sicque eorum vetustiora non raro ad faciem superiorem variorum Lichenorum epiphyllorum orbiculis varie coloratis ornata, etiamsi vix coriacea; petioli 3-4, rarius 5 lin. longi, canaliculati, plus minusve acute carinati, basi vaginante carnosulo-tumidi, hinc exsiccatione plerumque transversim rugulosi, post laminæ lapsum in cornicula supra notata indurati, longe persistentes, et una cum eorum vagina caulis ramorumque nodos stipantes; lamina foliorum plene evolutorum 4-5 poll. longa, 2 poll. lata, nervis supra vix, sed mediano subtus ad laminæ medium usque manifeste prominente, costis utrinque 5 vel 6, arcuato-patentibus, sursum et marginem versus sensim evanidis, in vivo e viridi flavescentibus. *Amenta* mascula terminalia, solitaria, gracilia, rectiuscula vel obiter arcuata, pedunculo subcompressa circiter semipollicem longo; ima basi pilorum rufescentium circulo, supra medium bracteis 2 oppositis, ovalibus, acutis, erectis, basi vaginantibus munito, suffulta, excluso pedunculo 2-2½ pollices longa, verticillis 8-10, rarissime pluribus, singulis inter se 1½ lin. distantibus, densifloris onusta; involucra breviter cyathiformia, ore truncato plerumque omnino nuda vel hinc inde tenuiter crispula, staminibus pro more sat longe exsertis coronata. *Filamenta* simplicia, involucella longe superantia, antheris biporosis flavicantibus terminata. *Rhachis* amenti ultra verticillum summum in acumen elongato-conicum, plus minusve acute subulatum, 1½-2 lin. longum strictumque protracta. *Cetera* generis.



*Observatio.*—Stirps ab autochthonibus passim “*N-Coco*” nuncupatur et rami ob eorum longitudinem et tenacitatem chordarum ad instar utuntur; folia recentiora autem cocta atque oleo palmarum condita sapidum ipsis cibum offerunt, etiam mihi in istis solitudinibus non raro graviter esurienti nequaquam ingratum. Fructus maturi, qui ex Nigritarum descriptione oblongo-ovoidei et læte rubentes, nucleum pro more sat amplum includunt, ob avium simiarumque voracitatem non nisi rarius inveniendi.

### Ordo CYPERACEÆ.

Trib. HYPOLYTREÆ, Nees, Endl. Gen. Pl. 216\*.

ASCOLEPIS, Nees.

Genus reformatum et ampliaturum :

*Spiculæ* numerosissimæ in capitula densa hemisphærica vel subglobosa, longe bracteato-involucrata, dispositæ, receptaculo depresso globoso vel hemisphærico, distincte alveolato, insertæ, bisquamosæ. *Squama* exterior plana, angusta, acuminata, vacua, floriferam stipans eaque brevior; squama interior spongioso-turgida, basi interna in rimula hiante florifera, hermaphrodita, sursum in appendicem subulatam vel compresse subprismaticam, longitudine variam angustata. *Stamina* 3 vel 2, rarius 1; filamentis filiformibus, antheris linearibus obtusis. *Setæ hypogynæ* nullæ; discus nullus vel rudimentarius. *Ovarium* anguste ovoideum, obtuse vel acutius trigonum; stylus brevis, basi æqualis, stigmatibus 3, rarius 2, filiformibus, obtusiusculis. *Caryopsis* libera, anguste latiusve obovoidea, plus minus evidenter trigona vel tricostata, glabra†, vertice nuda vel brevissime apiculata aut truncata, lateribus subtilissime impresso-punctulata, quam squama fructifera multoties brevior.

Herbæ elegantulæ, perennes, erectæ, in Africa tropica cis- et transæquatoriali observatæ, cæspitosæ, glabræ, basi foliosæ. *Folia* filiformia vel anguste linearia. *Culmi* stricti, graciles, obscure angulati, rarius firmiores et sulculati, basi succulento-tumescens, foliis laxè vaginantibus vestiti, superne longe nudi, monocephali, infra capitula modice incrassati. *Capitula* globosa, discoidea vel pseudo-radiata, involucri polyphyllo, e foliolis inæquilongis basi dilatata membranaceo-marginatis composito, suffulta, nunc *Kyllingiarum* vel *Eriocaulonearum*, nunc quarundam *Compositarum* capitula radiata mire æmulantia. *Spiculæ* basi arcte imbricatæ, apice liberæ, erectæ vel patentes, coloratæ, niveæ, lacteæ, flavæ vel aureæ, nunquam omnino viridescens, collapsæ demum varie costulatæ vel angulatæ ac plus minus rigidescens.

*Ascolepis*, Nees in Plant. Schimp. Abyss. sect. iii. no. 1664.

*Kyllingiæ* spec., Steud. in Flora [B. Z.], 1842, p. 597.

*Isolepidis* spec., A. Rich. Tent. Flor. Abyss. ii. p. 501.

*Antrolepis*, Welw. Apont. p. 578.

*Antrolepis*, Thomson in Speke's 'Journ. of the Disc. of the Source of the Nile,' p. 654.

Genus *Platylepidi* Kunth affine et proximum, sed, ni fallor, bene distinctum, hucusque monotypicum, ab acutissimo Neesio ad specimina a cl. Schimper in Abyssinia lecta recognitum, ne dicam divinatam, sed vix ullibi verbis definitum. Differt autem *Asco-*

\* Tribus *Hypolytrearum* a C. Neesio olim introducta, nec tamen bene limitata, postea ab Endlicherio l. c. quidpiam reformatam, nunc generis præsentis speciebus pluribus quodammodo illustrata, in posterum, characteribus *Ascolepidis* additis, accuratius circumscribenda.

† *Caryopsis* plene matura sæpius membranula tenuissima, hyalina, arcte adglutinata, sub tritu frustulatim secedente, sed in ovario sub anthesi vix perceptibili obducta invenitur, sicque, obiter aspecta, grisea et omnino levigata, vix punctulata, apparet.



*lepis* a *Platylepide* receptaculo hemisphærico (nec elongato-conico), squamis floriferis subcylindræo-turgidis (nec plano-compressis), genitalibus in eorum rima basali sitis et liberis (nec intra squamæ utriculo inclusis), stylo typice trifido (nec constanter bifido), caryopsi demum trigona libera (nec biconvexa et in ipso squamæ fructiferæ utriculo inclusa.

A *Kyllingia*, quacum species typica [i. e. *Ascolepis eriocauloides* Nees] a cl. Steudel in plantis Schimperianis Abyss. Sect. II. no. 1195 et postea in Flora (Bot. Zeit.) loco supra citato conjungitur, nec non ab *Isolepide*, cui eadem species ab A. Rich. in Flor. Abyss. subscripta fuit, *Ascolepis* non solummodo genere, sed imo, uti ex supra allatis patet, tribu differt; non enim *Scirpeis* neque *Cypereis*, sed tribui *Hypolytrearum* prope *Platylepidem* adjungenda.

Vegetationis modum quod attinet, species omnes densius laxiusve cæspitosæ crescunt, earumque individua, eximie socialia, capitulis innumeris hinc vere et æstate prata paludosa, illinc autumnali tempore pascua montana humidiora denso agmine decorant, hocque modo, dum vix non semper cum *Xyrideis*, *Eriocauloneis*, *Commelynaceis* atque *Irideis* pumilis, colore et elegantia æque insignibus sociatæ, pascuis illis characterem peculiarem admodum variegatum imprimunt. Species singulæ autem vix unquam in eodem loco promiscue inter se crescentes observantur, et simul etiam rhizomatis indole atque perennandi modo inter se diversæ, unde commode in duas sectiones divelluntur. Species nempe tenuiores rhizoma offerunt e culmorum basi carnosoincrassata et bulbulis gemmæformibus, intra bulbi matricialis vaginas exteriores nascentibus fibrisque crebris gracilibus stipitatis laxè conflatum, dum contra species robustiores rhizomate gaudent lignescente, horizontali vel oblique descendente, ex quo culmi floriferi, basi itidem carnosotumidi, seriatim vel fasciculatim gregati assurgunt. Species rhizomate bulbulifero donatæ plerumque præcociores sunt, sed individuorum vegetatio, etiamsi jam ineunte vere incipiens, ob bulbulorum in culmos florentes evolutionem successivam, pluviarum copia vel parcitate moderatam, in variis locis non raro ad æstatis finem usque extenditur, sicque crebris temperaturæ et humiditatis vicissitudinibus exposita, unde, saltem pro parte, facies polymorpha capitulorum speciei maxime vulgaris, in diversis soli elevationibus æque frequenter occurrentis (*Ascolep. proteæ* nostræ) explicatur; species robustiores autem, rhizomate repente vel nodoso simulque profundius penetrante perennantes, tardius sese evolvunt, non nisi versus æstatis finem vel ineunte autumno florescere solent, sicque imbribus copiosioribus et longius persistentibus irrigatæ, nec non temperaturæ vicissitudini minus subjectæ, etiam quoad capitulorum magnitudinem spicularumque formam et colorem magis constantes inveniuntur.

§ 1. *Rhizoma tenuiter fibrosum, bulbuliferum; caryopsis*  $\frac{1}{5}$ – $\frac{1}{2}$  lin. longa, vertice dilatato rotundato-obtusa\*.

1. ASCOLEPIS PROTEA, Welw. Culmis (floriferis) 3–10 poll. altis; foliis basilaribus [i. e. e bulbulis non nisi sequente anno culmiferis enatis] fasciculatis, angustissime linea-

\* Huic sectioni etiam species typica, nempe *Ascolepis eriocauloides* Nees, l. c. (*Isolepis Ascolepis* A. Rich. l. c.), in Abyssiniæ montosis primum a cl. Schimper, demum a C. Quartin Dillon lecta, inserenda. Specimina sicca hujus speciei Schimperiana, quæ in Herb. Kew. et in Museo Brit. prostant, sat bene cum descriptione Richardii conveniunt, excepta spicularum squama dorsali vacua, a Richardio prætervisa, sed certe obvia. Quoad habitum et capitulorum molem hæc species formis microcephalis *Ascolepidis proteæ*  $\beta$  *bellidifloræ* nostræ satis similis, sed floribus



ribus vel fere capillaribus, erectis, culmo duplo triplove brevioribus, caulinis duobus vel sæpius solitario, culmi basim laxè alteque vaginante, quam basilaria duplo latiore et plerumque arcuatim patulo; capitulis nunc globosis  $2\frac{1}{2}$ –4 lin. crassis, nunc plus minusve hemisphæricis, transversim 3–8 lin. latis; spiculis albis vel flavis; squamis floriferis ovalibus, lanceolatis vel lineari-lanceolatis, a medio apicem versus subulatis vel compresso-cylindricis, obtusis vel acutiusculis, singulis e capituli centro peripheriam versus sensim longioribus; staminibus 3 vel rarius 2, stylo tri- vel bifido; caryopsi minima,  $\frac{1}{5}$ – $\frac{1}{4}$  lin. longa, obovoidea vel pyriformi, obscure trigona, vertice rotundato-obtuso vix apiculata, ad basim conico-attenuatam oblique truncata.

*Habitat* in Distr. Pungo Andongo et Huilla montosis breve herbidis subspongiosis a 3200 ad 5000 ped. altit., in demissioribus locis a Novembri ad Martii initium, in editioribus a Januario usque ad Maium florens. Etiam in Africa centrali observata.

Stirps quoad capitulorum figuram et magnitudinem squamarumque florigerarum configurationem et colorem maxime polymorpha, formis numerosis, primo aspectu inter se, uti dicere solent, toto cælo diversis ludens, quæ tamen accuratius examinatæ et comparatæ sensim atque sensim inter se confluent, ita ut imo varietates, characteribus aliquomodo constantioribus circumscriptæ, non nisi difficiliter et vix bene limitatæ statui queant. Sunt tamen formæ distinctiores sequentes:

*α. kyllingioides*: capitula virescenti-albida vel sordide lactea, sphærica vel depresso globosa,  $2$ – $3\frac{1}{2}$  lin. crassa; squamæ floriferæ abbreviatæ, ovales vel lato-lanceolatæ, compressiusculæ (in sicco subplanæ), apice obtusæ vel parum acutatae; stamina et stigmata 3; caryopsis vix unquam  $\frac{1}{4}$  lin. longior, angulo uno alterove magis prominente.

*Habitat* in decliviis brevissime herbidis sed humidiusculis inter rupes editiores [3400 ped.] ipsius Præsidi Pungo Andongo loco dicto Tunda Quilombo, nec alibi in omni Angola a me observata. Floret Nov. Decbr. *Exsic.* Welw. Iter Angol. no. 1667.

Forma omnium præcocior, capitulis plus minusve globosis, compactis, sordide albescentibus, *Kyllingias microcephalas* æmulans. Squamæ floriferæ quidem, uti in omnibus sequentibus, turgidæ, sed latiores et breviores simulque quidpiam compressæ, in sicco demum fere planæ apparent et extus 1–3-nerves.

Huc forsitan: *Isolepis Kyllingioides* Rich. Tent. Abyss. ii. 502 trahenda?, sed auctor caryopsim apice acutam dicit, qualem in nulla *Ascolepidis proteæ* varietate observavi.

*β. bellidiflora*: capitula splendide nivea vel lactea, depresso hemisphærica, transversim 5–8, rarius 3–4 lin. lata, centro plerumque excavata, *Bellidem perennem flore pleno* mire fingentia. Squamæ floriferæ graciles, elongatulæ, lanceolatæ vel lineari-lanceolatæ, apicem versus subulatæ vel compresso-cylindricæ, in sicco demum angulatæ, plerumque laxius quam in *α* et *γ* imbricatæ. Caryopsis in speciminibus robustioribus  $\frac{1}{2}$  lin. longa, omnino sessilis.

*Habitat* in Distr. Pungo Andongo ad 3000 ped. alt., Januario et Febr. florens, nec non in Distr. Huilla pascuis editis ad 5000 ped. alt., ibidemque a Febr. usque ad Maium floret. In Africa centrali durante

constanter monandris et squamis floriferis a basi latiore apicem versus longissime acuminato-subulatis differt. Specimina tamen solummodo pauca, et quidem non nisi e culmis singulis a cæspite solutis constantia, necdum fructifera, examinare licuit.



expeditione Spekeana (fid. Herb. Kew.) a cl. Capt. T. A. Grant in 5° 26' lat. austr. ad 3900 ped. altit. lecta. *Exsic.* Welw. Iter Angol. no. 1668 & 1672 (formæ platycephalæ), dein 1671 & 1667 *b* (formæ microcephalæ).

*Antrolepis leucantha*, Welw. Apont. p. 578 (nomen cum observ.).

*Antrolepis*, sp. n., Thomson, *l. c.* p. 654\*.

Capitulorum magnitudo hujus varietatis admodum variat, sed eorum figura (etiam in formis microcephalis, locis macrioribus enatis, et iis varietatis  $\alpha$  vix majoribus) semper plus minusve depresso hemisphærica, disco ad centrum subexcavato. *Squamæ* floriferæ in formis microcephalis acutius subulatæ, rectiusculæ, in platycephalis obtusiores et frequenter sursum arcuatæ. *Stamina* in hac varietate non raro 2; stylus nunc elongatulus 3- vel 2-fidus, nunc brevissimus vel fere nullus; *i. e.* stigmata 3 vel 2, ovarii apici insidentia, elongata.

$\gamma$ . *santolinoides*: capitula sulphurea aut lutea vel intense aurea, ea *Santolarum* vel *Anacycli aurei* quodammodo simulantia, plerumque quam in varietate præcedente robustiora et magnitudine minus variantia. *Squamæ* floriferæ paullo turgidiores et obtusiores, excepta forma maxime serotina (*exsic.* no. 1673) in qua sensim longe acuminatæ occurrunt. *Caryopsis* circiter  $\frac{1}{2}$  lin. longa.

*Habitat* in Distr. Pungo Andongo socialis cum var.  $\beta$ , paullo serius florens, et in Distr. Huilla spongiosis de Morro de Lopollo, ad 5200 ped. una cum *Droseræ*, *Utriculariæ*, et *Disæ* speciebus. *Exsic.* Welw. Iter Angol. no. 1664, 1666, et 1673.

*Antrolepis sulphurea* et *A. Santolina*, Welw. Apont. *l. c.* (nomina c. notula).

*Observ.*—Cæspites omnium varietatum laxiusculi. *Culmi* in  $\alpha$  et  $\beta$  tenuiores et breviores, sed in omnibus varietatibus quoad longitudinem valde variantes, vix unquam tamen quam 10 vel 12 poll. longiores, basi constanter bulboso-tumidi, disco parvulo, carnosio, fibrillifero suffulti, vaginis emarcidis, basi bulbolum 1 vel plures foventibus, vestiti; bulbuli minuti, *Cannabis* seminibus vix majores, durante anthesi culmi matricalis folium unum vel plura fasciculata emittunt, quæ cæspitis folia basilaria sistunt, caulinis et involucralibus semper angustiora, sed longiora. *Involucrum* capituli basim arcte amplectens, 7–10-phyllum; foliola a basi latissima, extus profunde plurisulcata, sensim vel abruptius in laminam lineari-lanceolatam acuminata, exteriora 2–4 reflexa, infimo longiore 1–2-pollicari; interiora sensim breviora, squamæformia, spiculis adpressa, iisque æquilonga vel paullo breviora. *Spicularum* longitudo secundum capitulorum diametrum varians, in formis microcephalis lineam vel sesquilineam, in platycephalis, inprimis exteriores, ad  $2\frac{1}{2}$ –3 lineas longæ; squamæ vacuæ tenues, lineari-lanceolatæ, planæ, basi hyalino-membranaceæ, floriferis breviores et multo angustiores, earumque dorso arcte adpressæ vel fere adglutinatæ, sicque, præcipue in exsiccatis, facile prætervisæ. *Caryopsis* cinereo-fuscescens vel nigricans, angulis, inprimis vertice et prope basim, non raro obscuris vel omnino evanidis.

2. *ASCOLEPIS ANTHEMIFLORA*, Welw. n. sp. (Tab. XXIV. fig. 9–13.) *A.* culmis 1–1 $\frac{1}{2}$ -pedalibus, gracillimis; foliis basilaribus anguste linearibus, culmo multo brevioribus, abrupte acutatis, caulinis paucis parum latioribus, erectiusculis; capitulis depresso hemisphæricis, radiatis, transversim (inclusis radiis)  $\frac{2}{3}$ –1 $\frac{1}{4}$  poll. latis; spiculis aureo-flavis; squamis floriferis centralibus (discum formantibus) abbreviatis, densissime congestis, erectiusculis, cylindræis; periphericis elongatis, ligulæformibus, stellatim

\* “Four to nine inches high; growing like *white daisies*, in rather moist places. Alt. 3900 ft., 5° 26' S. Uncommon.” (Capt. Grant, apud Speke, *l. c.*) Eodem modo et ego formam hanc elegantissimam jam 1858 in Apont. *l. c.* cum *Bellide perenni* comparavi.



patentibus, compressis, subtus obtuse carinatis, supra secundum medium elevatim costatis, illas disci duplo triplove excedentibus, omnibus nitidulis apiceque obtusiusculis vel abrupte subulatis; staminibus 3; stylo trifido; caryopsi  $\frac{1}{2}$  lin. longa, elongato-obovoidea vel claviformi, obtuse trigona, minutim apiculata, basi, angulis evanidis, in stipitem brevissimum cylindricum attenuata.

*Habitat* in Distr. Pungo Andongo interioribus pratis palustribus juxta ripas fluminis Cuije, inter Quibinda et Quitage, una cum *Strigæ*, *Scleriæ*, atque *Commelynearum* speciebus socialis; ad fin. Martii c. fl. et fr. lecta. *Exsic.* Welw. Iter Angol. no. 1669.

*Antrolepis anthemiflora*, Welw. l. c.

Cæspites angusti, laxe cohærentes. *Culmi* pro ipsorum longitudine admodum graciles, obsolete angulati, tenuissime striati, infra capitulum parum vel vix incrassati, sat debiles sed constanter erecti. *Folia* basilaria fere capillaria, 4–7 poll. longa, sed in planta florente non raro jam emarcida; caulina paullo supra basim culmi 2–3, inferiora brevivaginata, superius culmum ad 2–2 $\frac{1}{2}$  poll. altitudinem laxiuscule vaginans, vagina striato-sulcata, sensim in laminam linearem angustata. *Involucri* foliola circiter 10; exteriora basi dilatata, margine lato-membranaceo undulata, laminis inferiorum 2 vel 3 sub plena anthesi reflexis, anguste lineari-lanceolatis, apice obtusiusculis; infimo 2–3 poll. longo. *Capitula* constanter aureo-flava, disco valde depresso, circumcirca longe denseque radiata, *Anthemidum* quarundam calathia eximie simulantia. *Squamæ* floriferæ centrales 1–2 lin. longæ, densissime in discum leviter convexum vel subtruncatum congestæ; periphericæ, i. e. capituli discum circumcurrentes, 4–6 lin. longæ, horizontaliter expansæ, rigidulæ, turgidulæ sed compressæ, semilineam latæ, mox post anthesin (ob carinam et costam nunc magis prominentes) tetragono-prismaticæ, fructiferæ fuscescentes; squamæ vacuæ lineari-lanceolatae vel lineares, sensim longe acuminatae, floriferis tamen semper breviores. *Caryopsis* quam in *Ascol. protea* parum crassior sed longior, angulis apicem et basim versus evanidis vel obscuris, ima basi cylindrico-attenuata transverse truncata, quasi substipitata.

Species, primo aspectu, capitulorum figura admodum singularis nec non caryopsis configuratione ab *Ascolepide protea* discrepans, ceteris autem characteribus hujusce varietati  $\gamma$  satis affinis et forsan non nisi ejusdem forma serotina, in solo ditioire et humidioire exorta. *Anne Ascolepidi proteæ* qua varietas  $\delta$ . *anthemiflora* subscribenda?

§ 2. *Rhizoma repens, indurescens; caryopsis  $\frac{3}{4}$ –1 lineam longa, vertice angustato truncata.*

3. *ASCOLEPIS SPECIOSA*, Welw. n. sp. (Tab. XXIV. fig. 1–8.) *A.* culmis subpedalibus, firmis, lineam crassis, basi elongato-conicis, vaginis foliorum emortuorum dense vestitis; foliis ad basim culmi pluribus, erecto-vel arcuato-patulis, linearibus, culmo vix angustioribus, apice planis, obtusiusculis, minutim denticulatis, rigidulis; capitulis depresso globosis, densissimis, transversim  $\frac{3}{4}$ –1 poll. latis; spiculis intense sulphureis, verniceo-nitentibus; squamis floriferis lanceolatis, a medio apicem versus cylindræis vel subulato-attenuatis, obtusis rariusve acutiusculis, singulis a capituli peripheria centrum versus sensim brevioribus; staminibus 3; stylo trifido; caryopsi lineam longa, elongato-obovoidea, manifeste trigona, vertice angustato transversim truncata.

*Habitat* in Distr. Huilla pascuis breve herbidis humidiusculis prope Lopollo ad 5000 ped. altit., in *Lythracearum*, *Daphnoidearum* humilium et *Cyperii* plurium specierum fidei societate. A fine Januarii usque ad Martium florens mox demum fructificat. *Exsic.* Welw. Iter Angol. no. 1674.



Cæspites lati, densissimi. *Culmi* sub plena anthesi plerumque pedales vel paullo altiores, basi succulenta conico-tumida vaginis foliorum tam vigentium quam emarcidorum et externe insuper squamis elongatis, profunde plurisulcatis, fusco-purpurascensibus vestiti, arcte inter se cohærentes, fibris tenacibus stipati, rhizomati oblique descendenti demum indurescenti fasciculatim insidentes, quam in ceteris speciebus multo crassiores et rigidiores, evidenter plurisulcati, infra capitula parum vel vix incrassati. *Folia* culmorum sterilium fertiliumque plura, 3-7, gregata, inæquilonga, e viridi glaucescentia, fere carnosula, juniora erecta, adultiora modice arcuato-patula; vaginæ parum supra terram exsertæ, ad oram membranaceam plus minusve undulatæ, longitudinaliter sulcatæ, sensim in laminam linearem culmo vix angustiore sed plicatam, obtuse carinatam, obiter striatam, superne explanatam, margine et (inprimis prope apicem obtusiusculum vel abrupte acutatum) anguste hyalinam et remote spinuloso-denticulatam abientes. *Involucri* foliola 12-15, foliis vix latiora sed acutiora, longitudine inter se admodum varia, exteriora 4-7 reflexa, infimum ad 2-3 poll. longum; interiora sensim breviora et basi angustiora vel omnino ad vaginam reducta, squamiformia. *Capitula* pro more generis sat ampla, bene evoluta pollice paullo latiora et fere semipollicem alta, primum omnino læte sulphurea, demum ob spiculas exteriores præcocius fructificantes tumque fulvescentes bicoloria, centro nempe nunc dilutius flava, margine lato aureo-fulvo cincta, pro stirpe *Cyperacea* reapse speciosa. *Squamæ* vacuæ lineares vel lineari-lanceolatæ, nervo crassiusculo, dorso obiter prominente, percursæ, inferne hyalino-membranaceæ, apicem versus longe acuminatæ vel subulatæ, ibidemque coloratæ, fertilibus fere dimidio breviores; squamæ floriferæ verniceo-nitidulæ, circumscriptione lanceolatæ, exteriores 4-4½ lin. longæ, fere usque ad medium rimula hiantæ apertæ, dorso, inprimis prope basim, nervis pluribus tenuibus percursæ, supra rimulam in appendicem cylindræam obtusam vel acutius subulatam protractæ. *Ovarii* quam squama florifera multo brevioris anguli superne acutiores; stylus basi æqualis, longitudine varians; stigmata obtusa. *Caryopsis* fusco-atra, circiter 1 lin. longa, angulis omnibus a basi ad apicem usque manifestis, subcostatis, vertice horizontaliter, basi attenuata oblique truncata, lateribus densissime seriatim foveolata.

Species omnium cognitarum robustissima, in *Cyperacearum* cohorte facile elegantissima, habitu quasi *Armeriam* capitulis sulphureis ornatam repræsentans, sicque una cum præcedente futura Adonistarum attentione non omnino indigna, a reliquis speciebus præter notas allatas simul majore rigiditate partium omnium discrepans, territorio Huillensi peculiaris videtur, nec ibidem infra 5000 ped. altit. a me visa.

4. ASCOLEPIS ELATA, Welw. n. sp. *A.* culmis subbipedalibus, vix  $\frac{3}{4}$  lin. crassis, basi parum tumida vaginis crebris foliorum emarcidorum laxè vestitis; foliis propriis et iis turionum fasciculatis, circa caulium basim congestis, erectis, 6-9 poll. longis, subfiliformibus, culmo duplo triplove angustioribus, apice planiusculo subacutis tenuiterque denticulatis, supremo patulo ceteris latiore; capitulis hemisphæricis, subdensis, transversim 8-10 lin. latis; spiculis sordide albidis, vix nitidulis; squamis floriferis lanceolatis, a medio apicem versus longe sensimque attenuatis, compresse tetragonis, longitudine, centralibus exceptis, inter se subæqualibus, acutiusculis; staminibus 3; stylo trifido; caryopsi  $\frac{3}{4}$  lin. longa, elongato-obovoidea, manifeste trigona, vertice parum angustato truncata.

*Habitat* in Distr. Pungo Andongo pratis paludosis juxta dextram ripam fluminis Cuanza, inter Condo et Quisonde ad 3600 ped. circiter altit., in *Xyridearum*, *Droseræ indicæ* et *Eriospermi* specierum consortio. Ad finem Martii c. fl. et fr. lecta, sed rarius obvia.

*Antrolepis elata*, Welw. l. c.

*Rhizoma* omnino antecedentis speciei; *culmi* autem fere duplo altiores, nec non angustiores, obtusanguli,



tenuiter sulcati, basi vix succulenti, sed vaginis emarcidis numerosis, profunde sulcatis, exterioribus in fibras setiformes solutis, vestiti. *Folia* pallide viridia, culmo multo tenuiora, angustissime linearia, concava vel plicata, dorso sulculata sed vix carinata, apicem versus plana, hyalino-marginata et denticulata. *Involucri* foliola foliis saltem duplo latiora, reflexorum infimum ad 3 poll. longum. *Capitula* quam in ceteris speciebus evidenter laxiora; spiculæ quoad longitudinem inter se parum variantes, 3-4 lin. longæ, maxime centrales tamen semper breviores. *Squamæ* fertiles ad rimulæ florigeræ altitudinem usque biconvexæ, supra rimulam plus minusve evidenter tetragonæ, angulis lateralibus acutioribus, omnibus in squama fructifera vel collapsa magis prominentibus; squamæ vacuæ uninerves, nervo excurrente acute subulatae. *Caryopsis* griseo-fuscescens, lateribus sub lente forti densissime foveolata.

Species foliis filiformibus capitulorumque figura et colore ad *Ascolepidem proteam*  $\beta$ . *bellidifloram* accedens, rhizomatis indole autem nec non caryopsis configuratione *Asc. speciosæ* magis affinis sed a me non nisi in paucis speciminibus iisque jam fere defloratis observata et proinde in posterum secundum specimina numerosiora in diversis habitationibus et evolutionis periodis lecta accuratius definienda.

*Species inquirendæ vel recognoscendæ.*

1. KYLLINGIA MICROCEPHALA, Steud. in Plant. Schimp. Exsicc. Abyss. ii. no. 650 (nec Liebm.), sive *Isolepis Kyllingioides*, A. Rich. Tent. Abyss. i. pag. 502. Secundum cl. Rich. l. c. *Ascolepidi eriocauloidi* affinis, ast cel. auctor squamas floriferas *planas*, stamina *tria*, caryopsim apice *acutam* et folia culmum æquantia vel superantia describit. Anne *Ascolepidis* species distincta vel forsitan *Ascolepidis proteæ* supra descriptæ varietas?
2. ISOLEPIS POLYPHYLLA, A. Rich. l. c. p. 503. Species una cum priore in Abyssiniæ provincia Chiré lecta, a cl. auctore non nisi in statu fructifero visa et breviter descripta et quidem *Ascolepidi eriocauloidi* proxima habita, sed ex diagnosi nimis brevi vix rite eruenda. Etiam hujus speciei squamam fertilem *planam* et caryopsim obovatam, non angulatam sed *acuminatam* dicit cl. auctor.

Ambarum stirpium specimina sicca videre nondum licuit.

Ordo GRAMINEÆ.

Trib. IV. STIPACEÆ, Kunth, Gram. 57.

1. ARISTIDA PRODIGIOSA, Welw. n. sp. (Tab. XXV.) Cæspitosa, plurennis, gracilis; culmo glabro 1-3-pedali, nodis coloratis imberbibus; foliis radicalibus angustissimis, sub-4-pollicaribus, glaucis, sub lente scabrido-puberulis, ligulis brevissimis ciliatis; panicula lineari-oblonga, multiflora,  $\frac{1}{2}$ -1-pedali, ramis 2-5 fasciculatis fere a basi floriferis, spiculas plures, sub 3, lineares, pedicellatas gerentibus; glumæ subæquales acutæ, hirsutæ vel glabratae, basi violaceo-coloratæ, ad infimam basim trinerves; flosculus, dempta arista, glumarum dimidium vix æquans, glaber; arista circumscisse decidua, stipite  $1\frac{1}{2}$  lin. longo, vix torto, glabro, conico, intus cavo, setis lateralibus nudis, intermedia basi nuda, a medio ad apicem usque plumoso-pennata, laterales duplo et ultra superante.

*Habitat* frequens in collinis arenosis siccissimis Distr. Mossamedes, ex Giraûl usque ad Cabo negro, inprimis



locis sabulosis oceano proximis, v. gr. ad "Praia da Amelia," denso agmine crescens, per totum fere annum florens et fructificans (Junio, Julio et Septb. 1859 legi). *Exsic.* Welw. Iter Angol. no. 2000.

*Rhizoma* abbreviatum, mox in fibras descendentes solutum; fibræ perplures, elongatæ, cylindræ, simplices, pennæ corvinæ crassiores, villo albido, velutino, viscido undique obtectæ et subsucculentæ. Cæspites pro soli et expositionis ratione nunc angusti et depressi, pauciculmes, nunc ampliores et altiores, culmos 8-10 et plures emittentes. *Folia* radicalia dense congesta, in macrioribus arcuato-ascendentia, 1-2-pollicaria, in robustioribus erectiuscula, 3-5 pollices longa, angustissima, arcte plicata sive convoluta, subulatim acuminata, rigidula, cinereo-glaucoscentia, sub lente sulcato-striata et subtiliter scabrido-puberula, successive evoluta atque longe perennantia. *Culmi* simplices, a basi ascendenter erecti, inferne nodosi, nunc 1-1½-pedales, gracillimi et debiles, nunc (in solo humidiusculo vel minus sterili) 2-3-pedales, pennæ corvinæ fere crassitudine et firmiores, parce foliosi; nodi 2-4, constricti, glabri, fusco-purpurascens, 1-3 pollices inter se distantes; folia culmi radicalibus quoad figuram et indumentum similia, sed longe vaginata; vaginæ glaucoscentes, tenuiter puberulæ, ad oram pilis albidis fasciculatis prompte deciduis barbulatæ, medio parum tumentes, inferiores nodos denudantes, suprema longissima, lamina abbreviata, culmum non raro ad paniculæ basim usque vestiens. *Panicula* erecta, nunc vix 4-pollicaris, laxior et rariflora, sed plerumque elongata, 6-12-pollicaris, densior et multiflora, rachi compresso-angulata glabra, ramis 2-5 fasciculatis levigatis, erecto-patulis, parce ramulosis. *Spiculæ* graciles, absque arista 3-4 lin. longæ, pedicellis gracillimis, ipsis æquilongis vel longioribus, apice incrassatis suffultæ. *Glumæ* fere æquales, concavæ, carinatæ, constanter acutæ, basi semper, rarius omnino violaceæ, dorso undique vel solum juxta carinam hirsutæ (nunc penitus glabrata), basi prominenter trinerves. *Palea inferior* coriacea, glaberrima, trinervis; aristæ seta intermedia 1-1½ poll. longa, a medio ad apicem pilis hyalinis, tenuissimis, eleganter plumosa, laterales ea dimidio saltem breviores, nudæ, divergentes, tenuissime capillares; *palea superior* abbreviata, obtusa, membranacea; *squamulæ* integræ, acutiusculæ, in diversis ejusdem paniculæ flosculis diversæ magnitudinis, quondam parum evolutæ. *Ovarium* oblongo-ovoideum, stipitatum, glabrum, stigmatibus intense flavis, pilis simplicibus hyalinis plumosis, mucro copioso involutis. *Caryopsis* cylindræ, vertice obtuso styli rudimentis biapiculata, basin versus obconico-attenuata, longitudine lineam parum excedens, glaberrima, longitudinaliter unisulcata.

*Observatio.*—Gramen elegans sed sat polymorphum, uti in stirpe sub variis solis et expositionis conditionibus vigente expectandum. Formæ hyemales, i. e. a Junio ad Septembris initium florentes, uti et illæ in macrioribus et siccioribus obviæ, foliis angustioribus et brevioribus nec non varie curvis vel arcuatis, panicula laxiore glumisque basi intensius violaceis et dorso hirsutis gaudent, dum individua mensibus vernis vel in solo minus arido aut juxta rivorum ripas crescentia foliis longioribus, erectiusculis vel leviter arcuatis, paniculis densioribus ac glumis pallidioribus et non raro omnino glabris sese distinguunt; ast glumarum magnitudinem et figuram, earumque inter se et cum flosculo relationem nec non aristæ fabricam, in omnibus et quidem numerosis a me examinatis speciminibus semper easdem et constantes observavi. Proxima quidem et affinis hæc præsens species videtur *Aristidæ ciliatæ* Desf., a qua tamen ex auctoritate acutissimi Agrostologi clar. Guill. Munro, cujus benevolam consilium in stabilienda et definienda hac specie secutus sum, imprimis *glumis acutis* differt; ab *Aristida plumosa* Lin., etiam quodammodo affini, præcipue *aristæ basi conica intus cava* distinguitur.

*Prodigiosam* hanc *Aristidæ* speciem vocavi, quoniam illa, etiamsi ob totius plantæ gracilitatem et foliorum culmorumque indumentum cinereo-glaucoscentis, solo arenoso quasi concolor, peregrinatoris oculis facile fugit, nihilo minus multitudini Zebrarum,



Antilopum atque Leporum, in istis desertis ab omni reliqua vegetatione fere penitus denu-  
datis vagantium, et imo pecorum domesticorum gregibus, optimum lætumque, et quidem  
durante hyemis siccissimo tempore unicum pabulum offert, et ita non minus ac *Acan-*  
*thosicyos* supra descripta desertorum Africæ calidæ prodigiis adnumerari meretur.

## EXPLICATIO TABULARUM.

## TABULA I.

*Monodora Angolensis.*

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| <p>Fig. 1. Ramulus florifer; magn. nat.<br/>2. Flos, demtis petalis exterioribus; paullo<br/>auct.<br/>3. Stamen a latere, et<br/>4. a fronte visum; auct.</p> | <p>Fig. 5. Ovarium.<br/>6. Idem transverse sectum; auct.<br/>7. Fructus; magn. nat.<br/>8. Semen; magn. nat.<br/>9. Idem verticaliter sectum; paullo auctum.</p> |
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## TABULA II.

*Alsodeia (Ceranthera) ilicifolia.*

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| <p>Fig. 1. Ramulus florifer; magn. nat.<br/>2. Flos; auct.<br/>3. Idem, demto calyce, a latere visus; auct.<br/>4. Flos vi apertus a fronte visus; auct.<br/>5. Stamina duo a fronte, et<br/>6. a dorso visa; auct.<br/>7. Ovarii pars cum stylo; auct.<br/>8. Ramulus fructifer; magn. nat.</p> | <p>Fig. 9. Semina; magn. nat.<br/>10. Semen testæ parte demta, albumen exhi-<br/>bens; auct.<br/>11. Albuminis pars, embryonem in situ exhi-<br/>bens; auct.<br/>12. Embryo a fronte, et<br/>13. a latere visus; auct.</p> |
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## TABULA III.

*Oncoba Welwitschii.*

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| <p>Fig. 1. Ramus florifer; magn. nat.<br/>2. Pistillum; paul. auct.<br/>3. Ovarium transverse sectum; auct.<br/>4. Ramulus fructifer, magn. nat., fructum<br/>unum (inferiorem) ante, et alterum<br/>(superiorem) post dehiscenciam repræ-<br/>sentans.</p> | <p>Fig. 5. Semina; magn. nat.<br/>6. Semen; auct.<br/>7. Idem verticaliter sectum, embryonem ex-<br/>hibens; auct.<br/>8. Embryo, a latere visus; valde auct.</p> |
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## TABULA IV.

*Polygala Gomesiana.* Caulis pars inferior et ejusdem apex florifer, magn. nat.

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| <p>Fig. 1. Flos c. bracteolis; auct.<br/>2. Flos a fronte visus.<br/>3. Flos sepalis demptis; auct.<br/>4. Idem sepalis et carina demptis; magis<br/>auct.<br/>5. Carina; auct.<br/>6. Petalum laterale; auct.</p> | <p>Fig. 7. Stamen; auct.<br/>8. Pistillum; auct.<br/>9. Capsula; magn. nat.<br/>10. Eadem; auct.<br/>11. Semen; magn. nat.<br/>12. Idem; auct.<br/>13. Idem a latere visum; auct.</p> |
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## TABULA V.

*Vatica africana.*

- Fig. 1. Ramulus florifer; magn. nat.  
 2. Alabastrum; auct.  
 3. Flos expansus; auct.  
 4. Stamen a fronte, et  
 5. a dorso visum; auct.  
 6. Calyx cum pistillo; auct.  
 7. Pistillum dempto calyce; magis auct.

- Fig. 8. Ovarium transverse sectum; magis auct.  
 9. Idem verticaliter sectum; auct.  
 10. Calyx fructifer; magn. nat.  
 11. Fructus verticaliter sectus; auct.  
 12. *Vatica africana*  $\beta$ . *hypoleuca*, ramulus  
 florifer; magn. nat.

## TABULA VI.

*Octolobus spectabilis.* Ramus florifer, magn. nat.

- Fig. 1. Flos masc. vi apertus; magn. nat.  
 2. Flos fem. vi apertus; magn. nat.  
 3. Gynæcium verticaliter sectum; auct.  
 4. Gynæcii stamen imperfectum, a latere, et  
 5. a fronte visum; auct.  
 6. Carpellum; auct.  
 7. Idem verticaliter sectum.  
 8. Carpellum maturum; magn. nat.

- Fig. 9. Idem apertum.  
 10. Semen; magn. nat.  
 11. Idem vertical. sectum, cotyledones exhi-  
 bens.  
 12. Idem cotyledone una dempta, plumulam  
 exhibens.  
 13. Plumula cum radícula; auct.

## TABULA VII.

*Paivaeusa dactylophylla.*

- Fig. 1. Ramul. florib. masc.; magn. nat.  
 2. Capitulum florum masc., et  
 3. Idem verticaliter sectum; auct.  
 4. Flos masc. singulus; valde auct.  
 5. Stamen; auct.  
 6. Ramulus florib. fem.; magn. nat.  
 7. Flos fem.; auct.

- Fig. 8. Idem calyce demto.  
 9. Ovarium transverse sectum; auct.  
 10. Ramus fructifer; magn. nat.  
 11. Fructus, necdum bene maturus, vertica-  
 liter sectus; paullo auct.  
 12. Ejusdem pyrenæ, altera abortiente; magis  
 auct.

## TABULA VIII.

*Myrothamnus flabellifolia.*

- Fig. 1. Ramus florib. masc.; magn. nat.  
 2. et 3. Folia a facie et a dorso visa; auct.  
 4. Flos. masc.; auct.  
 5. Stamen; auct.  
 6. Ramulus florib. fem.; magn. nat.  
 7. Flores femin.; auct.  
 8. Ovarium transverse sectum; auct.

9. Ramulus fructifer; magn. nat.  
 10. Capsula matura; auct.  
 11. Carpellum singulum seminiferum; auct.  
 12. Semen; auct.  
 13. Semen verticaliter sectum, albumen et  
 embryonem exhibens; valde auct.



## TABULA IX.

*Basananthe nummularia.* Planta integra c. flore et fr., magn. nat.

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|---|--|
| <p>Fig. 1. Folium; paullo auct.<br/>         2. Flos habitu naturali; auct.<br/>         3. Idem arte expansus; auct.<br/>         4. Idem verticaliter sectus; magis auctus.<br/>         5. Coronæ pars, fila seriei internæ appendiculata exhibens; auct.<br/>         6. Eadem pars a facie externa visa.</p> | <p>Fig. 7. Stamen a fronte, et<br/>         8. a dorso visum; auct.<br/>         9. Gynophorum cum pistillo; auct.<br/>         10. Capsula matura; modice auct.<br/>         11. Eadem verticaliter secta; auct.<br/>         12. Semen cum funiculo; pariter auct.</p> |
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## TABULA X.

*Machadoa Huillensis.* Planta integra c. flor. et fr., magn. nat.

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|--|---|
| <p>Fig. 1. Flos; parum auct.<br/>         2. Idem vi aperta; magis auct.<br/>         3. Idem dissectus et adhuc magis auct.<br/>         4. Petalum; auct.<br/>         5. Pars annuli staminiferi cum stamine; auct.</p> | <p>Fig. 6. Stamen a dorso visum; auct.<br/>         7. Pistillum; auct.<br/>         8. Ovarium transverse sectum; auct.<br/>         9. Semina a facie et a latere visa; magn. nat.<br/>         10. Semen; auct.<br/>         11. Idem transverse sectum.</p> |
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## TABULA XI.

*Acanthosicyos horrida.*

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| <p>Fig. 1. Plantæ modum crescendi exhibens; dimin.<br/>         2. Ramus sterilis, et<br/>         3. Ram. florifer masc.; magn. nat.<br/>         4. Flos masc.; auct.<br/>         5. Idem apertus; auct.<br/>         6. Calyx cum staminibus ab interna facie visis; auct.</p> | <p>Fig. 7. Pars calycis verticaliter dissecti, staminis insertionem illustrans; auct.<br/>         8. Pilus singulus barbæ filamentorum; valde auct.<br/>         9. Planta juvenilis; magn. nat.<br/> <i>Obs.</i> Hæc ultima figura perperam no.8. designata.</p> |
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| <p>Fig. 1. Ramus fructifer; magn. nat.<br/>         2. Corticis fructus fragmentum; auct.<br/>         3. et 4. Semina; magn. nat.<br/>         5. Semen auctum, a facie, et<br/>         6. a latere visum.</p> | <p>Fig. 7. Semen verticaliter dissectum; auct.<br/>         8. Embryo a facie, et<br/>         9. a latere visus; paullo auct.<br/>         10. Cotyledon a facie interna visa cum plumula et radícula in situ; auct.</p> |
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*Corallocarpus Welwitschii.*

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*Mussenda splendida.* Ramus florifer, magn. nat.

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| Fig. 1. Floris alabastrum; auct.        | Fig. 4. Idem transverse sectum; magis auct. |
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## TABULA XIV.

*Corynanthe paniculata.* Ramus florifer, magn. nat.

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| Fig. 1. Flos nondum apertus, et  | Fig. 7. Capsula matura dehiscens; auct.                                      |
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| 4. a dorso visa; auct.   | 10. Semen; magn. nat.  |
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*Schrebera Golungensis.* Ramus florifer, magn. nat.

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| 4. a facie visum; auct.  | 13. et 14. Embryo a facie et a latere visus;<br>magn. nat.                             |
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## ADDENDA VEL CORRIGENDA.

- Pag. 6, lin. 11, *loco quos lege quas*  
 8, 16, *loco sylvatica lege silvatica*  
 8, 30, *loco hibernum lege hiemem*  
 9, post lin. 33, *adde: Quoad generalia de conformatione geognostica terrarum Angolensium conf. " Voyage du Dr. Fr. Welwitsch dans les Royaumes d'Angola et de Benguella. (Molusques par A. Morelet.) Paris, 1868," pag. 5 et 6.*  
 9, 34, *loco vetegabilium lege vegetabilium*  
 13, ultima, *loco postero lege posterum*  
 14, 10, *loco infra lege inferne*  
 14, 13, *loco quidquam lege quidpiam*  
 15, 4, *loco tri- lege tri-*  
 20, 37, *loco Burseracearum lege Burserearum*  
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*Observ.* De generibus speciebusve paucis, nostris supra descriptis valde affinibus vel omnino synonymis, opusculo hocce jam prelo subjecto a variis phytographis in lucem editis, mox alio loco tracturus sum.



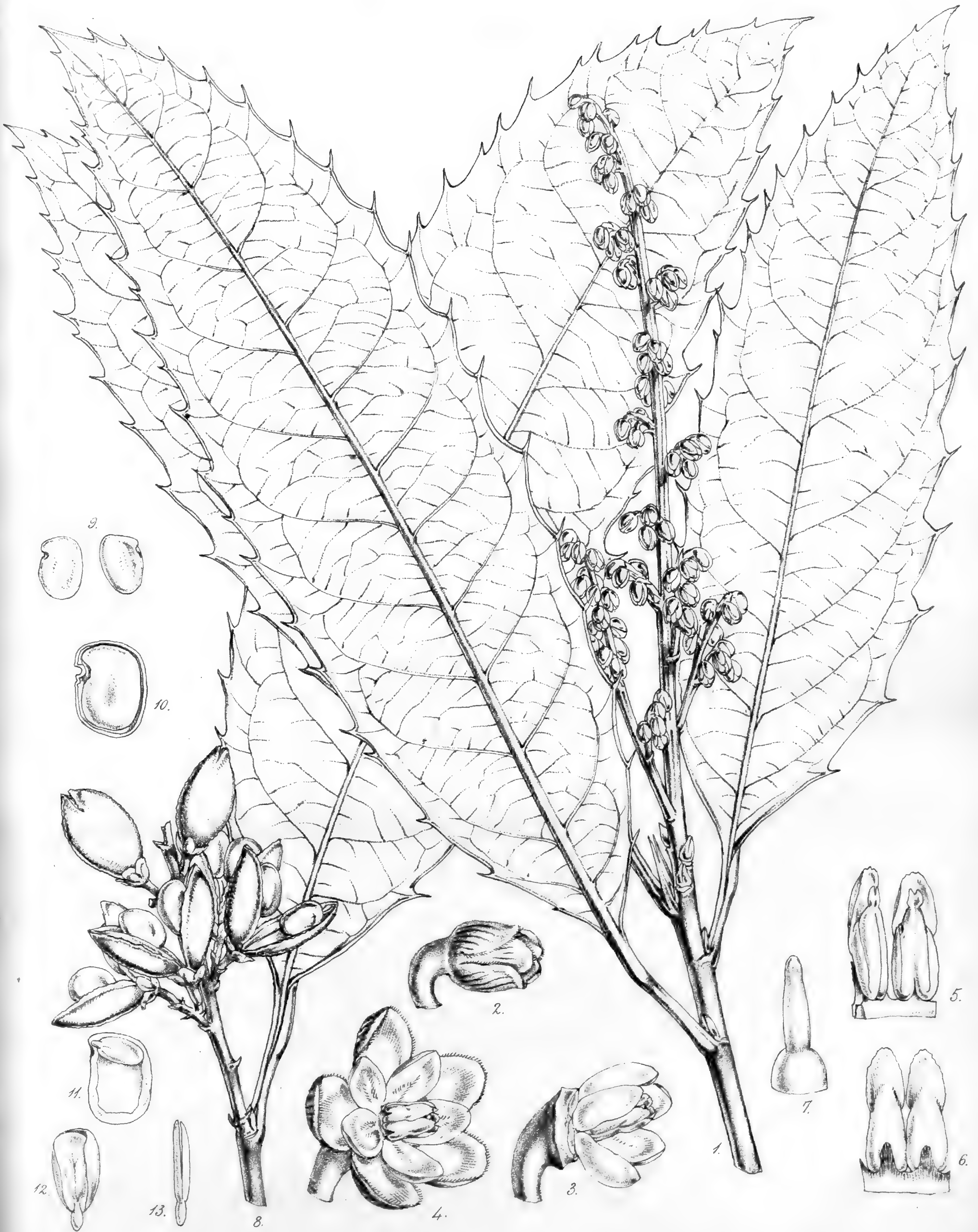


W. H. Fitch, del et lith.

J. N. Fitch, imp.

*Monodora Angolensis. Welw.*



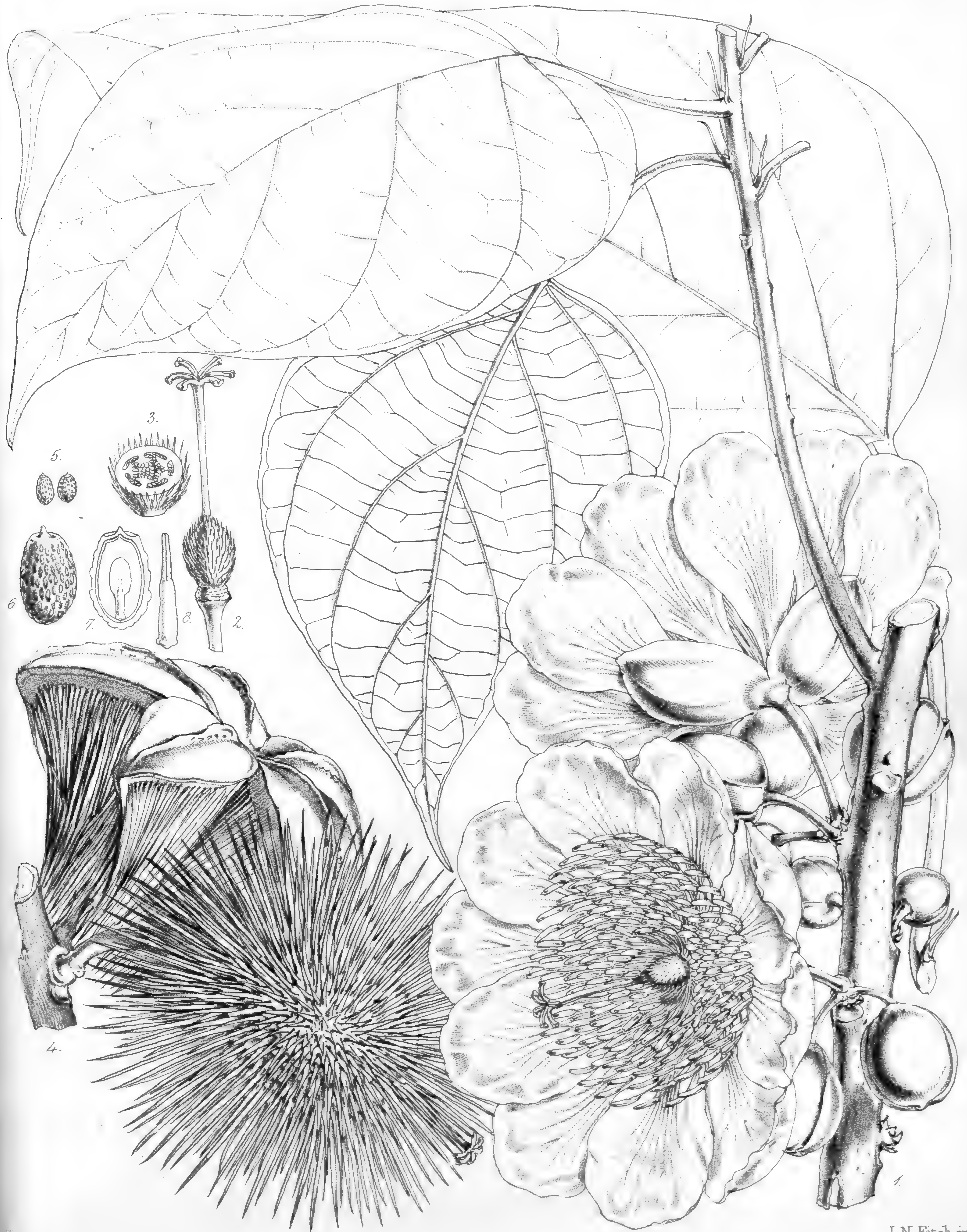


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*Ceranthera ilicifolia*, Welw.





W.H Fitch, del. et. lith.

J. N. Fitch, imp.

*Oncoba Welwitschii, Oliv.*





W. H. Fitch, del. et. lith.

J. N. Fitch, imp.

*Polygala Gomesiana, Welw.*





W H. Fitch, del. et. lith.

J.N Fitch, imp.

*Vatica africana*, Welw.



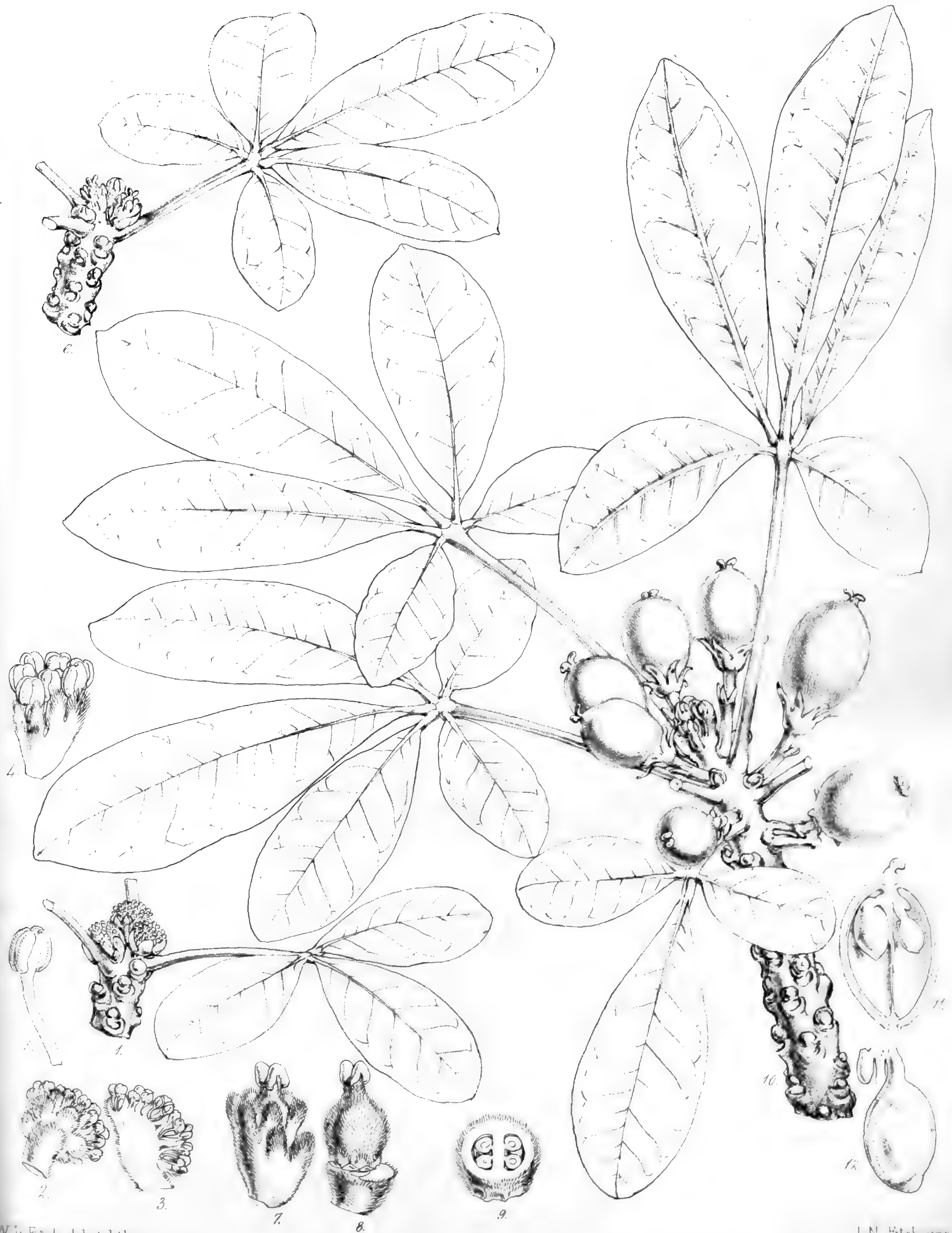


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*Octolobus spectabilis*, Welw.



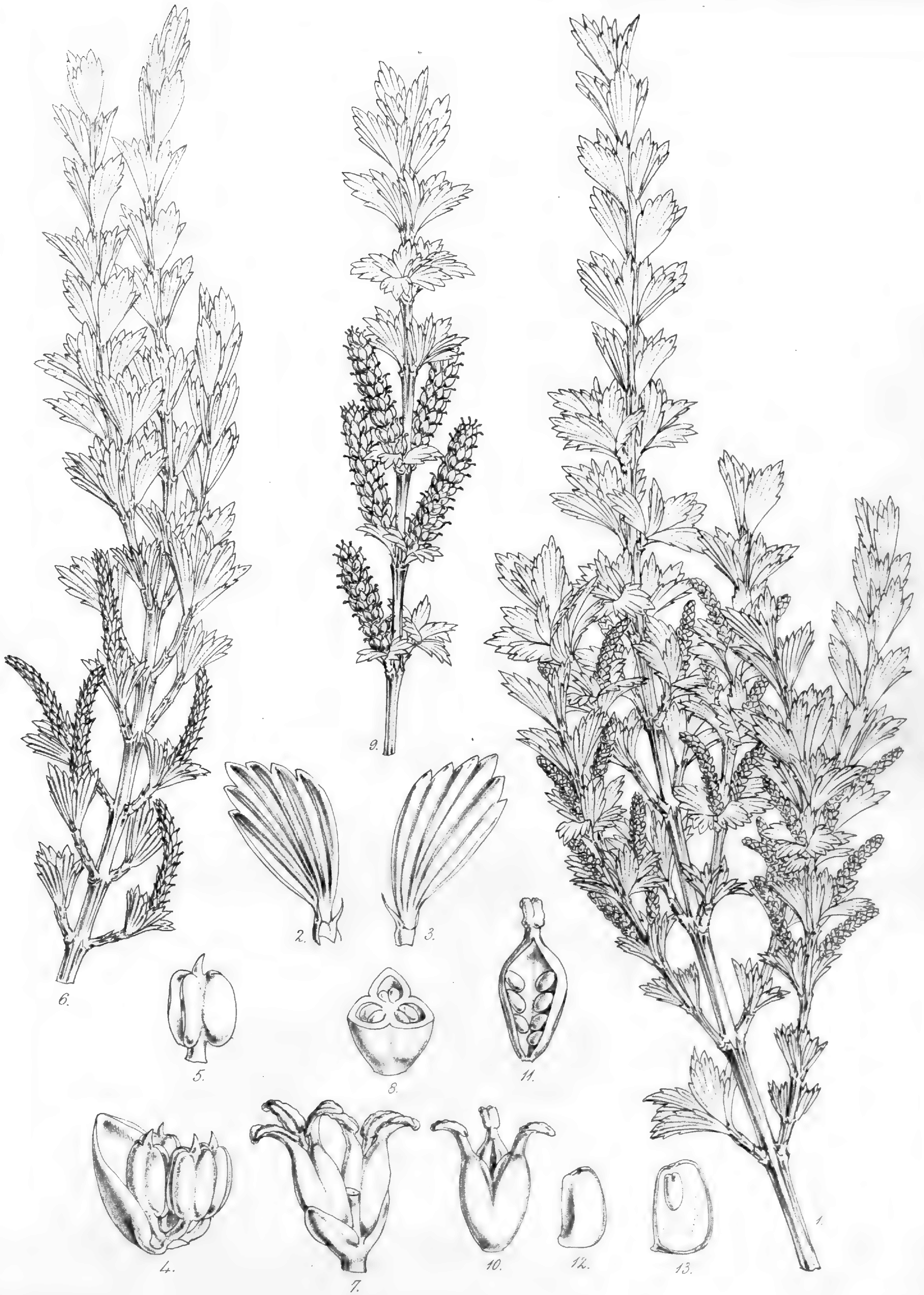


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J. N. Fitch, imp.

*Paivæusa dactylophylla, Welw.*





W.H. Fitch, del et lith.

J N Fitch, imp.

*Myrothamnus flabellifolia*, Welw.





W H Fitch, del et lith.

J N Fitch, imp.

*Basananthe nummularia, Welw.*





W. H. Fitch, del. et. lith.

J. N. Fitch, imp.

*Machadocia Huillensis*, Welw.



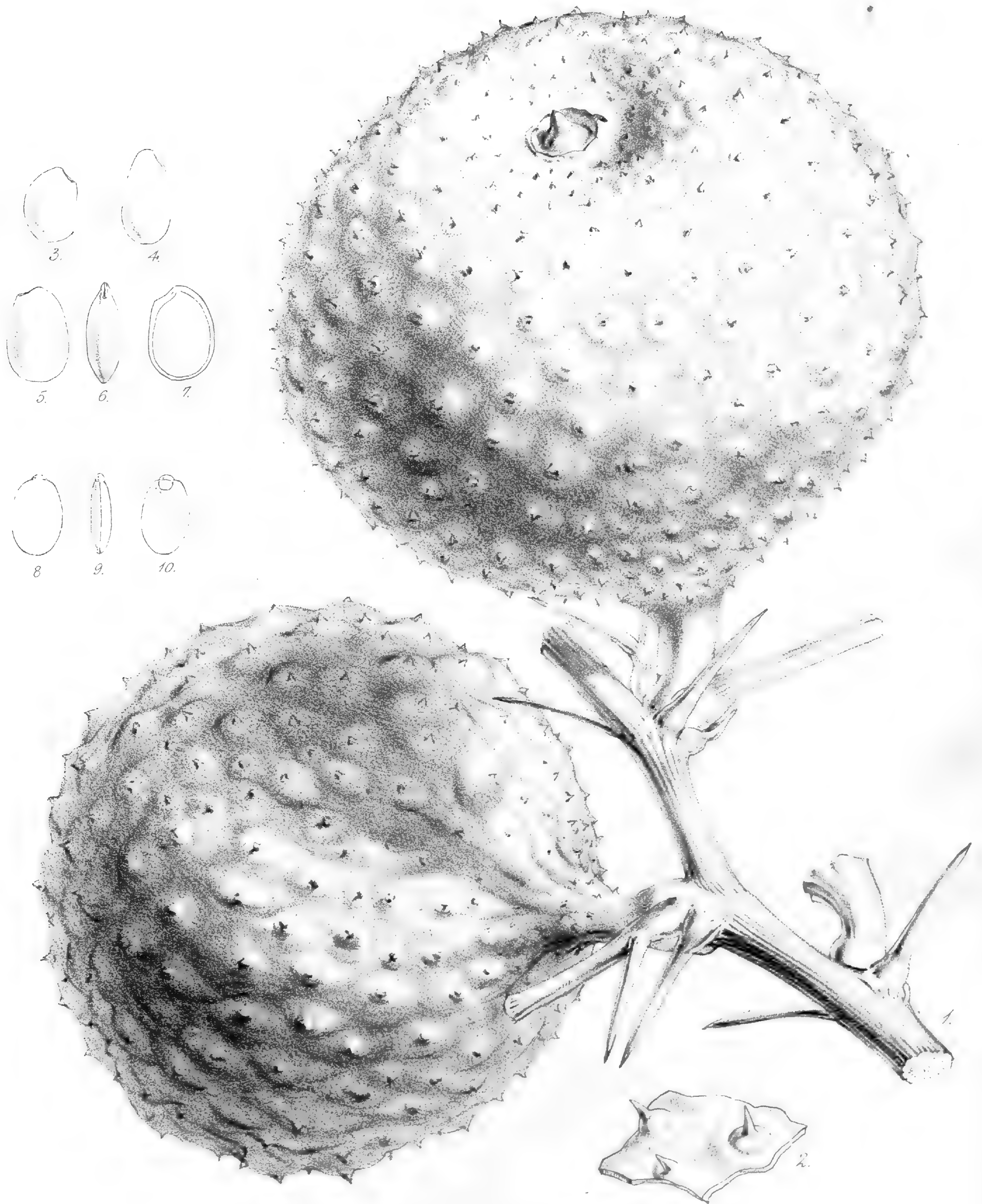


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J. N. Fitch, imp.

*Acanthosicyos horrida*, Welw.









W. H. Fitch, del. et. lith.

J. N. Fitch, imp.

*Corallocarpus Welwitschii*, Hook. f.



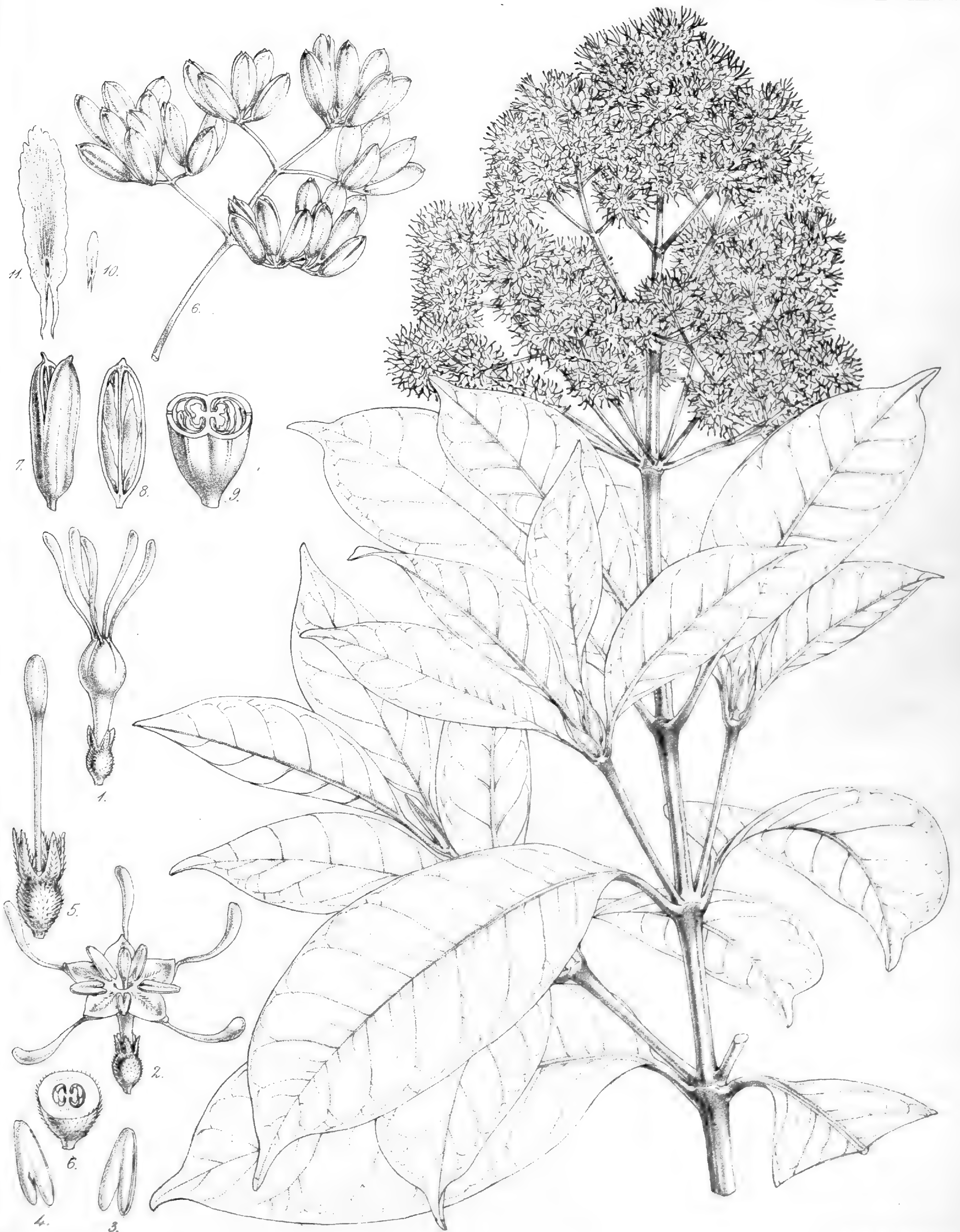


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J. N. Fitch, imp.

*Mussaenda splendida*, Welw.





W. H. Fitch, del et lith.

J. N. Fitch, imp.

*Corynanthe paniculata*, Welw.





W. H. Fitch, del et lith.

J. N. Fitch, imp.

*Schrebera Golungensis*, Welw.



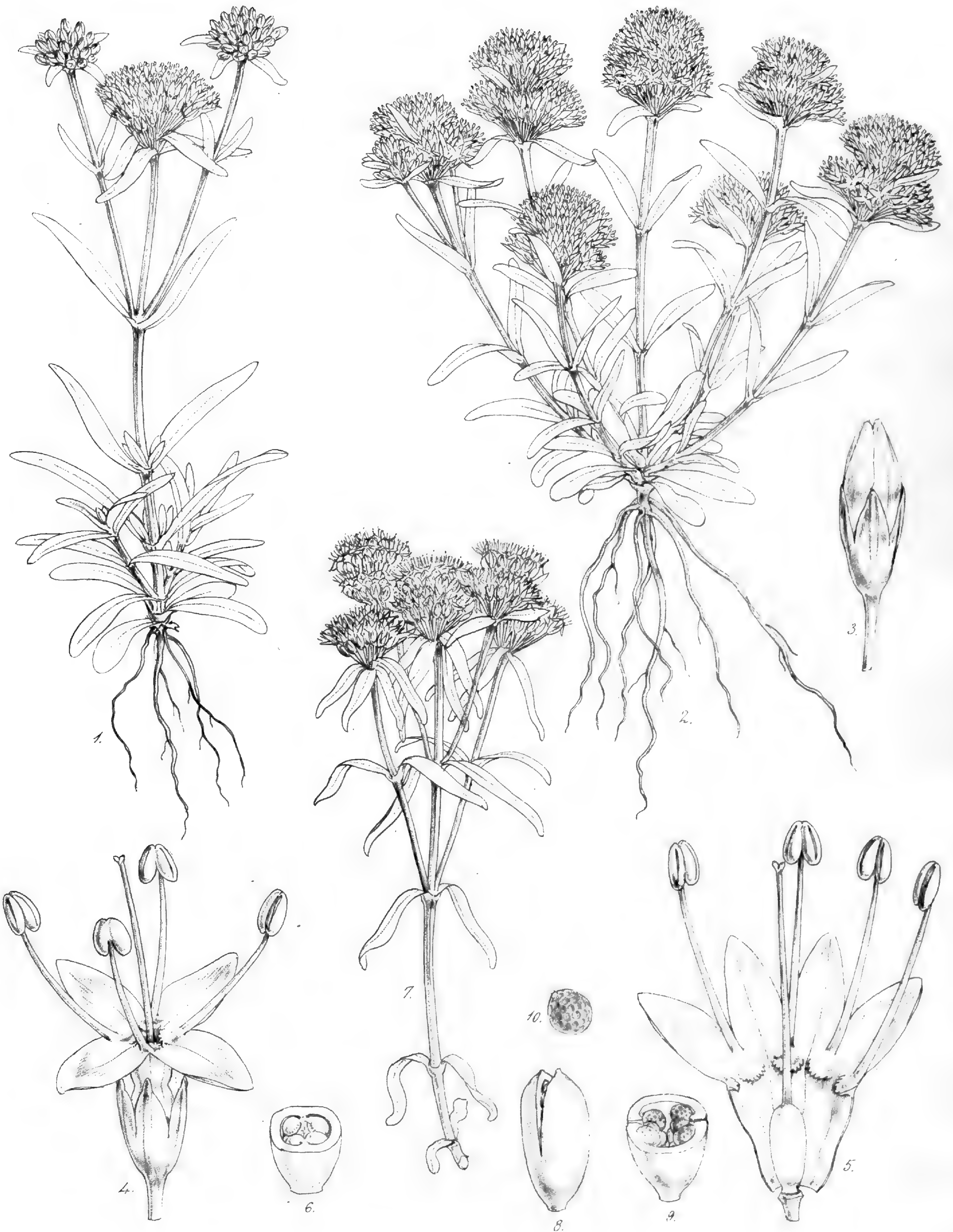


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J. N. Fitch, imp.

*Pachypodium Lealii*, Welw.





W. H. Fitch, del. et lith.

J. N. Fitch imp.

*Farea salutaris*, Welw.





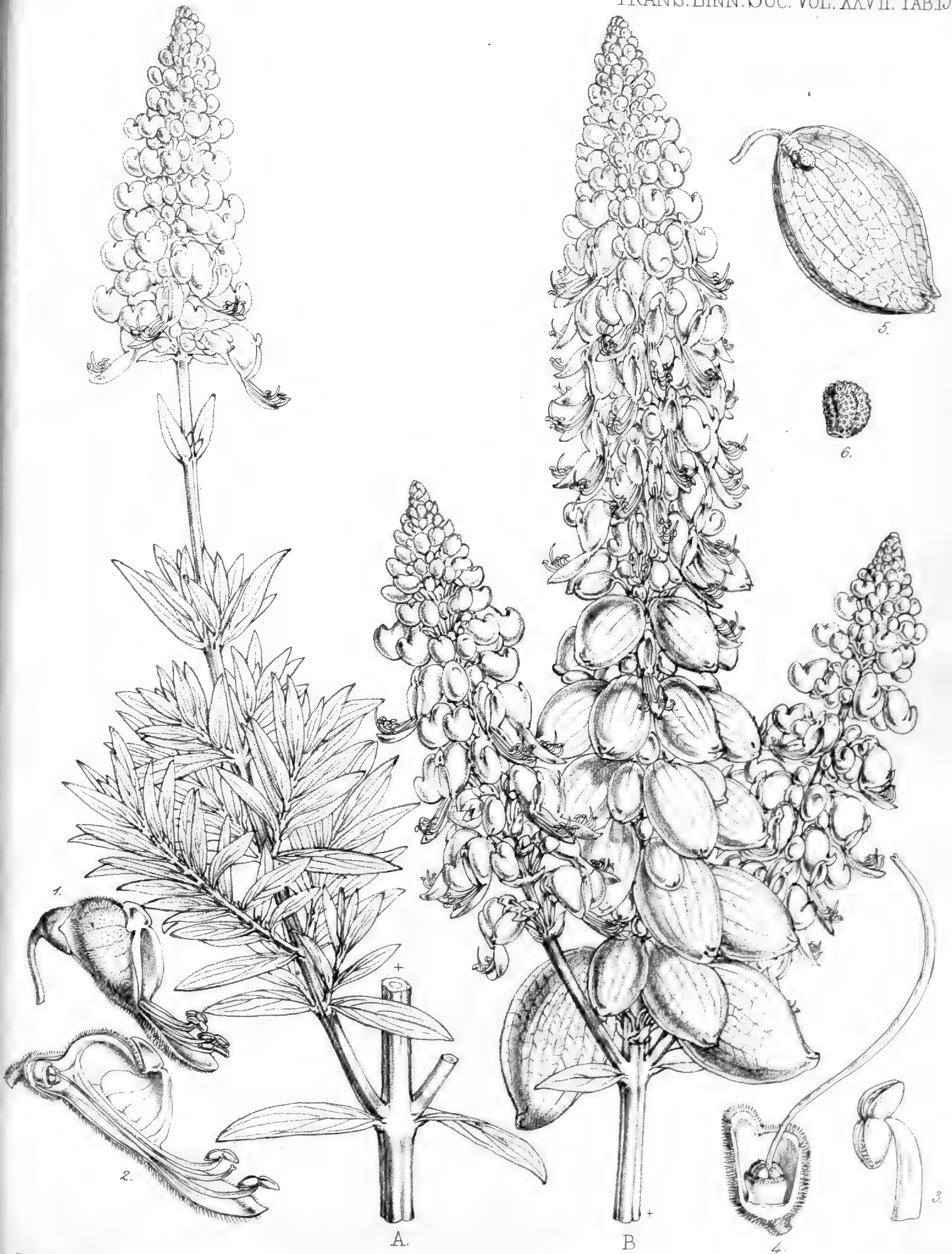
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*Sesamothamnus Benguellensis, Welw.*



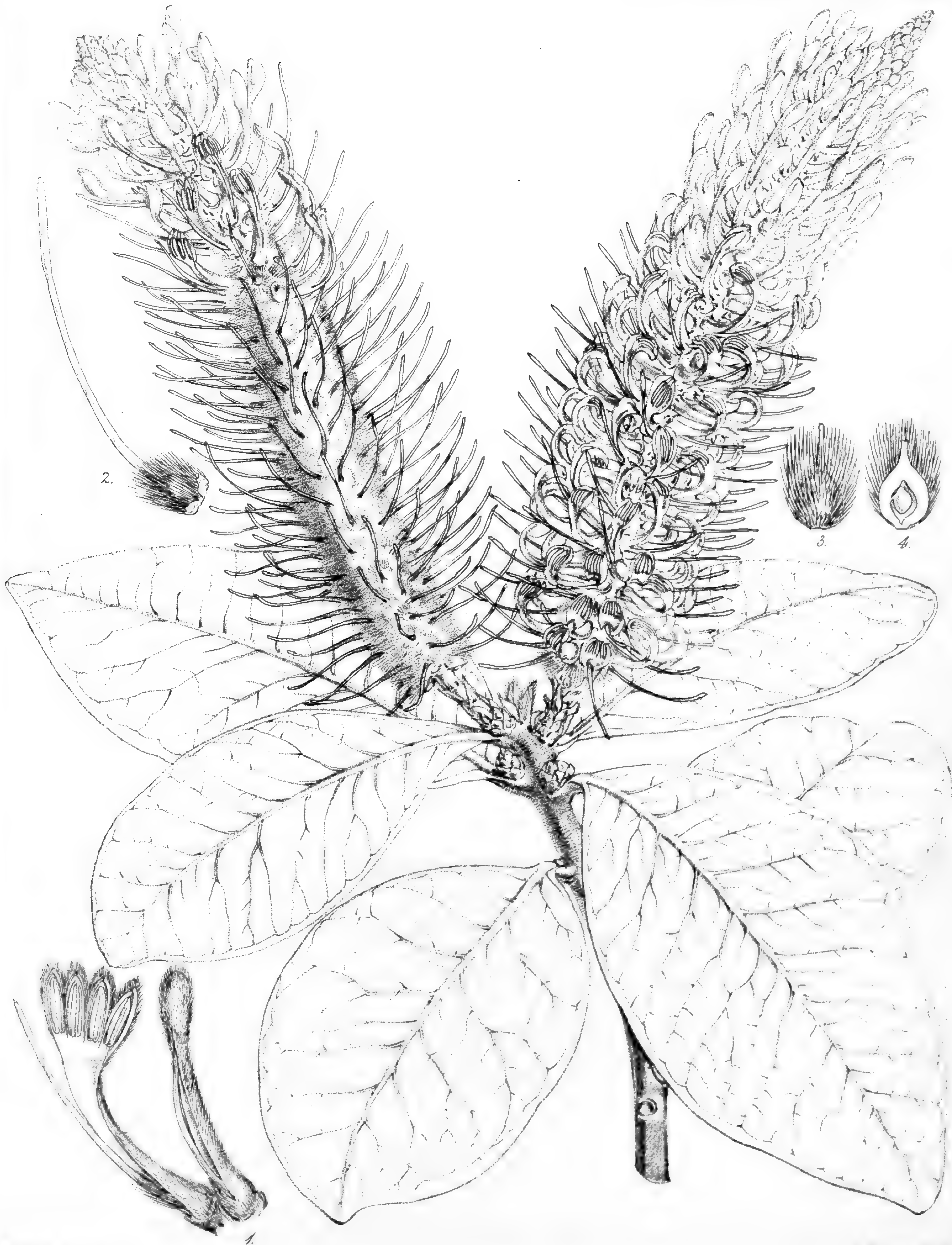


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*Alvesia rosmarinifolia*, Welw.



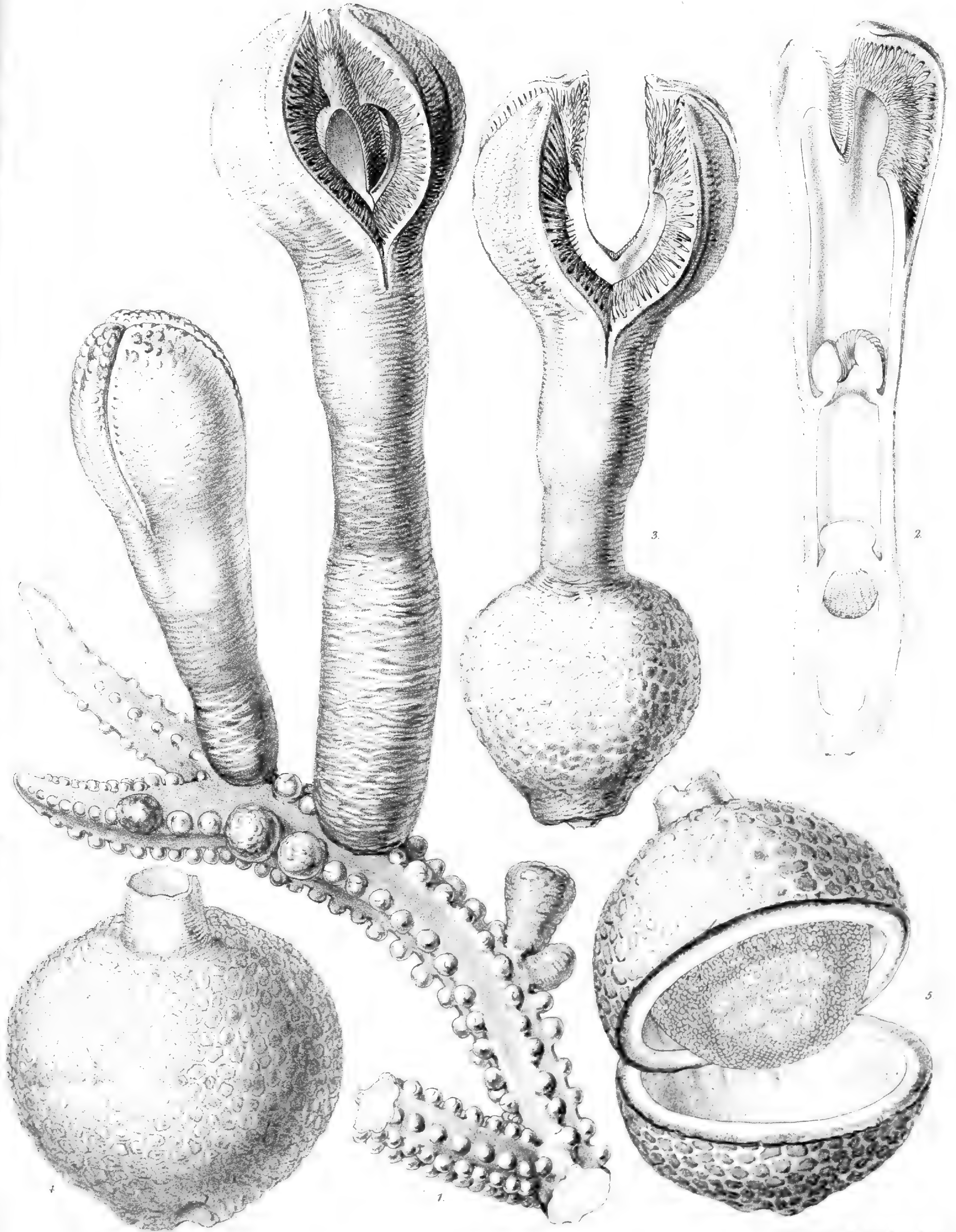


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J. N. Fitch, imp.

*Faurea speciosa*. Welw.



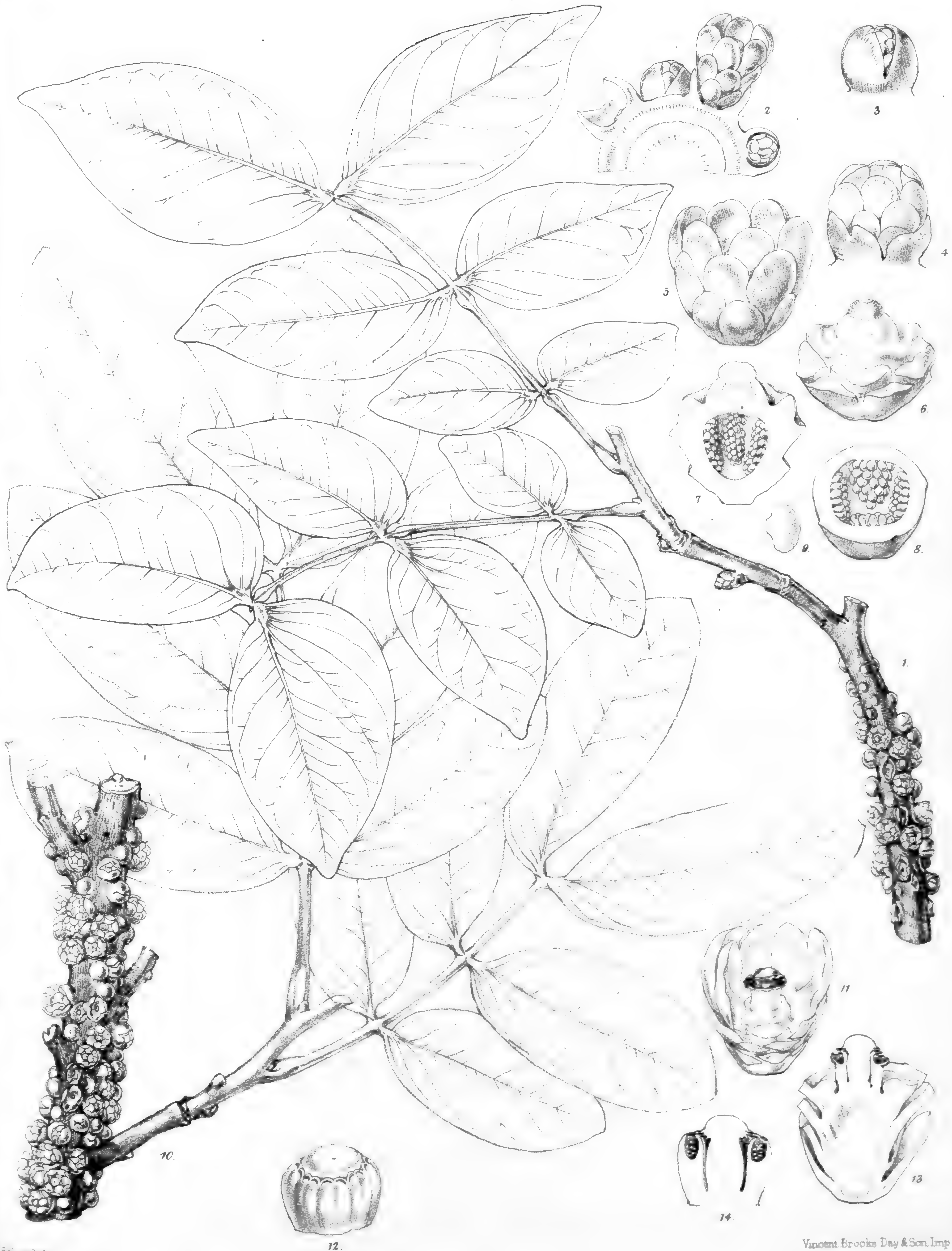


W. H. Fitch, del. et lith

Vincent Brooks, Day & Son, Imp

*Hydnora longicollis* Welw.





Fine del et lith

Vincent Brooks Day & Son, Imp

*Pilostyles aethiopica*. Welw.





W H Fitch, del. et lith.

J. K. Fitch, imp.

*Morus excelsa*, Welw.



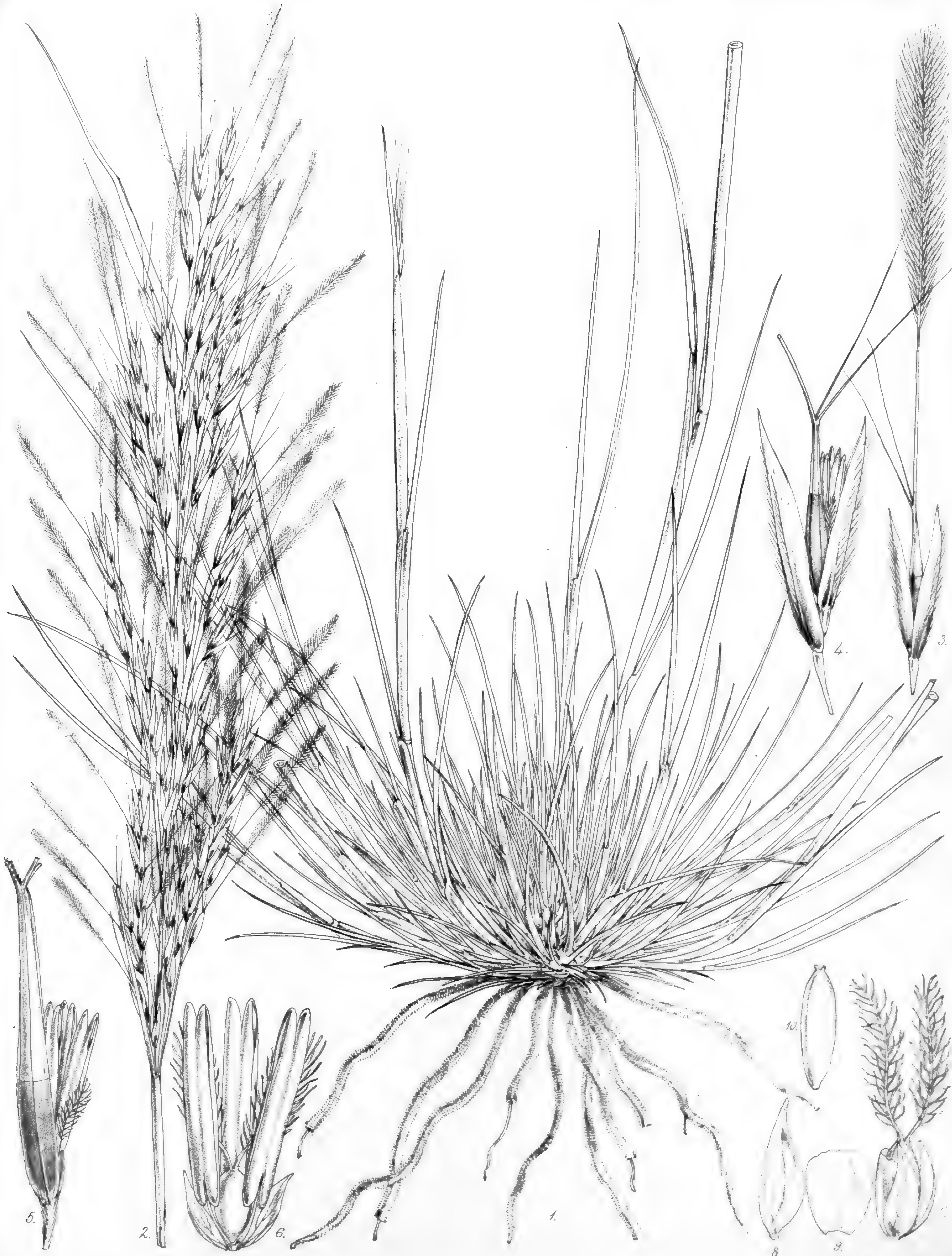


W H Fitch, del. et lith.

J N Fitch imp.

*Asclepis speciosa*, Welw. (f. 18.) | *Asclepis anthemiflora*, Welw. (f. 9 13.)





W. H. Fitch, del. et lith.

J. N. Fitch, imp.

*Aristida prodigiosa*, Welw.



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II. *On Three New Genera of the Verbenaceæ from Chile and its adjacent regions.*  
 By JOHN MIERS, F.R.S. & L.S., Dignit. & Commend. Ord. Imp. Bras. Rosæ, &c. &c.

(Plates XXVI.-XXVIII.)

Read May 6th, 1869.

1. RHAPHITHAMNUS.

THE type of this genus was first described in 1841, and figured in the Botany of 'Beechey's Voyage,' under the name of *Citharexylon cyanocarpum*, by Sir William Hooker, specimens having been previously brought from Chile by Bertero, under the manuscript name of *Pöppigia cyanocarpa*. The accompanying drawing was made by me in 1822 from the living plant, which is mentioned in my 'Travels' (1826) by the name of *Duranta umbilicata*. In its spinescent habit it approaches *Citharexylon* and *Volkameria*, but differs from those genera in many essential characters. Mr. Bentham (Ann. Nat. Hist. ii. p. 488) considered it very distinct from *Citharexylon* and more allied to *Duranta*, on account of its purple fleshy fruit: the name *Pöppigia* has long ago been universally adopted for a leguminous genus. The manner of its inflorescence is singularly different from that of *Citharexylon*; in the latter genus it is always terminal, either in elongated racemose panicles, or in axillary leafless spikes, which spring from between the spines and petioles of the leaves: in *Rhaphithamnus* we see only two flowers oppositely pendent from the middle of each axillary leafless spine, or from three to five flowers as a very short raceme axillary in the young foliiferous branchlets, which spring from the spine and leaf of the main branch, and they are always pendulous. In *Citharexylon* the corolla is either subcampanulate, or in a regular tube, with a border of five nearly equal segments; in this genus it is funnel-shaped, gibbously ventricose on the anterior side above the middle, and contracted in the mouth, with a border of four segments,—one anterior, broader than two others, which are lateral; while the posterior segment is cleft more than halfway, into two linear parallel divisions. In *Citharexylon* the five stamens, sometimes all fertile, are very short and inserted in the mouth of the tube or below it, with collateral adnate anthers slightly cordate at base; in *Rhaphithamnus* they are always didynamous, inserted below the middle of the tube, with long slender filaments, the lateral shorter pair being included within the tube, the anterior pair exerted beyond the mouth, the posterior filament being shorter and barren; the anther-lobes are oval, quite separated, and divaricately affixed upon a broad, very fleshy connective. The greatest difference is in the structure of the fruit: in *Citharexylon* it is obovate, covered by a somewhat dry pericarp, and seated on the much shorter cup-shaped coriaceous calyx; it encloses two bilocular osseous nuts, leaving a hollow space in the middle, occupied by the dried remains of the central columella; and near each anterior and posterior margin of each nut is seen a long cicatrical line, covering a foramen leading into each



cell, at a point where the seed is suspended a little below its apex. On the other hand, in *Rhaphithamnus* the fruit is a globular drupe of a fine deep blue colour, with a very thick pulpy pericarp, formed by the subsequent adhesion of the calyx to the ovary, its presence being now only perceptible by the five small teeth which form the margin of the umbilicated hollow in the apex of the drupe; it contains two suborbicular nuts, convex and smooth outside, flat on the adjoining faces, and rounded on the margins, separated by the fleshy axile columella; these are dark and of corneous consistence, 2-celled, and marked at the base, within each margin, by a deep hollow depression, whence, by means of a small perforation, a chord of nourishing vessels enters through the base of each cell, in communication with the laterally ascending raphe, so that the seeds here are quite anatropous, not semianatropous as in *Citharexylon*. The name of the genus is derived from *ῥαφίς* (*acus*), *θάμνος* (*frutex*), from the long slender, needle-like, flower-bearing spines.

*RHAPHITHAMNUS*, nob. *Flores* hermaphroditi. *Calyx* urceolatus, breviter 5-dentatus, augescens, demum accretus et pulposus. *Corolla* infundibuliformis, tubo supra medium antice subventricoso, fauce constricta, limbo expanso, parce piloso, 4-lobo, lobis patentibus, inæqualibus, posteriore ad medium 2-partito, lacinulis parallele linearibus, inferiore integro, rotundiore, 2 lateralibus hoc angustioribus, oblongis. *Stamina* didynama, infra medium tubi ex annulo barbato orta, 2 anteriora paululo exserta, 2 posteriora inclusa, cum quinto ananthero intermedio; *filamentis* tenuibus; *antheris* 2-lobis, lobis sejunctis, imo divaricatis, dorso ad connectivum crassiusculum agglutinatis, utrinque rima longitudinali dehiscentibus. *Ovarium* subglobosum, e carpellis 2, singulis bilocularibus, cum columella centrali in intervallo paulo distincta, hinc 4-loculare, loculis *ovulo* unico erecto instructis: *stylus* filiformis, vix exsertus: *stigma* subgibbum, breviter aut longius bilamellatum. *Drupa* globosa, apice umbilicata, succosa, ad calycem valde auctum demum crasse carnosum accreta, 2-pyrena; *pyrenes* semiorbiculares, plano-convexi, læves, cornei, fusci, 2-loculares, ad imum faciei internæ plagis 2 rotundis impressi, et illic foramine parvo intra basin loculorum utrinque perforati. *Semina* in loculis solitaria; *integumenta* 2, tenuia, *raphe* laterali e basi ad *chalazam* apicalem adscendente notata: *embryo* exalbuminosus, *cotyledonibus* ovatis, crasso-carnosis, *radicula* brevi, conica, infera.

Arbusculæ et frutices *Chilenses*, *frondosi*; ramuli *spinosi*, *sub-4-goni*, *pubescentes*, spinis *supra folios enatis*; folia *opposita vel terna*, *integra*, *rare serrata*, *ovata aut oblonga*, *lucidula*, *breviter petiolata*; flores *oppositi ternive*, *e medio spinarum enati*, *aut pauci in racemulum axillarem dispositi*, *lilacini*; drupa *globosa*, *læte cærulea*.

1. *RHAPHITHAMNUS CYANOCARPUS*, nob.: *Citharexylon cyanocarpum*, Hook. & Arn. Bot. Beech. Voy. 58, tab. 11; Sch. in DC. Prodr. xi. 609; Gay, Chile, v. 34: *Duranta umbilicata*, nob. olim in Trav. ii. 530: *Pöppigia cyanocarpa*, Bert. Bull. Sc. Nat. (1830) p. 109: ramulis subteretibus, ad nodos compressis, flavidis, crebriter adpresse hirsutulis, spinis gracilibus, aurantiacis, folio 2-3-plo longioribus; foliis infra spinas enatis, oppositis, orbiculari-ovatis, imo rotundatis, apice obtusis vel subacutis, apice



repente mucronatis, valde coriaceis, supra subnitidis, glabris, læte viridibus, in nervis venisque profunde sulcatis, marginibus revolutis, subtus paulo pallidioribus, nervis crassiusculis subimmersis, punctis sparsis impressis notatis, sparse pilosulis, demum glabris, petiolo brevi, pubescente; floribus solitariis, e medio spinarum opposite pendulis, vel ex axillis ramulorum 3-4, brevissime racemosis, breviter pedicellatis; corolla lilacina; drupa globosa, succosa, cærulea.—In Chile, provinc. centralibus: *v. v.* ad Concon, *v. s. in hb. Hook.* Valparaiso (*Matthews*, 236), ibidem (*Cuming*, 625), ibidem (*Bridges*, 123).

A beautiful evergreen tree, 15 to 20 feet high, much branched, conspicuous for its numerous bright green leaves, accompanied by golden spines and lilac flowers, intermixed with blue shining drupes. It is called by the natives *Arrayan espinudo* (Prickly Myrtle). The decussating axils are  $\frac{1}{2}$ -1 inch apart, the horizontally spreading branchlets gradually diminishing upwards: the leaves are 8-10 lines long, 6-8 lines broad, on a petiole 1 line long; the spines are 10-18 lines long, and stand at a complete right angle. The flowers are in an opposite pair upon each spine, or in a 3-flowered extremely short pubescent raceme, in each opposite axil; the pedicels are 1 line long; the subpilose calyx is 2 lines long, with five equal short triangular teeth; the tube of the corolla is 6 lines long, the lobes of the border  $1\frac{1}{2}$  line long and subpilose inside; the longer pair of filaments are 4 lines, the shorter pair 3 lines, the sterile one 2 lines long; the ovary, style, and stigma are 6 lines long: the drupe, when fully ripe, is  $\frac{1}{2}$  inch in diameter; the nucules are 3 lines long and broad, of very thick corneous consistence, and each 2-celled, two depressions are seen at the base of their internal face near the margin, where the perforation leading into the bottom of each cell is distinctly visible, communicating with the raphe of each seed, and which ascends along the external angle of each cell; the integuments are very thin and membranaceous; the embryo, destitute of albumen, has fleshy cotyledons with a much smaller inferior radicle.

*Var. pallida*: foliis minoribus, rotundato-ovatis apice sæpe mucronulatis, convexiusculis, crasso-coriaceis, glabris, supra pallidissimis, subtus fere concoloribus, nervis immer-sis: spinis gracillimis, folio longioribus.—Circa Valparaiso, *v. s. in hb. Hook. et nostr.* (*Bridges*).

A much smaller plant, with axils 3-5 lines apart; leaves 5-6 lines long, 4-5 lines broad.

2. RHAPHITHAMNUS AMÆNUS, nob.: ramulis subteretibus, substriatis, rigide et adpresse hirsutulis; spinis folio haud brevioribus; foliis oppositis, ovatis aut oblongo-ovatis, imo obtusis aut subacutis, a medio sensim acuminatis, longe acutis et mucronatis, supra nitidiusculis, pallidissimis, a nervis venisque impressis areolato-inæquatis, costa sulcata, subtus stramineo-glaucis, subplanis, nervis tenuissimis paulo promi-nulis, sparse et obsolete impresso-punctatis, minutissime pellucido-punctulatis, mar-ginibus paulo revolutis; petiolo brevissimo, rigide hirsutulo: racemis axillaribus, brevissimis, 3-floris, rachi pubescente, petiolum vix excedente; calyce brevi, 5-denti-culato, dentibus 2 minimis; corolla infundibuliformi, tubo vix ventricoso, limbi lobis



5 æquilongis, 2 anterioribus angustioribus, intus glabris; drupis carnosis.—In Chile: *v. s. in herb. Mus. Brit. Quillota (Bertero, 1253)*.

A species differing from the preceding in its larger, acuminate, very pale leaves, of much thinner texture, extremely pale beneath, with very fine nerves: the leaves are 10–17 lines long, 7–10 lines broad, on a petiole  $1\frac{1}{2}$  line long; the pubescent rachis of the raceme is 2 lines long; the calyx is 1 line long,  $\frac{2}{3}$  line in diameter, with two of its teeth very minute, 5-nerved, slightly pubescent outside, minutely pellucido-punctulate: the corolla is funnel-shaped, almost regular, the tube, with several parallel nerves, is 6 lines long, with a border of five ovate lobes, equally  $1\frac{1}{2}$  line long, the two anterior narrower, one posterior broader, all glabrous inside, the tube below the insertion of the stamens is more densely pilose than in the preceding species; the two longer stamens are slightly exerted; style slender; stigma more distinctly 2-lamellated.

3. RHAPHITHAMNUS LONGIFLORUS, nob.: ramis ad nodos valde compressis, ramulisque elongatis, sursum curvatim divergentibus, sub-4-gonis, adpresse hirsutulis; spinis raris, horizontalibus, folio brevioribus; foliis oppositis, obovato-oblongis vel oblongis, imo rotundiusculis vel subcordatis, a medio sensim lanceolato-acutis, acute mucronatis, canaliculatim recurvatis, crasso-coriaceis, costa pilosula excepta utrinque glabris, supra nitidis, in nervis sulcatis, subtus brunneo-glaucis, nervis pallentibus divaricatis arcuatim nexis et prominulis, reticulatis, crebriter profunde impresso-punctatis, marginibus subrevolutis; petiolo brevissimo, pilosulo: floribus circiter 3, in racemulum axillarem dispositis, læte purpureis; calyce tubuloso, crassiusculo, subpiloso, dentibus 5 acutis mucronato-apiculatis; corollæ tubo longiusculo, subcylindræo, superne paulo ampliato, lobis 4, intus pilosiusculis, posteriore ad medium bifido; staminibus exertis: drupis carnosis, purpureis, pisi mole.—In insula Juan Fernandez: *v. s. in herb. nostr. loc. cit. (Miller)*; *in hb. Hook. loc. cit. (Cuming, 1331)*; *ibidem, Citharexylon elegans nominatus (Philipi, 1861)*; *ibidem (Douglas, 56)*; *ibidem (Bertero, 1498)*; *ibidem (Mrs. Graham)*.

A species peculiar to the island of Juan Fernandez, differing from all the preceding in its more thickly coriaceous, more shining, longer leaves, canaliculately recurved from the base to the apex, and more thickly punctated beneath, and also in its very long tubular corolla of a rich purple colour. In Mrs. Graham's specimen the leaves are shorter, cordate at base, and somewhat obtuse at the summit. In the branches the axils are 1 inch, in the branchlets about  $\frac{1}{2}$  inch apart; the leaves are  $1-1\frac{3}{4}$  in. long, 6–12 lines broad, on a petiole 1–2 lines long: the rachis of the raceme is 3 lines long, the pedicels 3 lines; the calyx 2– $2\frac{1}{2}$  lines long; the tube of the corolla  $1\frac{1}{4}$  inch long, the lobes of the border 3 lines long, 2 lines broad; the anterior stamens are exerted as far as the lobes, the posterior pair extend a little beyond the mouth, the sterile filament being about half their length: the drupes are 3–4 lines in diameter.

4. RHAPHITHAMNUS BUXIFOLIUS, nob.: ramulis sub-6-gonis, sulcatis, breviter rigide pilosulis, axillis inferioribus sæpius ternatim spinigeris, superioribus inermibus, spinis supraaxillaribus, divergentibus, folio brevioribus vel æquantibus; foliis ternatim



verticillatis, rarius oppositis, minoribus, late ovatis, utrinque paulo acutis, mucrone apiculatis, marginibus valde revolutis, coriaceis, supra profunde viridibus, nitidis, glabris, in nervis anguste sulcatis, subtus pallidioribus, opacis, crebre impresso-punctulatis, in costa nervisque paulo prominulis pilosulis; petiolo tereti, adpresse piloso, limbo 8-plo brevior: racemis ternatim vel opposite axillaribus, rachi brevissima, pilosa, sub-3-flora, apice in spinulam brevem terminata; floribus minoribus, breviter pedicellatis; calyce corollaque subbrevis subpuberulis.—In ins. Chiloë: *v. s. in hb. nost. Chiloë (Capt. King)*; *in hb. Hook. Chiloë (Lobb)*, *ibidem (Capt. King)*, Valdivia et Chiloë (*Cuming*, 603).

A distinct species, easily recognized by its much smaller ternate leaves and shorter spines, as well as by its aspect, more rigid pubescence, and smaller extremely pale flowers. The axils are 5 lines apart, each with three verticillate spines 3–5 lines long; the leaves, also ternate, are 6–7 lines long, 5–6 lines broad, on a petiole nearly 1 line long: the rachis is 2 lines, the calyx  $1\frac{1}{2}$  line long, acutely toothed, the tube of the corolla  $4\frac{1}{2}$  lines long, pubescent outside, thickly pilose inside below the insertion of the stamens, the five lobes of the border all equally  $1\frac{1}{2}$  line long, pubescent inside, two posterior narrower, one anterior broader; stamens included, connective of anthers thick and fleshy: the drupe is 3 lines in diameter.

5. RHAPHITHAMNUS PARVIFOLIUS, nob.: *Citharexylon cyanocarpum*, Gay (pro parte), Fl. Chil. v. 34 (cum icone in vol. ornith. tab. 6, sub *Zenaida Souleyetiana*): ramulis subteretibus, adpresse hirsutulis; foliis sæpius ternatis, ovato-oblongis, imo obtusis, a medio sensim acutis, mucronulatis, crassiusculis, supra opacis, profunde viridibus, in costa nervisque anguste sulcatis, subtus pallidis, crebre impresso-punctulatis, parce puberulis aut glabris, marginibus vix revolutis; petiolo pilosulo, brevi; spinis raris, gracilibus, folio longioribus: racemis axillaribus, brevissimis, sub-3-floris; corolla infundibuliformi; drupa pisi minoris mole.—In Chile australi et insulis adjacentibus: *v. s. in herb. Hook. ins. Chiloë (Pöppig, 53)*; ins. Mocha (*Eights, 11*); Arique (*Lechler, 520*); So. Chile (*Capt. King*); Rio Negro, Valdivia (*Gay*).

This species, which seems confined to the more southern regions of Chile, is distinguished by its much smaller leaves, shorter branches, and apparently lower growth, being, according to Cuming, a small tree 10 to 15 feet high. The axils are 2–4 lines apart; the leaves are 4–6 lines long, 3 lines broad, on a petiole  $\frac{1}{2}$  line long: the calyx is  $1\frac{1}{2}$  line long; the tube of the corolla 8–10 lines long, of a pale blue colour; the lobes of its border  $1\frac{1}{2}$  line long: the drupe is scarcely 3 lines in diameter.

6. RHAPHITHAMNUS SERRATIFOLIUS, nob.: ramulis strictis, gracilibus, adpresse hirsutulis; foliis oppositis, oblongis, utrinque acutis, imo ad medium integris, hinc superne grosse serratis (dentibus mucronulatis utrinque 4), membranaceis, ubique glaberrimis, supra læte viridibus, planis, subtus opacioribus, crebre fusco-punctulatis, nervis tenuissimis, paulo prominulis, reticulatis, minute pellucido-punctulatis; petiolo tenui, hirsutulo, limbo 15-plo brevior; spinis axillaribus, petiolo 2-plo longioribus.—In ins. Juan Fernandez: *v. s. in herb. Hook. loc. cit. (Bertero)*.



A singular species, but the specimen wants flowers and fruit. The axils are  $\frac{3}{4}$ –1 inch apart; the spines are 1–2 $\frac{1}{2}$  lines long; the leaves are  $\frac{3}{4}$ –1 $\frac{1}{4}$  inch long,  $\frac{5}{8}$ – $\frac{3}{4}$  inch broad, patent, upon a petiole 1–1 $\frac{1}{4}$  line long.

## 2. PHELLODERMA.

I have proposed this genus, having for its type the *Priva lævis*, Juss., *Castelia cuneato-ovata*, Cav., which, though often described, has never been correctly investigated. This plant was collected by me in 1825, and then carefully examined. It is described by Gay, first as *Priva lævis* (Fl. Chil. v. 7), and a second time under the name of *Bouchea Copiapensis* (l. c. p. 26, where it is figured in pl. 55), from which it is evident that he was not aware of their identity. M. Bocquillon has followed the same mistake, no doubt upon Gay's authority. It differs from *Priva*:—in its calyx, which does not become globosely expanded in fruit; in the distinctly bilabiated border of the corolla; in the form of the anthers; in the presence of a fifth sterile stamen; in the shape of the stigma; in its oval, apiculated, smooth, drupaceous fruit; in its nucules not separating spontaneously at maturity, in consequence of the somewhat suberose mesocarp which firmly holds them together; in the antical and postical position of the nucules; in the copious pithy ring which surrounds them; in the nucules being osseous (not testaceous), deeply furrowed at the back (not armed with long curved spines); and in having a distinct, though thin, albumen in the seeds. From *Bouchea* it differs in having the longer tooth of the calyx posterior (not anterior), in having a fifth sterile stamen, in the oval (not linear) form of the nuts, which are osseous, dorsally and deeply furrowed (not smooth and thinly testaceous), in not separating spontaneously, in being surrounded by a large pointed pith-like ring of double their length, by the presence of albumen in the seeds, and, finally, by the nucules being 2-celled, not unilocular.

The chief peculiarity of this genus consists in the remarkable structure of the fruit, which no one appears to have seen, except Cavanilles, who merely describes it as containing two bilocular nuts. As sufficient has been stated to show its differential features, I will proceed to give its generic characters: its proposed name is derived from  $\phi\epsilon\lambda\lambda\omicron\varsigma$  (*suber*),  $\delta\acute{\epsilon}\rho\mu\alpha$  (*vestis*), from the suberous covering in which the nuts are imbedded.

PHELLODERMA, nob.: *Priva*, Juss.: *Bouchea*, Gay. *Calyx* cylindricus, 5-gone striatus, inæqualiter 5-dentatus, dentibus lineari-acuminatis, erectis, posteriore brevior. *Corolla* tubulosa, tubo cylindrico, calyce dimidio longiore, curvato, antice paulo inflato, fauce obliqua, limbo subbilabiato, 5-lobo, lobis ovatis, inæqualibus, 2 posterioribus brevioribus et erectioribus, lobo antico longiore et latiore, 2 intermediisque subreflexis, his paulo minoribus, marginibus undulatis. *Stamina* 4, didynama, cum 5<sup>to</sup> ananthero inter breviora paulo inferiore; *filamenta* brevia, tenuia, pilosula, antheris paulo longiora, 2 superiora antica, sub faucem inserta, 2 inferiora postica, ad medium tubi inserta; *antheræ* oblongæ, 2-lobæ, ad medium sagittatæ, lateraliter compressæ, connectivo tenui ad sinum affixæ, rima longitudinali utrinque introrsum dehiscentes, superiores faucem attingentes: *pollen* globosum, reticulatum. *Ovarium* conico-oblongum, *disco* glanduloso insitum, 4-loculare, cum dissepimento ad axin



inflorescentiæ directo et 2-lamellato, lamellis intervallo disjunctis; *ovula* 4, erecta; *stylus* filiformis, apice gradatim dilatatus et compressus, faucem attingens; *stigma* majusculum, subito uncinatim recurvum, mucronatum, bilamellatim compressum, intus papillosum. *Drupa* calyce distenso dentibus contortu-plicatis coronato inclusa, ovata, apiculata, lævis, vix striata, indehiscens, in carcerulos 2 vi tantum partibilis; *carceruli* dorso mesocarpio subsuberoso tecti, ad margines, ad apicem cuneato-acuminatum et ad basin cavam medulla crassa extus indurata circumdati; *pyrenes* 2, in carcerulis immersis, eis dimidio breviores, ovati, plano-convexi, extus profunde 9-sulcati, valleculis mesocarpio repletis, intus 3-sulcati, hic interspatio separati, ossei, singuli 2-loculares; loculi ad basin pro vasibus nutritoriis perforati; *columella* centralis, crasse membranacea, vacua, adnata, vasa ad semina proferens: *semina* in loculis solitaria, oblonga, subteretia, angulo externo-basali funiculo brevi affixa, erecta; *integumenta* tenuissima, *raphe* laterali ad *chalazam* apicalem adscendente; *embryo* in *albumine* parco inclusus, lineari-cylindricus, *cotyledonibus* *radicula* infera 2-plo longioribus.

Herba in Chile et prov. Argentinis vigens, perennis, opposita ramosa, axillis remotiusculis, radice fusiformi tubera e fibrillis emittente; folia opposita, subovata, imo in petiolum cuneata, dentata; spica terminalis; flores breviter pedicellati, bracteolati, lutescenti-rubicundi, odorati.

1. PHELLODERMA CUNEATO-OVATA, nob.: *Castelia cuneato-ovata*, Cav. Icon. vi. 61, tab. 583; Ann. Sc. Nat. iii. 134, tab. 30: *Priva lævis*, Juss. Ann. Mus. vii. 70; DC. Prodr. ii. 533; Hook. Bot. Misc. i. 172; Gay, Fl. Chil. v. 7: *Priva orchioides*, Walp. Rep. iv. 36: *Bouchea Copiapensis*, Gay, l. c. 26, tab. 55; Bocq. Adans. iii. 236: *Verbena tuberosa*, Grah. Edin. Phil. Journ. xxix. 174: caule ramisque oppositis 4-gonis, inferne glabris, superne rigide pilosulis; foliis oppositis, deltoideo-ovatis aut oblongo-ovatis, obtusule acutis, imo truncato-cuneatis, in petiolum abeuntibus, irregulariter grosse mucronato-dentatis, nervis tenuibus immersis, eveniis, opacis, pallidis, subtus pallidioribus, utrinque sæpe rugulosis, glabris, in dentibus tantum scabrido-ciliatis; petiolo latiusculo, compresso, margine breviter ciliato, limbo dimidio brevior: spicis terminalibus, longiusculis, brevissime pilosulis; floribus oppositis et pseudo-verticillatis, verticellis cum floribus circiter 6 subremotis; pedicellis brevibus, bracteola brevi lanceolata instructis; calyce membranaceo, 5-gono, acutissime 5-dentato, dente brevioris exterioris; corollæ subbilabiatae tubo pubescente, intus pilosulo, albo, fauce obliqua lutescente, lobis rubicundis.—In Chile et prov. Argentinis: v. v. in Andibus Mendocinis, in desertis circa Mendozam et ad Tres Cruces, prov. Cordovæ: v. s. in herb. Hook. Coquimbo (*Bridges*, 1354); Quillota (*Bridges*, 453); Rio de la Plata in arenosis (*Tweedie*, 1105).

Besides these localities, where I found this plant in 1826, Gay gives its habitat in Chile, in dry places in the province of Copiapo: Ney was the first who discovered it, in 1794, in the Pampas. It is about a foot and a half high, with a somewhat flexuous tap-root about 3 in. long, its fibrils spreading and producing fleshy tubers about the size of a hazel-nut. The stem is fistulous, bearing leaves from the base, with axils 2 in. apart, and throwing



out two opposite branches about 9 in. from the ground; the leaves are  $1\frac{1}{4}$ –2 in. long,  $\frac{3}{4}$ – $1\frac{1}{4}$  in. broad at the truncated portion, and a little narrower where the leaf begins suddenly to diminish in a cuneate form towards the compressed petiole, which is 7 to 15 lines long: the terminal spike is about 4 in. long in flower, 6 in. long in fruit, bare at base for 1 or 2 inches; about six decussately opposite flowers are closely approximated in several subverticils, which are from 6 to 9 lines apart; and there are six or seven such clusters in each spike; the bract is  $1\frac{1}{2}$  line long, the pedicel is  $\frac{1}{2}$  line, the calyx 3 lines long, including the teeth, of which the longest is  $\frac{1}{2}$  line; the tube of the corolla is  $4\frac{1}{2}$  lines long,  $1\frac{1}{4}$  line broad, the two upper lobes  $1\frac{1}{4}$  line, the three lower lobes  $1\frac{1}{2}$  lin. long; the filaments are very short and patently puberous; the calyx, in fruit, is 5 lines long; the drupe is 3 lines long, 2 lines in diameter, with a structure already described. The tubers appear to have escaped the observation of those who collected the specimens existing in different herbaria, owing to the plant growing mostly in stony ground: that they are known to the natives is evident from the name by which the plant is called, *Papilla* (literally a small potato). Dr. Graham, who raised the plant from seed in Edinburgh, was not aware that it belonged to this well-known species, describes its tubers as being of the size of a hazel-nut: they certainly escaped my observation, as well as that of Gillies, Gay, Ney, and others. Walpers, who describes the plant from cultivated specimens grown on the Continent, gave it the name of *Priva orchioides*, from its stoloniferous long creeping root.

### 3. DIOSTEA.

This consists of a small group of plants from the cordillera of Chile and Mendoza, the type of which is the *Verbena juncea*, Hook., which I propose to separate as a distinct genus, under the name of *Diostea*. They have all a peculiar habit, mostly having subfistulose virgate branches, with distant axils, which are often aphyllous, with opposite, oblong and dentated, or linear and entire leaves, with very short petioles, and with spicated inflorescence: some of them become black in drying. The calyx is cylindrical, with five unequal subulate teeth; the corolla is tubular and incurved, twice or three times the length of the calyx, with a border of five small, oblong, entire or emarginated, patent lobes; the stamens are in superposed pairs, often with a sterile fifth, all included within the tube; the style, also included, is gradually dilated towards its obliquely truncated extremity, and furnished with a smaller subglobular papillose stigma; the ovary, in its early development from a single carpel, is like that of *Casselia*, being at first imperfectly unilocular, two short parallel semisepta advancing from the sulcated anterior side across the centre, where they are each reflected; while, in progress of growth, two other semisepta advance from the posterior wall, and uniting with the others, make the ovary 2-celled, with an erect ovule in each cell, the dissepiment remaining bilamellated in its entire length. The fruit is an oval drupe, enclosed in the swollen persistent calyx, consisting of a smooth, dry pericarp, enclosing two oval, hard, dark, corneous nuts, each 1-celled, convex outside, flat inside, within the margins rounded, having at the base, near the anterior side, a long, oval, white, placentiferous patch, covering a small foramen which leads into the base of the cell, continuous with a late-



rally ascending raphe the whole length of the seed, and terminating in a small apical chalaza; the seed is therefore quite anatropous; the nuts are placed laterally in regard to the axis. This will be seen to be the structure of *Dipyrena*, with the essential difference that its nucules are 1-locular. The *Verbena scoparia*, Hook. & Gill., figured in the Bot. Misc. pl. 47, belongs to this group. Schauer, in his Monograph of the family, places *D. juncea* in *Lippia*, and *D. scoparia* in *Verbena*, stating erroneously that its fruit is a 4-coccous capsule. From *Verbena* it is manifestly distinct, and it differs from *Lippia* in its peculiar habit, its inflorescence, and in its corolla with a 5-lobed (not 4-lobed) border, and other particulars. Walpers, in his arrangement of the genus *Verbena*, places the species of this group in a separate division, *Junceæ*, in which he includes *V. Ephedrioides*, *V. alata*, and *V. sagittata* of Chamisso; but these belong to *Verbena*, having a fruit of four nucules; he also includes *V. glauca* and *V. aphylla*, Hook. & Gill., which do not possess the features of *Diostea*, their fruit being that of *Verbena*. The latter species appears to differ from *V. intermedia*, Hook. & Gill., in little else besides the abortion of its leaves, the last-mentioned plant being an intermediate form between *V. aphylla* and *V. Bonariensis*. The generic name of *Diostea*, after the example of *Dipyrena*, is derived from  $\delta\iota\varsigma$  (*duplex*),  $\omicron\sigma\tau\acute{\epsilon}\alpha$  (*ossa, nuculae*).

**DIOSTEA**, nob. *Calyx* tubulosus, inæqualiter subulato-5-dentatus, persistens. *Corolla* tubulosa, tubo calyce 2-plo longiore, subcurvato, limbo subobliquo, 5-lobo, lobis ovatis vel oblongis, sæpe subemarginatis, expansis. *Stamina* 4, didynama, sæpe cum quinto sterili multo brevioris inter par posterioris sito, inclusa; *filamenta* subbrevia, filiformia, 2 superiora anteriora paulo supra, 2 inferiora posteriora paulo breviora sub medium tubi inserta, glabra, tubo intus antice pilis longis albis retrorsus hirsuto. *Stylus* inclusus, filiformis, compressus, apice gradatim dilatatus, suboblique truncatus, latere superiore inferioreve uncinato-recurvus; *stigma* globosum, papillosum. *Ovarium* oblongum, disco pulviniformi insitum, maturitate 2-loculare, loculis lateralibus, 1-ovulatis, dissepimento distincte 2-lamellato. *Drupa* ovata, calyce persistente tecta, *pericarpio* subsiccato, nitente, 2-pyrena; *pyrenes* planoconvexi, fusci, subcornei, duri, læves, monospermi, facie interiore ad basin et latus posticum versus plaga alba ovali placentari notati, et hinc foramine basin loculi penetrante perforati: *semen* loculum implens, erectum, *hilo* basali sublaterali foramini nexum, *raphe* laterali, hinc adscendente, *chalazam* apicalem attingente; *embryo* exalbuminosus, *cotyledonibus* crasse carnosus, facie interna pyrenibus parallelis, *radicula* infera conica 3-plo longioribus.

Suffrutices humiles *Andium Chilensium*; rami e basi plurimi, virgati, ramosi ramis oppositis vel 4-natis verticillatis iterumque ramulosis, ramulis erecte adscendentibus, teretibus, sæpius fistulosis et sicco nigrescentibus, axillis remotis, vetustioribus aphyllis, ut in *Ephedræ constrictis*; folia opposita, parva, linearia, integra et sessilia, vel ovata dentata et breviter petiolata; inflorescentia terminalis, sublaxe spicata; flores sessiles aut brevissime pedicellati, bractea parva suffulti.

1. **DIOSTEA JUNCEA**, nob.: *Verbena juncea*, Hook. et Gill. Bot. Misc. i. 162: *Lippia*



*juncea*, Sch. in DC. Prodr. xi. 573; Gay, *l. c.* p. 30; Philippi, Linn. xxxiii. 196: *Diphyrena dentata*, Philippi, Linn. xxix. 22: suffruticosa, ramis elongatis, virgatis, teretibus, ramulisque oppositis, strictis, fistulosis, subadscendentibus, glabris, rarius in junioribus puberulis, axillis remotis, demum aphyllis; foliis in ramulis junioribus oppositis, parvis, lineari-oblongis vel obovatis, imo in petiolum brevem attenuatis, subcoriaceis, imo integris, apice 3-dentatis vel grosse serratis, glabris vel rarius obsolete puberulis: spicis terminalibus; floribus laxis, sessilibus, bractea oblonga apice attenuata puberula suffultis; calyce tubuloso, bractea 2-plo longiore, inæqualiter subulato-5-dentato, utrinque pilosulo; corolla tubulosa, tubo subrecurvo, imo cylindraceo, superne ampliore, antice infra faucem subobliquam paulo ventricoso, parallele nervoso, glabro, limbo 5-lobo, lobis ovatis, integris, expansis; tubo intus antice retrorsus piloso; staminibus didynamis, cum quinto brevissimo (anthera effeta) inter anteriora paulo inferius sito; filamentis tenuibus, 2 posticis medio tubi affixis, 2 anticis altius positis; antheris ovatis, inclusis; stylo apice incrassato, recurvo; ovario oblongo: drupa parva, ovata, calyce inclusa, structura generis.—In Cordilleris Mendozinis et Chilensibus, *v. v.* ad Villa Vicencio: *v. s.* in *hb. nost. et Hook.* Cordill. Chile (*Bridges*, 460), Cordill. Maule (*Germain*, sub nom. *Priva dentata*, Phil.); in *hb. Hook.* Quillota (*Germain*), Cord. Chile (*Macrae*), Guardia (*Gillies*), Cord. Chile (*Cuming*, 225).

I collected this plant in 1825, both in flower and in fruit, in the Cordillera of Mendoza, in which region Gillies found it about the same time. The plants on the eastern side of the Cordillera are always a little puberulous on the younger branchlets, while those on the Chile side are quite glabrous. It forms a low suffruticose shrub, about 3 or 4 feet high; the lower branches are lignescent, about the thickness of a quill; the upper branchlets are more slender, fistulous and subherbaceous; the axils are 2 or 3 inches apart; the leaves are from 4 to 11 lines long, 3 or 4 lines broad, on a slender petiole  $1\frac{1}{2}$  line long, which is a little dilated at its insertion, where it is connected with a transverse line across the axil; the leaves on the floral branchlets are more linear, and about 3 lines long. The terminal spikes are from 2 to 3 inches long, with numerous somewhat divergent flowers about a line apart; the bract is about  $1\frac{1}{2}$  line long; the calyx is 2 lines long; the tube of the corolla 3– $3\frac{1}{2}$  lines long, the lobes of the border  $\frac{1}{2}$  line long: the presence of a fifth sterile antheriferous stamen distinguishes this species from the others, but it is sometimes wanting; the style rarely extends beyond the mouth. The drupe is  $1\frac{1}{4}$ – $1\frac{1}{2}$  line long,  $\frac{3}{4}$  line in diam., black and polished; the nucules are dark-coloured, hard and corneous. The plant, though fuscous, does not always grow black in drying as in the following species; but its flowers become nigrescent.

2. DIOSTEA SCOPARIA, nob.: *Verbena scoparia*, Hook. et Gill. Bot. Misc. i. 161, tab. 47; Sch. in DC. Prodr. xi. 544; Gay, Chile, v. 20: suffruticosa, tota nigrescens, e basi multiramosa, ramis ramulisque oppositis vel 4-nis, erectis, strictis, teretibus, striato-sulcatis, basi breviter articulatis, in axillis remotis linea transversali constrictis, glabris, fistulosis; foliis minimis, lineari-oblongis aut subovatis, subdenticulatis, glabris, petiolo brevissimo, basi dilatato, cum opposito fere nexo: inflorescentia



terminali, sublaxe spicata; floribus brevissime pedicellatis, odoratis, siccitate nigrescentibus, bractea acute ovata squamiformi munitis; calyce cylindrico 5-gono, bracteaque rigide puberulis, dentibus 5, subulatis, inæqualibus, quorum posterior brevior; corolla extus glabra, tubo imo cylindrico, superne ampliore, recurvato, calyce 2-plo longiore, antice sub faucem obliquam paulo ventricosus, parallele nervoso, intus antice retrorsum piloso, limbo 5-lobo, lobis oblongis, subemarginatis, antico paulo latiore, expansis; staminibus inclusis, cum 5° sterili ananthero tenuissime filiformi, antheris sagittatis, acuminatis; stylo vix exserto; ovarii structura ea generis; fructu ignoto.—In Andibus Mendozinis et Chilensibus, v. v. circa Villa Vicencio: v. s. in herb. nostr. et Hook. Chile (Cuming, 226), ibidem (Bridges, 459), Cordillera de Santiago (Germain cum nom. Privæ sp.); in herb. Hook. Villa Vicencio (Gillies), Ojos de Agua (Cruckshanks, 97), Chile (Meyen), Valparaiso (Bridges).

This plant was also collected by me, at a spot a few miles distant from where the preceding species was gathered; it was found by Dr. Gillies at the same place, and by others on the opposite side of the Andes. It has so much the habit of *Ephedra ochreata*, a native of the same region, that, except for its inflorescence, it might be mistaken for a kindred species of that genus. It darkens more than the preceding species (becomes altogether black) in drying. The axils are from  $2\frac{1}{2}$  to  $3\frac{1}{2}$  in. apart, and are articulated by a transverse line formed by the union of the opposite petioles of the decayed leaves; each branchlet has a short articulation above its base, 1 or 2 lines long, as in *Ephedra*. The leaves are seen only on the young branches, as they soon wither; they are about  $1\frac{1}{2}$  line long,  $\frac{1}{2}$  line broad, thick, black, subdenticulated, with a slender very short recurved petiole. The inflorescence is like that of the preceding species,  $1\frac{1}{2}$ –2 in. long, but the flowers are somewhat larger; the subovate bract is squamiform, scarcely 1 line long; the calyx is 3 lines long; the tube of the corolla is 4 lines long, curving sigmoidly outwards and more swollen above the middle than in Sir W. Hooker's drawing, the lobes are 1 line long; inside upon the anterior side the tube is retrorsely pilose; the fifth sterile filament is very distinct, but from its tenuity might be overlooked; the style is dilated and curved at the apex and does not extend beyond the mouth: the construction of the ovary is precisely like that of the typical species. The fruit does not appear to be known; Schauer, who did not see it, assumed it to be a 4-coccos capsule—which must be a mistake, judging by the structure of the ovary.

3. *DIOSTEA STENOPHYLLA*, nob. : humilis, caule prostrato, inferne fruticosa, superne subherbacea, ramosa, ramis plurimis, erectis, ramulis oppositis, tenuiter teretibus, ultimis subulatis, striatis, flexuosis, subfistulosis, glabris, pallidis, interdum fusciscentibus; axillis constrictis, superioribus remotioribus; foliis oppositis, spathulato-linearibus, fere sessilibus, marginibus integris late plicato-reflexis, supra rigide pilosulis vel scabridulis, subtus pubescentibus, pallidis, rigidis, superioribus minoribus linearibus; petiolo brevissimo, imo dilatato et persistente, cum opposito linea transversali nexo: spicis terminalibus, capitato-oblongis, pubescentibus; floribus imbricatis; bracteis acute ovatis, puberulis, calyce dimidio brevioribus; calyce cylindrico, puberulo, inæqualiter dentato, dentibus longe subulatis; corollæ tubo



imo cylindrico, superne ampliore, subincurvo, calyce 2-plo longiore, parallele nervoso, extus puberulo, intus antice sub medium pilis albis longis retrorsis hirsuto; staminibus subbrevibus, didynamis cum 5<sup>to</sup> brevissimo ananthero, inclusis; stylo antheras inferiores vix excedente; ovarii structura ea generis; fructu ignoto.—In Andibus Chilensibus: *v. s. in herb. nostr. Chile (Bridges, 458); in herb. Mus. Brit. et Hook. Chile (Cuming, 282), Cordillera Chile (Bridges, 1220).*

This plant does not grow higher than 2 feet, often only half that size; the main stems appear to run parallel with the ground, and to throw up vertical branches  $1\frac{1}{2}$  line thick, with branchlets half that thickness, the lower axils are  $\frac{1}{2}$ –1 inch apart, the upper internodes being  $1\frac{1}{2}$  inch long: the lower leaves are 1 inch long, when unfolded  $1\frac{1}{2}$  line broad, on a slender petiole  $1\frac{1}{2}$  line long, the upper leaves are almost sessile, 3 lines long; the margins of the leaves are folded back to such an extent that they almost meet. In my specimen the spikes are 10 lines long; the bracts are 2 lines long,  $\frac{3}{4}$  line broad; the calyx 3 lines long; the tube of the corolla 4 lines long, the lobes of the border  $1\frac{1}{3}$  line long; both the calyx and corolla are of thinner texture than in the preceding species, and the structure of the ovary is exactly like that of all the foregoing plants.

4. *DIOSTEA FILIFOLIA*, nob.: suffruticosa, tota pallide glauca, e basi ramosa, ramis teretibus, striatis, lignosis, ramulisque oppositis, elongatis, tenuiter virgatis, recte adscendentibus, obsolete 4-gonis, striolatis, glabris, subfistulosis, internodiis inferioribus brevioribus, superioribus in ramulis multo longioribus; foliis oppositis, anguste linearibus, imo in petiolum brevem subspathulatis, integris, marginibus revolutis, coriaceis, rigide pilosulis, petiolo dilatato cum opposito linea transversali nexo: spicis terminalibus, cylindræis; floribus imbricatis, sessilibus, bractea oblonga mucronata calyce brevior instructis; calyce cylindrico, pilosulo, membranaceo, dentibus 5, longis, subulatis, inæqualibus, cum nervis totidem continuis, brevior postico; corollæ tubo subinfundibuliformi, parallele nervoso, tenuiter membranaceo, subincurvo, extus glabro, intus antice retrorsum hirsuto, lobis oblongis, subemarginatis, antico paulo latiore, expansis; staminibus brevibus, inclusis, didynamis, cum quinto sterili sæpius abortivo; ovarii stylique structura ea generis; fructu ignoto.—In Andibus Chilensibus: *v. s. in herb. nostr. et Hook. Cordillera de Santiago (Germain).*

Germain's specimens were distributed under the name of *Verbena spathulata*, Hook. & Gill., which is a very different plant and a true *Verbena*. This appears to be a low very branching shrub; its many branches are lignescent, its upper branchlets hollow and filled with pith; the axils in the branches are  $\frac{1}{2}$ – $\frac{3}{4}$  inch apart, and  $1\frac{1}{2}$ –2 inches apart in the numerous virgated floriferous branchlets, which are 10 inches long and barely  $\frac{1}{2}$  line thick; the spikes are about 10 lines long, the flowers very imbricated and subdivergent; each bract is 2 lines long, 1 line broad, with a carinate nerve and a mucronate point, subcuneate at base; the calyx is 3 lines long; the tube of the corolla is 4 lines long, with several parallel nerves, membranaceous, the lobes of the border being 1 line long.



5. *DIOSTEA VALDIVIANA*, nob.: *Dipyrena Valdiviana*, Philippi, Linn. xxix. 31: arbuscula glaberrima, ramosa, ramis ramulisque oppositis, elongatis, virgatis, subfistulosis, striolatis, brunneis: foliis oppositis, lanceolato-oblongis, acutis, mucronatis, integerrimis, aut apice obsolete dentatis et tunc dentibus utrinque 3, coriaceis, enerviis, utrinque brevissime scabrido-pilosulis; petiolo imo incrassato, intus pubescente, brevi: spicis terminalibus, brevissimis, rachi pubescente; floribus circiter 20, azureis, fere sessilibus, e cupulis carnosis alternis ebracteatis crebre singulatim ortis et in verticillis interruptis subaggregatis; calyce ovato-inflato, carnosus, subpilosulo, ore constricto, e nervis excurrentibus 5-denticulato, dentibus intus pilosis, persistente, demum aucto, glabro, submembranaceo, nitido; drupa calyce inclusa, carnosula, glabra, 2-pyrena, pyrenibus 1-ocularibus.—In Chile, prov. Valdivia circa Osorno: *v. s. in hb. Hook.* in fructu, prov. Valdivia ad Huiti (*Lechler*, 615).

This is described as an arborescent shrub, about 20 feet high, woody at the base, throwing up numerous repeated ramifications, which are slender and virgated: the axils in the branches are about 2 inches, in the branchlets 1 inch apart; the flowering branchlets are 3–10 inches long: the leaves are 3–9 lines long, 2–3 lines broad; the terminal spikes are  $\frac{1}{2}$  inch long: the style is scarcely exerted: the drupe is  $1\frac{1}{3}$  line long, and its nucules are constructed as in the typical species.

6. *DIOSTEA SCIRPEA*, nob.: *Lippia scirpea*, Philippi, Linn. xxxiii. 196; Ann. Univ. Chil. (1862) ii. 402: fruticosa, subaphylla, glabra, ramosa; ramulis elongatis, striatis; foliis oppositis, minimis, oblongis: spicis terminalibus; floribus bifariis, laxis, bractea squamiformi instructis; calyce longe tubuloso, glabro, dentibus inæqualibus, subulatis; corollæ albidæ tubo calyce duplo longiore, fauce pilosa; fructu ignoto.—In Andibus Chilensibus, paso de los Piuquenes (*Diaz*). (*Non vidi*.)

This plant, very closely allied to *Diostea scoparia*, was found in the Portillo de los Piuquenes, the summit pass of the main ridge of the Cordillera, where it attains an elevation of 10,000 or 12,000 feet, and forms the head source of the river Maypo on one side, while to the eastward it leads into the valley of the Tupungato, and finally debouches upon the plains near Luxan, 5 leagues to the southward of Mendoza. It is evidently a small shrub with many lignescent branches rising from the base, and divided into numerous branchlets 1 foot long,  $1\frac{1}{4}$  line thick, with axils 1– $1\frac{1}{2}$  inch apart; below they are aphyllous, but the younger and more slender branchlets have opposite, almost squamiform leaves  $1\frac{1}{4}$  line long; the spikes are 1–2 inches long; the subulate bracts are  $1\frac{1}{4}$  line long; the pedicels scarcely 1 line long; the calyx is  $2\frac{1}{2}$  lines long; the tube of the corolla is curved, 4 lines long, the border being 4 lines in diameter, its lobes are of a sulphur-colour when dry, with black veins. Doctor Philippi suggests that this plant may be identical with *Dipyrena glaberrima*, Hook.; but had he seen the latter, such an idea would never have occurred to him.

7. *DIOSTEA INFUSCATA*, nob.: *Lippia juncea*, Gay, in parte (non Sch.), Fl. Chil. v. 50: suffruticosa, ramosa, ramis teretibus, virgatis, fistulosis, striolatis, glaberrimis, sicci-



tate nigrescentibus, in axillis linea transversali constrictis; foliis oppositis, lanceolatis, utrinque acutis, mucronatis, integerrimis, crasso-coriaceis, enerviis; petiolo brevi, imo incrassato et cum opposito nexo, limbo delapso persistente et tunc noduliformi: spicis terminalibus; floribus parvis, laxis, subpatentibus.—In prov. Valdivia: *v. s. in hb. Hook. ad Rio Negro (Gay)*.

This plant has much the aspect of *D. juncea*, but the leaves are smaller, more lanceolate, entire, and the flowers are only half the size; it is also very different from *D. Valdiviana*, its branches being more herbaceous, less branched, becoming black in drying; and its axils are more distant, being  $1\frac{1}{2}$ –2 inches apart: the leaves are 4–9 lines long,  $1\frac{1}{2}$ –2 lines broad. The terminal spike is 1 inch long: the 5-nerved calyx has five short excurrent teeth, it is smooth below, pubescent on both sides towards the top, and is 1 line long: the corolla is swollen below its mouth, retrorsely pilose inside, the tube being  $2\frac{1}{2}$  lines long, its 4 rounded lobes  $\frac{1}{2}$  line long, the upper one being deeply bifid; there is a rudimentary fifth stamen, the longer pair not extending beyond the mouth.

## DESCRIPTION OF THE PLATES.

### PLATE XXVI.

Shows a portion of a plant of *Raphithamnus cyanocarpus*, in flower and in fruit: *natural size*.

Fig. 1. A flower.

Fig. 2. The calyx and style: *both nat. size*.

Fig. 3. The pistil, with half of the calyx removed.

Fig. 4. The corolla cut open to show the position of the stamens in regard to the lobes of the border: *both magnified*.

Fig. 5. A stamen, seen in three different positions.

Fig. 6. The style and stigma: *both more magnified*.

Fig. 7. A longitudinal section of the ovary, in a line parallel with the floral axis.

Fig. 8. A transverse section of the same, showing its four uniovular cells, separated in the direction of the floral axis by the space occupied by the hollow central columella: *both magnified*.

Fig. 9. A fruit, with its umbilicated apex.

Fig. 10. The same, with half of its fleshy covering removed, showing its two contained nucules.

Fig. 11. One of the nucules, seen on its external face.

Fig. 12. The same, seen on its inner flattened face, showing the two apertures leading into the base of the cells, for the passage of the cords of nourishing vessels from the columella.

Fig. 13. A transverse section of the same, showing the position of the seeds and of their raphe: *all nat. size*.

Fig. 14. One of the nucules, with its inner wall cut away, showing the position of the seeds and the apertures leading into the cells for the cords of nourishing vessels.

Fig. 15. A cross longitudinal section of the same, through one of the cells, showing the basal aperture, the seed being removed.

Fig. 16. The seed removed, showing the raphe in continuation with the cord of nourishing vessels.

Fig. 17. The exalbuminous embryo extracted, showing its basal radicle and fleshy cotyledons: *all magnified*.



## PLATE XXVII.

A plant of *PHELLODERMA CUNEATO-OVATA*, of the natural size.

- Fig. 1. A flower, with its bract: *magnified*.  
 Fig. 2. The bract, separately.  
 Fig. 3. The calyx.  
 Fig. 4. The corolla cut open, showing the position of the didynamous stamens with the fifth sterile filament.  
 Fig. 5. The pistil: *all magnified on the same scale*.  
 Fig. 6. Two of the stamens, seen in front and sideway: *more magnified*.  
 Fig. 7. A transverse section of the ovary at the maturity of the flower: *magnified*.  
 Fig. 8. A fruit, invested by the persistent calyx.  
 Fig. 9. The same, with the calyx removed: *both nat. size*.  
 Fig. 10. The same: *magnified*.  
 Fig. 11. A transverse section of the same, showing the two nucules, with the vacant space between them formed by the central columella.  
 Fig. 12. A transverse section of one of the nucules.  
 Fig. 13. A transverse section of the tubular membranaceous columella adhering to the nucules.  
 Fig. 14. One of the nucules, seen on its ventral face, surrounded by its pith-like mesoderm.  
 Fig. 15. A longitudinal section of the same, showing its two cells, with the basal channels leading into them.  
 Fig. 16. A cross longitudinal section of the same, through one of the cells, showing the basal channel leading into it, for the passage of the cord of nourishing vessels proceeding from the central placentary columella.  
 Fig. 17. A seed extracted, seen on its inner face, with its raphe and chalaza.  
 Fig. 18. The same, seen on its inner edge, showing the ascending raphe in continuation with the cord of nourishing vessels.  
 Fig. 19. The same deprived of its outer integument.  
 Fig. 20. The embryo, seen on its face.  
 Fig. 21. The same, seen on one side: *all magnified on the same scale*.

## PLATE XXVIII.

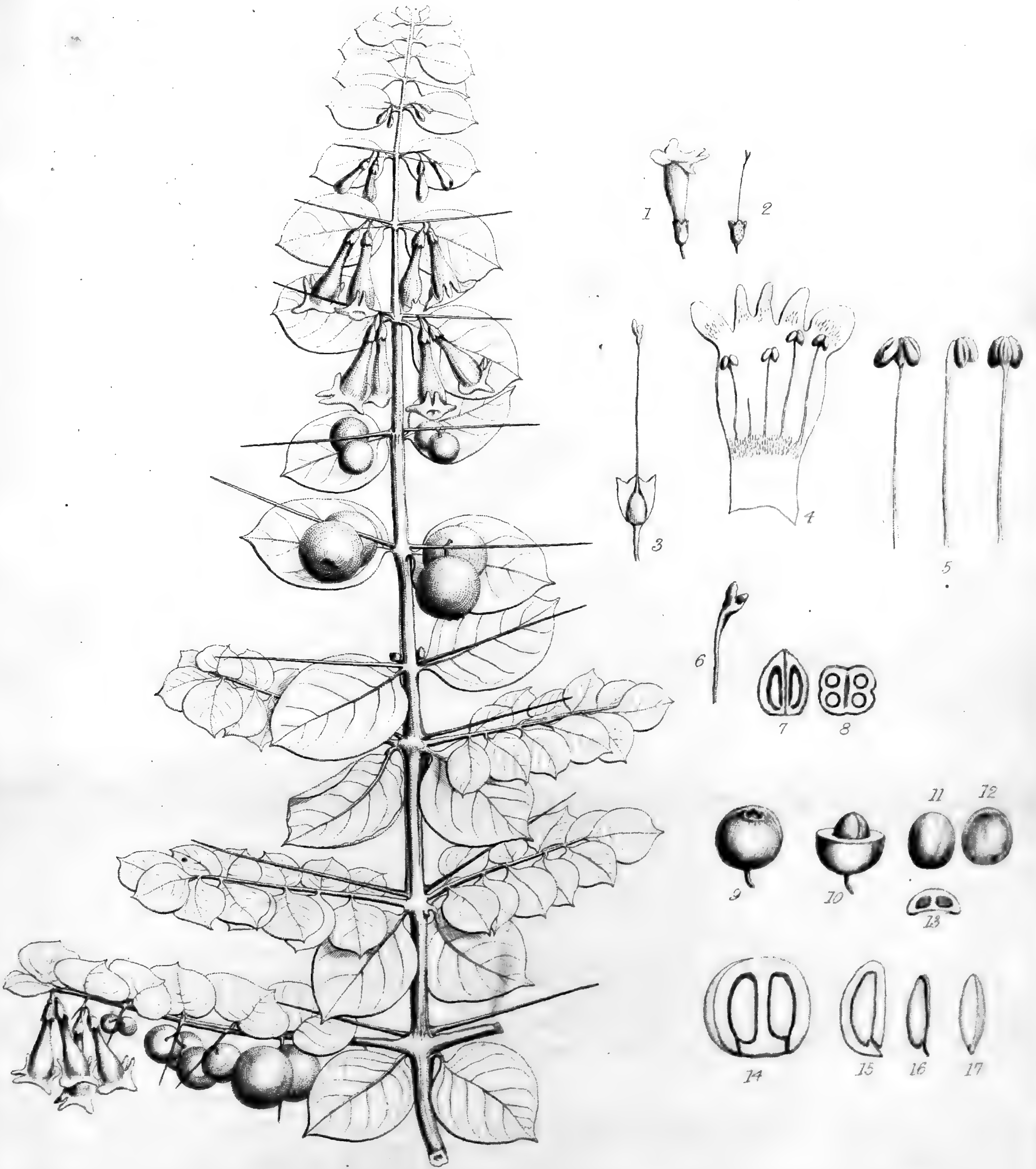
The upper portion of a plant of *DIOSTEA JUNCEA*, of the natural size.

- Fig. 1. A flower: *nat. size*.  
 Fig. 2. A bract: *magnified*.  
 Fig. 3. The calyx and bract.  
 Fig. 4. The calyx, separated.  
 Fig. 5. The corolla, separated.  
 Fig. 6. The same, cut open on the posterior side, to show the position of the stamens.  
 Fig. 7. The pistil: *all magnified on the same scale*.  
 Fig. 8. The stamens: *more magnified*.  
 Fig. 9. A transverse section of the ovary, at an early stage.  
 Fig. 10. The same, at the maturity of the flower: *both magnified*.  
 Fig. 11. A fruit, enclosed in its persistent calyx: *nat. size*.  
 Fig. 12. The same: *magnified*.  
 Fig. 13. The same, with the calyx removed.



- Fig. 14. A transverse section of the same, showing the two unilocular nucules, with the vacant space between them, and the position of the raphe next the axis of inflorescence.
- Fig. 15. A nucule, seen on its ventral face, with the somewhat lateral placentary patch at its base, where it is attached to the central columella.
- Fig. 16. A longitudinal section of the same, showing the channel leading into the cell, for the passage of the funicular chord passing from the placentary patch, in communication with the ascending raphe of the seed.
- Fig. 17. A longitudinal section of the same, in the contrary direction.
- Fig. 18. A side view of the seed removed from its cell, showing the ascending raphe terminating in the apical chalaza, and in connexion with the basal funicular cord.
- Fig. 19. The same, shown on its anterior edge.
- Fig. 20. The embryo, seen on its face.
- Fig. 21. The same, seen on its edge : *all equally magnified.*





J. Miers del.

*Raphithamnus cyanocarpus*, Miers.

G. Jarman sc.



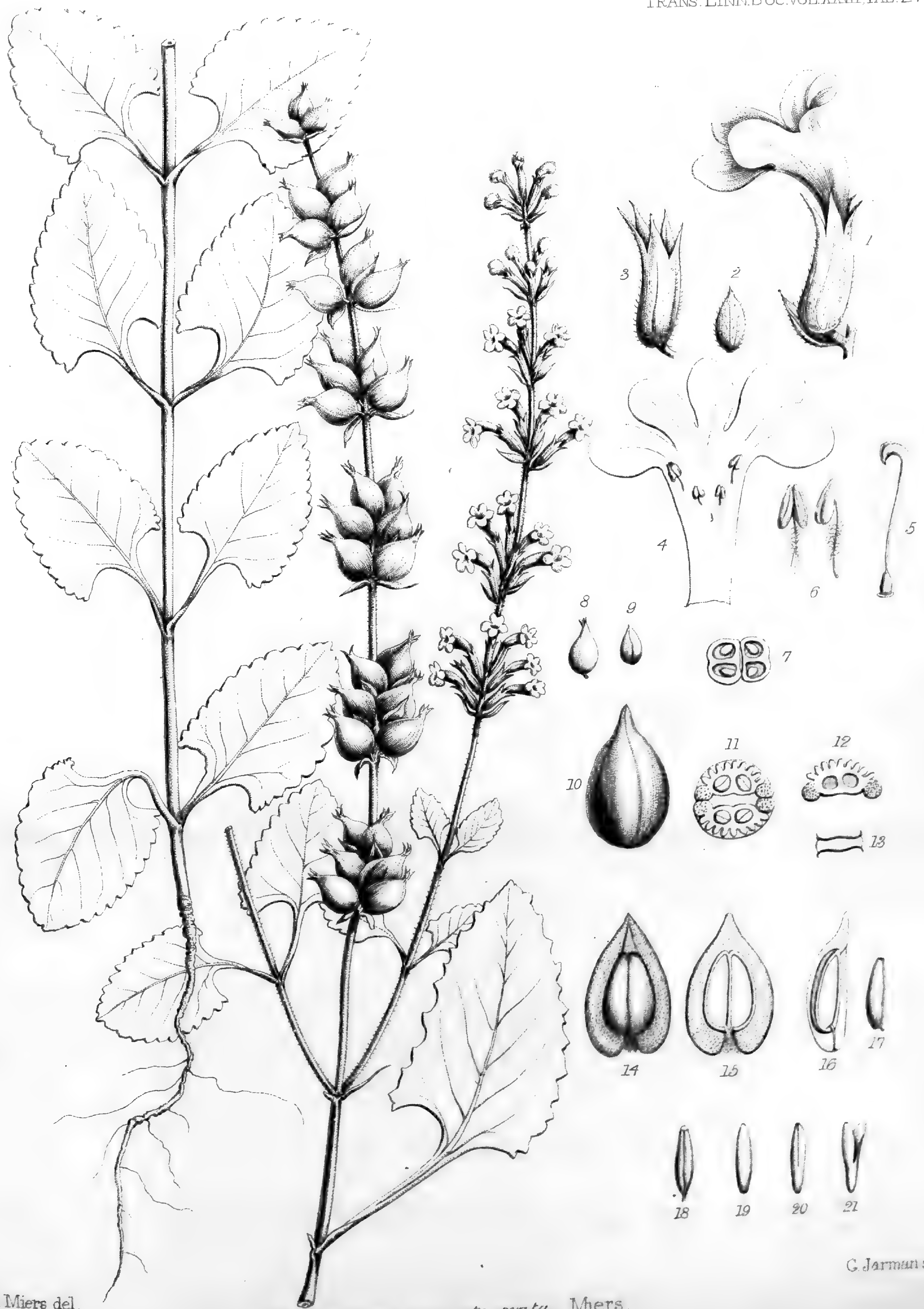


J. Miers del.

*Diostea juncea*, Miers.

G. Jarman sc.





J. Miers del.

*Phellodermma cuneato-ovata* Miers.

G. Jarman sc.



III. *On the Genus Boswellia, with Descriptions and Figures of three new Species.* By  
 GEORGE BIRDWOOD, M.D. Edinburgh. Communicated by DANIEL HANBURY, Esq.,  
 F.R.S. & L.S.

(Plates XXIX.—XXXII.)

Read April 1st, 1869.

I OFFER here the descriptions of three new species of *Boswellia*, natives of the Soumali country. The characters of one of them make it, I believe, necessary that the characters hitherto given of the genus *Boswellia* should be reconsidered; and hence the first part of the title which I have, very reluctantly, given to this paper. Another of these plants, all of which yield frankincense, yields, I believe, the bulk of the olibanum of commerce. And I believe that the discovery of these plants settles at last the controversy which has gone on for ages concerning frankincense.

The offering of incense on altars, and in cups and closed censers, is represented in painting and in sculpture on the monuments of Egypt and Assyria; but although incense, as a rule, implies frankincense, and these representations might with more or less plausibility be interpreted by the Jewish ritual, they merely record the contemporaneous use of incense. We are expressly told by Herodotus that frankincense was excluded from the balsamic substances used in the preparation of the mummies of the Egyptians; but although this might perhaps have been because of its being sacred to the service of their gods, still the first undoubted record of the use of frankincense, and the first mention of it—as yet known—is in the

BIBLE.—“Stacte, and onycha, and galbanum, with pure frankincense” were the “sweet spices” of which the “pure and holy perfume,” or “confection,” of divine prescription was made “after the art of the apothecary,” which was offered every morning and evening, on the “Altar of Incense” or “Golden Altar,” set in the “Holy Place” between the “Golden Candlestick” and “the Table of Shewbread,” before the “Holy of Holies”<sup>1</sup>. The priest took a censer, “full of burning coals of fire,” from off “the Altar of Burnt Offering” or “Brazen Altar,” and his “hands full of the sweet incense beaten small,” and entered “the Holy Place” from “the Court of the Tabernacle,” and emptied his censer upon the Golden Altar, and “put the incense upon the fire before the Lord, that the cloud of incense may cover the mercy-seat”<sup>2</sup>. It was death for the priests to make the sacred incense for themselves, even “to smell thereto”<sup>3</sup>, or for any one but the priests, “the seed of Aaron,” to offer it<sup>4</sup>, or to burn “strange incense” upon the Golden Altar<sup>5</sup>.

<sup>1</sup> Exod. xxx. 34–36.

<sup>2</sup> Lev. xvi. 12, 13.

<sup>3</sup> Exod. xxx. 37, 38.

<sup>4</sup> Numb. iii. 10; xvi.; 2 Chron. xxvi. 16–24.

<sup>5</sup> Exod. xxx. 9; Lev. x. 1–7; Numb. iii. 4, xxvi. 61.



Neither was it lawful to offer burnt sacrifice or meat-offering, or to pour drink-offering thereon<sup>1</sup>; but the blood of the sin-offering of atonements was once in every year sprinkled upon the horns thereof<sup>2</sup>. "Pure frankincense" was put on each of the two rows in which the twelve baked cakes of fine flour were set on the Table of Shewbread<sup>3</sup>; it was also put upon the meat-offering<sup>4</sup>, and was expressly prohibited to be put upon the sin-offering of fine flour, "for it is a sin-offering"<sup>5</sup>, or on "the offering of jealousy" of barley meal, "for it is an offering . . . bringing iniquity to remembrance"<sup>6</sup>. And in the service of the sanctuary, certain Levites were appointed to oversee "the frankincense and the spices"<sup>7</sup>, which were laid in "a great chamber" "of the house of God"<sup>8</sup>.

Frankincense is often named in the poetical books of the Old Testament:—"Who is this that cometh out of the wilderness, like pillars of smoke, perfumed with myrrh and frankincense, with all powders of the merchant?"<sup>9</sup>—an image which those only can fully appreciate who have themselves been

"Where through the sand of morning land  
The camel bears the spice."

"A garden inclosed is my sister, my spouse; a spring shut up, a fountain sealed. Thy plants are an orchard of pomegranates, with pleasant fruits; camphire [henna], with spikenard, spikenard and saffron; calamus [*Roosa* of India] and cinnamon, with all trees of frankincense; myrrh and aloes [aloeswood], with all the chief spices. A fountain of gardens, a well of living waters, and streams from Lebanon"<sup>10</sup>.

"I have not caused thee to serve with an offering, nor wearied thee with incense [frankincense]. Thou hast bought me no sweet cane [*Roosa*] with money"<sup>11</sup>. "The multitude of camels shall cover thee, the dromedaries of Midian and Ephah; all they from Sheba shall come; they shall bring gold and incense" [frankincense]<sup>12</sup>.

"He that offereth an oblation is as if he offered swine's blood; he that burneth incense [frankincense], as if he blessed an idol"<sup>13</sup>.

"To what purpose cometh there to me incense [frankincense] from Sheba, and the sweet cane [*Roosa*] from a far country?"<sup>14</sup> "And they shall come from the cities . . . and from the plain, and from the mountains, and from the south [Arabia<sup>15</sup>], bringing

<sup>1</sup> Exod. xxx. 9.

<sup>2</sup> Exod. xxx. 10; Lev. iv. 7.

<sup>3</sup> Lev. xxiv. 7.

<sup>4</sup> Lev. ii. 1, 2, 15, 16; vi. 15.

<sup>5</sup> Lev. v. 11.

<sup>6</sup> Numb. v. 15.

<sup>7</sup> 1 Chron. ix. 29.

<sup>8</sup> Nehemiah, xiii. 5-9.

<sup>9</sup> Song of Songs, iii. 6.

<sup>10</sup> Song of Songs, iv. 12-15.

<sup>11</sup> Isaiah, xliii. 23, 24.

<sup>12</sup> Isaiah, lx. 6.

"See a long race thy spacious courts adorn;  
See future sons and daughters yet unborn,  
In crowding ranks on every side arise,  
Demanding life, impatient for the skies!  
See barbarous nations at thy gates attend,  
Walk in thy light, and in thy temple bend!  
See thy bright altars throng'd with prostrate kings,  
And heap'd with products of Sabæan springs!  
For thee Idume's spicy forests blow,  
And seeds of gold in Ophir's mountains glow!"

<sup>13</sup> Isaiah, lxvi. 3.

<sup>14</sup> Jeremiah, vi. 20.

<sup>15</sup> Matt. xii. 42; compare Gen. xxv. 6, and Matt. ii. 1.



burnt-offerings, and sacrifices, and meat-offerings and incense [frankincense], and bringing sacrifices of praise, unto the house of the Lord ”<sup>1</sup>.

These passages emphatically derive frankincense from Sheba.

The Hebrew words for incense are quite different from the Hebrew word for frankincense (*Lebonah*); but in most of the passages where they are found, frankincense may be understood as necessarily a constituent of the sacred incense of the Jewish ritual. Kitto says that these words for incense (*miktar*, *kitter*, and *keturoth*) all signify to raise an odour by burning, and are applied not only to the offering of incense, but of sacrifices, and he points out that the word which denotes the incense of sweet spices in Exod. xxx. 1, describes an incense of fat in Psalm lxvi. 15 : “ I will offer unto thee burnt sacrifices of fatlings, with the incense of rams; I will offer bullocks with goats.” But the word may be used here to give poetic expression to the passage, as the thing itself was to give a sweet savour to the burnt sacrifices. In 1 Chron. vi. 49, the word for incense is also used, according to Calmet, for the fat of victims offered on the altar of the burnt-offerings, but here, it may be supposed, without poetical licence. Gradually, as the spiritual discernment of the Jews developed, the offering of incense itself sublimed into prayer, as indicated in the figurative language of David, in Psalm cxli. 2, “ Let my prayer be set forth before thee as incense, and the lifting up of my hands as the evening sacrifice.” And the same figure is used in the magnificent imagery of the Apocalypse : “ And the four-and-twenty elders . . . having every one of them harps, and golden vials full of odours, which are the prayers of the saints”<sup>2</sup>. “ And another angel came and stood at the altar, having a golden censer; and there was given unto him much incense, that he should offer it with the prayers of all saints upon the golden altar which was before the throne. And the smoke of the incense, with the prayers of the saints, ascended up before God out of the angel’s hand ”<sup>3</sup>.

The Jews buried their dead, the burning of the bodies of Saul and his sons<sup>4</sup> having been quite exceptional; but still they largely used unguents and spices, probably including frankincense, in their sepulchral rites. The dead body was anointed with spike-nard<sup>5</sup>, and “ they wound it in linen clothes with the spices, as the manner of the Jews is to bury ”<sup>6</sup>. And of the burial of Asa it is written, “ And they buried him in his own sepulchre, which he had made for himself in the city of David, and laid him in the bed which was filled with sweet odours and divers kinds prepared by the apothecary’s art : and they made a very great burning for him ”<sup>7</sup>.

The account in the Iliad, of the burning of the dead body of Patroclus, would, by substituting the presentation of cows to Brahmins for the sacrifice of horses at the pyre, and milk for wine to quench its embers, serve to describe the funeral rites of a wealthy high-caste Hindoo of Bombay, in which frankincense, with all manner of balsamic substances, and fragrant woods and oils, are largely used; and we know that in the burning of their dead and in their sacrifices the Greeks, like the Romans, used frankincense extravagantly; but yet frankincense is not anywhere named in the Iliad or Odyssey, and it

<sup>1</sup> Jeremiah, xvii. 26.

<sup>2</sup> Rev. v. 8.

<sup>3</sup> Rev. viii. 3, 4.

<sup>4</sup> 1 Sam. xxxi. 12, 13.

<sup>5</sup> John, xii. 7.

<sup>6</sup> John, xix. 39, 40.

<sup>7</sup> 2 Chron. xvi. 14; Pet. Cunæus de Respub. Hebræorum. Leyden, 1631.



is said that it was unknown to the Greeks at the time when they were written<sup>1</sup>. But from about B.C. 400 frankincense is commonly and unceasingly mentioned by classical writers.

HERODOTUS (born B.C. 484) mentions it frequently<sup>2</sup>; and what he says about it is of course particularly valuable. He says, "Arabia . . . is the only country which produces frankincense, myrrh, cassia, cinnamon, ladanum. The Arabians do not get any of these, except myrrh, without trouble. The frankincense they procure by means of the gum storax, which the Greeks obtain from the Phœnicians; this they burn and thereby obtain the spice. For the trees which bear the frankincense are guarded by winged serpents, small in size and of varied colours, whereof vast numbers hang about every tree. They are of the same kind as the serpents which invade Egypt, and there is nothing but the smoke of the styrax which will drive them from the trees"<sup>3</sup>. "As one proceeds beyond Heliopolis up the country, Egypt becomes narrow, the Arabian range of hills, which have a direction north to south, shutting it up on one side, and the Libyan range upon the other. The former ridge runs on without a break and stretches away to the sea called Erythræan: it contains the quarries whence the stone was cut for the pyramids of Memphis; and this is the point where it ceases its first direction, and bends away in the manner above indicated. In its greatest length from east to west it is, as I have been informed, a distance of two months' journey; towards its extreme east, its skirts produce frankincense"<sup>4</sup>. "The Arabs brought every year a thousand talents of frankincense, in tribute to Darius"<sup>5</sup>. "It is also on the great altar [of gold] that the Chaldæans burn the frankincense, which is offered to the amount of one thousand talents weight, every year at the festival of the god"<sup>6</sup> [Bel]. In describing "the mode of embalming amongst the Egyptians, according to the most perfect practice," he says "they fill the cavity [of the abdomen] with the purest bruised myrrh, with cassia, and every sort of spicery, *except frankincense*"<sup>7</sup>. And of the Scythians, "Their women make a mixture of cypress, cedar, and frankincense wood, which they pound into a paste upon a rough piece of stone, adding a little water to it. With this substance, which is of a thick consistency, they paste their faces all over, and indeed their whole bodies. A sweet odour is thereby imparted to them; and when they take off the plaster on the day following, their skin is clean and glossy"<sup>8</sup>.

THEOPHRASTUS, who lived only a century later (B.C. 394–287), gives the fullest and most accurate account of frankincense of all ancient writers. I give a translation of what he says about it, in full, and especially as it has never before, I believe, been done into English (History of Plants, book ix. ch. 4)<sup>9</sup>.

"Concerning frankincense and myrrh and balsam, and whatever else is like these, it

<sup>1</sup> Crusius, Homeric Lexicon, trans. Smith, ed. Arnold.

<sup>2</sup> Schweighæuser, Lexicon Herodoteum.

<sup>4</sup> Book ii. Euterpe, 8, Rawlinson's trans.

<sup>6</sup> Book i. Clio, 183, Rawlinson's trans.

<sup>8</sup> Book iv. Melpomene, 75, Rawlinson's trans.

<sup>3</sup> Book iii. Thalia, 107, Rawlinson's translation.

<sup>5</sup> Book iii. Thalia, 97, Rawlinson's trans.

<sup>7</sup> Book ii. Euterpe, 86, Rawlinson's trans.

<sup>9</sup> Θεόφραστος. Theophrasti Eresii opera quæ supersunt omnia. Græca recensuit, Latine interpretatus est, indices rerum et verborum absolutissimos adjecit Fridericus Wimmer, Doct. Philos. Parisiis, Didot, 1866, 8vo, pp. 143–145.



has [already] been said, that they are produced by incision, and spontaneously. And we must [now] endeavour to tell what is the nature of the trees, and if they have any thing peculiar as to their origin or collection, or other matters; and, in like manner, concerning the other sweet-smelling trees; for almost the whole of them grow in places towards the south and east. The frankincense-tree and myrrh and cassia and cinnamon grow in the Chersonese of the Arabians, about Saba and Adramyta, and Citibæna and Mali. But the trees of frankincense and myrrh grow, some of them on the mountain, and others in private plantations, at the foot of the mountain; on which account, some of them are cultivated, and others are not: and they say that the mountain is lofty and thickly wooded, and covered with snow, and that rivers also flow down from it into the plains, and that the frankincense-tree is not large, being five cubits high, and covered with boughs, and that it has a leaf like that of the pear-tree, only much smaller, and is of a grassy colour, very like rue, and has altogether a smooth bark like the laurel; but that the myrrh-tree is still smaller in size and more shrub-like, and that it has a hard trunk, and is twisted towards the ground, and is thicker than a man's leg, and has a smooth bark, like purslane. But others, who say they have seen them, nearly all agree concerning their size, namely, that neither of the trees is large, the myrrh-tree being the smaller and lower [of the two]. And they state that the frankincense bears a resemblance to a laurel, and that it has a smooth bark, but that the myrrh is prickly and not smooth, and that it has a leaf like the elm, only crisp, and prickly at the top, like the ilex-tree. And these said that in a voyage which they were making from the Bay of Heroes, they disembarked to search for water on the mountain, and thus saw the trees and the mode of collecting [the frankincense]. And that the trunks and boughs of both were incised; but that the former appeared to have been cut, as it were, by an axe, and the latter to have had more gentle incisions; and that the drops partly fell down and partly remained on the tree. And that in some places mats woven of palm-leaves were placed underneath, while in others the ground underneath was hardened and kept clean; and that the frankincense on the mats was pure and transparent, but that on the ground less so; and that they scraped off what adhered to the trees with knives, so that the bark stuck to some of them. And they said that the whole mountain was divided among the Sabæans; for that they were the lords [of the place], and that they were just towards one another, on which account no one kept any guard [over his own property]; and that having themselves taken thence an abundance of frankincense and myrrh, which they placed in their ships, none of the inhabitants being present, they had sailed away. And these both told this, and said they heard that the myrrh and frankincense is gathered together on every side to the temple of the Sun; and that this belongs to the Sabæans, being by far the most sacred thing in the country, and that certain armed Arabs have the custody of it; and that when they bring it, each, heaping up his own frankincense, and the myrrh in a similar way, leaves them with the keepers, and places upon the heap a little tablet, stating the number of the measures, and the price at which each measure is to be sold; and that when the merchants come they inspect these tablets, and having measured any heap that pleases them, they put the price of it in the place from which it is taken; and that the priest then coming takes a third part of the price for the god, and there



leaves the remainder, which is kept safe for the owners until they come and take it. But certain others say that the frankincense-tree is like the lentisk, and its fruit to the berries of the same, and that the leaf of it is reddish; and that the frankincense from the young trees is whiter and less fragrant, while that from the older trees is yellowish and more fragrant; and that the myrrh-tree is like the terebinth, but rougher and more thorny, and the leaf a little rounder and, if chewed, resembling the terebinth in taste; and that of these, also, the older are the more fragrant. And that both grow in the same place, and that the ground [there] is argillaceous and flaky, and that springs of water are rare. These things, however, are contradictory [to the statement] that it snows and is wet [in that locality], and that rivers issue from it. And others also say that the tree is like the terebinth, and others that it is the terebinth itself; for that specimens of the wood were brought to Antigonus by the Arabs who conveyed the frankincense, and that they differed in nothing from the terebinth. These, however, showed still greater ignorance; for they thought that both the frankincense and the myrrh grew on the same tree. On which account, the report brought by those that sailed from the City of Heroes is more credible; since the frankincense-tree that grew above Sardis, in a certain temple, has a leaf like the laurel, if from this we may form a conclusion, and the frankincense produced from it, whether from the trunk or branches, is like the other frankincense in appearance, and in smell when it is burnt. And this tree alone grew without [any culture]. And some say that the frankincense grows more abundantly in Arabia, but more beautiful in the neighbouring islands, over which the Arabs have sway; for there they make figures upon the trees of whatever they like; which is not incredible, as they admit of any incision that persons may wish to make in them. Some of the grains also are very large, in bulk as much as a handful, and in weight more than the third part of a mina. All frankincense is brought to market in a rough state, similar in appearance to the bark of a tree; but of myrrh there are two kinds, the one in drops, and the other in moulds. The quality is judged of by the taste; and from this they choose what is of uniform colour. Concerning frankincense and myrrh, this is nearly as much as we have heard up to the present time."

A fragment of AGATHARCIDES (B.C. 200) is said, for I have not seen the passage myself, to enumerate balm, cassia, frankincense, myrrh, and cinnamon as the productions of Saba.

DIODORUS (about B.C. 50) writes<sup>1</sup>:—"Next to these inhabit those Arabians called Carbi, and next to them the Sabæans, the most populous of any of the Arabians; for they possess Arabia the Happy, exceeding rich in all those things which we esteem most precious; and for breeding of cattle of all sorts, the most fertile country in the world; for the whole country is naturally perfumed all over, almost every thing growing there sending forth continually most excellent odours. On the sea-coasts grow balsam, cassia, and another herb of a strange and peculiar property, which while it is fresh is delightful and strengthening to the eyes, but kept awhile, presently loses its virtue. Higher in the heart of the country, are shady woods and forests, graced and beautified with stately

<sup>1</sup> Book v. Chap. iii. Booth's Translation, Lond. 1814, vol. i. pp. 186-189.



trees of frankincense and myrrh, palm-trees, calamus, and cinnamon, and such like odoriferous plants; for none can enumerate the several natures and properties of so great a multitude, or the excellency of those sweet odours that breathe out of every one of them. For their fragrancy is such, that it even ravishes the senses with delight, as a thing divine and unutterable; it entertains them that sail along by the coast at a great distance with its pleasures and delights. For in spring-time the winds from off the land waft the air, perfumed with the sweet odours of myrrh and other odoriferous plants, to those parts of the sea that are next to them. And these spices have nothing of a faint and languishing smell, as those that come to our hands, but a strong and vigorous odour, that strongly pierces all their senses to the utmost of their capacity; for the wafts of air dispersing the perfumes of these odoriferous plants, abundance of pleasant, healthful, and strange variety of scents (proceeding from the richest spices) are conveyed to them that sail near unto the coast. For this sweet smell comes not from fruit bruised in a mortar (whose strength is in a great measure decayed) or from spices made up in divers sorts of vessels for transportation; but from the ripeness of the fruit as it grows, and from the pure and divine nature of the plant itself. So that they that have the advantage of these sweet odours, seem as if they were entertained with that feigned meat of the gods called ambrosia, since those excellent perfumes cannot have a name ascribed them transcending their worth and dignity.

“Yet fortune has not imparted to men an entire and unmixed felicity in these things; but has joined some inconveniencies with these advantages, to correct them who (through a constant confluence of earthly blessings) have usually despised and slighted the gods. For these fragrant forests abound with red serpents of a span long, whose bite is deadly and incurable. They strike a man with a violent assault, leaping up in his very face, leaving him besmeared with his own blood.

“The capital city of this nation is called Saba, and stands upon a high hill; they are governed by kings, who inherit the crown by descent; yet the honour allowed them by their subjects is such, as that they are in some respects, notwithstanding, in a sort of bondage and slavery; for though they seem to be privileged in this, that they have a sovereign and absolute power in making laws, and are not to give an account of any of their actions to their subjects; yet they are as unhappy in this, that they are never to stir out of their palace; for if they do, the people stone them to death, for so they are commanded by an ancient oracle.

“This nation not only excels all the neighbouring barbarians in wealth, but all other people whatsoever for plenty of every thing that is accounted precious; for in their traffic, for a thing of a very small weight, they receive a greater sum of money than any other merchants that sell goods for silver.

“Being, therefore, that they never were conquered, by reason of the largeness of their country, they flow, as it were, in streams of gold and silver, especially at Saba, the seat-royal of their kings; their vessels and all their cups are of gold and silver, and likewise their beds, chairs, and stools have their feet of silver; and all other their household stuff is so sumptuous and magnificent, that it is incredible. The porticoes of their houses and temples are some of them overlaid with gold; and silver statues are placed upon



some of the chapiters of the temples. The doors and roofs of their inner rooms are adorned with many golden bowls, set with precious stones, and other things of great value; for they have enjoyed a constant and uninterrupted peace for many ages and generations, being very far remote from those whose covetousness prompts them to advance their gain by the riches of others.

“The sea there is of a very white colour, so that a man may as justly wonder at the strangeness of the thing, as be inquisitive what should be the cause.

“Near hereunto are the Fortunate Islands, full of walled towns, where all the sheep and cattle are exceeding white, and none of the females bear any horns. The merchants from all parts resort to these islands, especially from Pontana, built by Alexander the Great, upon the banks of the river Indus, that there might be a commodious port-town for shipping upon these coasts; but of this country and its inhabitants, we have said enough.”

And<sup>1</sup>:—“Having gone through the western and northern countries and the islands of the ocean, we shall now describe the southern islands, lying in the Arabian ocean, on the east part of Arabia, next to Gedrosia. This part of Arabia is a country full of villages and considerable towns, some of which are situated upon high hills, others upon rising grounds, or something higher than champaign fields. Their greatest cities have stately royal palaces, and are very wealthy and populous; the country abounds with all sorts of cattle, and is of a very fruitful soil, affording plenty of rich pastures for the flocks and herds; many rivers run through it, watering the fields, to the great increase of the fruits of the earth. And, therefore, this part of Arabia, which excels the rest in richness of soil, is justly called Arabia the Happy.

“Over against the utmost point of this country, near the ocean, lie many islands; but there are but three that are worth remark: the first is called the Holy Island, wherein it is unlawful to bury the dead; but not far from this, about seven furlongs distant, there is another, wherein they bury. The sacred isle produces frankincense, and in that abundance as suffices for the service and worship of the gods all the world over; it has likewise plenty of myrrh, with other odoriferous spices of several sorts, which breathe out a most fragrant smell. The nature of frankincense, and the manner of getting it, is thus: the tree is very small, like to the white Egyptian thorn, and bears a leaf like to the willow; it puts forth a flower of a golden colour; from the bark of this tree, by incision made, distils the frankincense in drops, like tears.

“The myrrh-tree is like to the mastic-tree, but bears a more slender leaf, and grows thicker on the branches. The myrrh flows forth by digging up the earth round about the roots. Those that grow in a rich soil, bear twice a year—that is, in the spring and summer: that in the spring-time is of a deep red colour, caused by the dew; the other, nearer winter, is white.

“There they got likewise the fruit of the paliurus tree, wholesome both in meat and drink, and good against a dysentery. The land is divided amongst the inhabitants, of which the best part is allotted to the king, who has likewise the tenths of the fruits.

<sup>1</sup> Book v. chap. iii. Booth's Translation, Lond. 1814, vol. i. pp. 324–329.



“They say the breadth of this island is about two hundred furlongs, inhabited by them they call Panchæans, who transport the myrrh and frankincense into foreign parts, and sell it to the Arabian merchants, from whom others buy these and such like merchandise, and convey them to Phœnicia, Cœlesyria, and Egypt; and from those places they are carried by the merchants over all parts of the world.

“Besides these, there is another large island, about thirty furlongs distance from this last mentioned, lying to the east, many furlongs in length. For they say, from a promontory thereof running out towards the east, may be seen India, like a cloud in the air, the distance is so great.

“There are many things observable in Panchæa that deserve to be taken notice of. The natural inhabitants are those they call Panchæi; the strangers that dwell among them are people of the western parts, together with Indians, Cretans, and Scythians.

“In this island there is a famous city, called Panara, not inferior to any for wealth and grandeur. The citizens are called the suppliants of Jupiter Triphylius, and are the only people of Panchæa that are governed by a democracy without a monarch. They choose every year the presidents or governors, that have all matters under their cognizance; but what concerns life and death, and the most weighty matters, they refer to the college of their priests. The temple of Jupiter Triphylius is about sixty furlongs distant from the city, in a champaign plain. It is in great veneration, because of its antiquity and the stateliness of the structure, and the fertility of the soil.

“The fields round about the temple are planted with all sorts of trees, not only for fruit, but for pleasure and delight; for they abound with tall cypresses, plane trees, laurels, and myrtles, the place abounding with fountains of running water; for near the temple there is such a mighty spring of sweet water rushes out of the earth, as that it becomes a navigable river; thence it divides itself into several currents and streams, and waters all the fields thereabouts, and produces thick groves of tall and shady trees; amongst which, in summer, abundance of people spend their time, and a multitude of all sorts of birds build their nests, which create great delight both by affecting the eye with the variety of their colours, and taking the ear with the sweetness of their notes. Here are many gardens, sweet and pleasant meadows, decked with all sorts of herbs and flowers, and so glorious in the prospect, that it seems to be a paradise worthy of the gods themselves.

“There are here likewise large and fruitful palms, and abundance of walnut-trees, which plentifully furnish the inhabitants with pleasant nuts. Besides all these, there are a multitude of vines of all sorts, spiring up on high, and so curiously interwoven one amongst another, that they are exceeding pleasant to the view, and greatly advance the delights of the place.

“The temple was built of white marble, most artificially jointed and cemented, two hundred yards in length, and as many in breadth, supported by great and thick pillars, curiously adorned with carved work. In this temple are placed huge statues of the gods, of admirable workmanship, and amazing largeness. Round the temple are built apartments for the priests that attend the service of the gods, by whom every thing in that sacred place is performed. All along from the temple is an even course of ground, four



furlongs in length, and a hundred yards in breadth; on either side of which are erected vast brazen statues, with four square pedestals; at the end of the course breaks forth the river, from the fountains before mentioned, from whence flows most clear and sweet water, the drinking of which conduces much to the health of the body. This river is called the water of the sun.

“The whole fountain is lined on both sides, and flagged at the bottom with stone, at a vast expense, and runs out on both sides for the space of four furlongs. It is not lawful for any body but the priests to approach to the brink of the fountain. All the land about, for two hundred furlongs round, is consecrated to the gods, and the revenues bestowed in maintaining the public sacrifices and service of the gods; beyond these consecrated lands is a high mountain, dedicated likewise to the gods, which they call the throne of Coelus and Triphylius Olympus; for they report that Uranus, when he governed the whole world, pleasantly diverted himself in this place, and from the top of the mount observed the motions of the heavens and stars, and that he was called Triphylius Olympus, because the inhabitants were composed of three several nations, Panchæans, Oceanites, and Doians, who were afterwards expelled by Ammon; for it is said that he not only rooted out this nation, but utterly destroyed all their cities, and laid Doia and Asterusia even with the ground. The priests every year solemnize a sacred festival in this mountain, with great devotion.

“Behind this mount, in other parts of Panchæa, they say there are abundance of wild beasts of all kinds, as elephants, lions, leopards, deer, and many other wonderful creatures, both for strength and proportion. In this island there are three chief cities, Hyracia, Dalis, and Oceanis. The whole country is very fertile, and especially in the production of all sorts of wine in great plenty.

“The men are warlike, and use chariots in battle, after the ancient manner. The whole nation is divided into three parts: the first class is of the priests, with whom are joined the artificers; the other tribe consists of the husbandmen; and the third are the militia and the shepherds.

“The priests govern all, and are the sole arbitrators in every matter; for they give judgment in all controversies, and have the power and authority in all public transactions of state. The husbandmen till the land; but the fruit is brought into the common treasury; and who is judged the most skilful in husbandry, receives the largest share of the fruits for a reward in the first place; and so the second, and the rest in order to the tenth, as every one merits, less or more, receives his reward by the judgment of the priests. In the same manner the shepherds and herdsmen carefully bring into the public stock the victims and other things, both by number and weight, as the nature of things are; for it is not lawful for any to appropriate any thing to themselves particularly, except a house and garden. For all the young breed of cattle and other things, and all the revenues, are received by the priests, and they justly distribute to every one as their necessity does require; only the priests have a double proportion.

“They wear soft and fine garments; for the sheep’s wool is much finer here than anywhere else. Both men and women likewise deck themselves with golden ornaments; for they wear necklaces of gold, and bracelets about their arms, and, like the



Persians, have ear-rings hanging in their ears. Their shoes are such as others wear, but richly beautified with divers sorts of colours.

“Their soldiers, for ordinary pay, defend the country, fortifying themselves within camps and bulwarks; for there is a part of the island infested with most daring thieves and robbers, who often lurch and surprise the husbandmen.

“To conclude, these priests, for delicacy, state, and purity of life, far excel all the rest of the inhabitants; their robes are of white linen, and sometimes of pure soft wool. They wear likewise mitres, embroidered with gold. Their shoes are sandals curiously wrought with exquisite workmanship; and in their ears hang golden ear-rings like to the women’s.

“They attend chiefly upon the service of the gods, singing melodious songs in their praises, setting forth their glorious acts and benefits bestowed upon men. The priests say they came originally from Crete, and were brought over into Panchæa by Jupiter when he was upon earth and governed all the world; and allege their language for a confirmation of this assertion, inasmuch as they retain many words of the Cretan speech among them: and further say that they derive from their ancestors that civility and kindness wherewith they entertain the Cretans, the fame and report of their ancient consanguinity descending continually in a perpetual succession to their posterity; they show likewise a record written, as they say, by Jupiter’s own hand, at the time when he was on earth and laid the foundation of the temple.

“There are in this island likewise mines of gold, silver, brass, and iron; but it is not lawful for any to export them. Nay, it is not lawful for any of the priests to go out of the verge of the consecrated ground; and if any do, it is lawful for any man that finds them to kill them. They have under their charge innumerable vast vessels, and other consecrated things, both of gold and silver, which have been laid up there in honour of the gods for many ages. The gates of the temple are of admirable workmanship, beautified with gold, silver, ivory, and thyine wood

“The bed of the god is six cubits long, and four broad, of massy gold, most curiously wrought in every part; near adjoining, stands the table, as large, and of the like materials and workmanship with the other in every respect.

“In the middle of the bed is placed a great golden pillar, whereon are letters inscribed, called by the Egyptians sacred writing, expressing the famous actions of Uranus, Jupiter, Diana, and Apollo, written, they say, by Mercury himself. But this may suffice concerning the islands lying in the ocean over against Arabia.”

STRABO (B.C. 54—A.D. 24) says<sup>1</sup>, “Frankincense is produced in Catabania and in the parts of Africa opposite. Here the frankincense-tree grows along the banks of the Isis and Nilus. The country of the Sabæi produces not only frankincense, but balsam, sweet-smelling palms, calamus, and larimnum, a most fragrant perfume. By the trade in these aromatics both the Sabæans and the Gerrhæi have become the richest of all the tribes, and possess a great quantity of wrought articles in gold and silver, as couches, tripods, basins, drinking-vessels; to which we must add the costly magnificence of their houses; for the doors, walls, and roofs are variegated with inlaid

<sup>1</sup> Book xvi. chap. iv. Falconer and Hamilton’s Translation, Bohn’s Classical Lib.



ivory, gold, silver, and precious stones." The expedition sent by Augustus, under the command of Ælius Gallus, against the Arabians (B.C. 24—A.D. 1) (at the same time that Petronius was sent into Æthiopia, and reduced Candace, queen of Meroe), was to explore the nature of these places and their inhabitants. It was very unfortunate. The expedition was fitted out as if for a great war; but the cities yielded one after another without a struggle, and, although the army suffered exceedingly from long marches over bad roads, and from want of food, and boils, only seven men fell in the expedition, which "contributed little in extending our knowledge of the country." "The aromatic country is divided into four parts. Of aromatics, the frankincense and myrrh are said to be the produce of trees, but cassia of bushes. Yet some writers say that the greater part of it [the cassia] is brought from India, and that the best frankincense is that of Persia." "The Nabatæans worship the sun, and construct the altar on the top of the house, pouring out libations, and burning frankincense on it every day."

PLINY (A.D. 23–79) says<sup>1</sup>, "There is no region in the whole world that bringeth forth frankincense but Arabia; and yet it is not to be found in all parts thereof, but in that quarter only of the Atramites. Now these Atramites inhabit the very heart of Arabia, and are a country of the Sabæi. The capitall city of the whole kingdom is called Sabota, seated upon a high mountain; from whence into Saba, the only country that yields such plenty of the said incense, it is about eight daies journey. As for Saba (which in the Greek tongue signifieth, a secret mysterie) it regards the Sunne rising in summer, or the north-east, enclosed on every side with rocks inaccessible; and on the right hand it is defended with high cliffes and crags that beare into the sea. The soile of this territorie, by report, is reddish, and inclining to white. The forrests that carry these incense-trees ly in length twenty schoenes, and beare in bredth half as much. Now that which we cal schoenus, according to the calculation of Eratosthenes, contains forty stadia, that is to say, five miles; howsoever some have allowed but thirty-two stadia to every schoenus. The quarter wherein these trees grow is full of high hills; howbeit, go down into the plains and valley beneath, you shall have plenty of the same trees, which come up of their own accord, and were never planted. The earth is fat, and standeth much upon a strong clay, as all writers do agree. Few springs are there to be found, and those that be are full of nitre. There is another tract by it selfe confronting this country, wherein the Minæans do inhabit; and through them there is a narrow passage, whereby the frankincense is transported into other parts. These were their first neighbours that did traffique with them. for their incense, and found a vent for it; and even so they doe still at this day, whereupon the frankincense itselke is called of their name, Minæum. Setting these people of the Sabeans aside, there be no Arabians that see an incense tree from one end of the yere to another; neither are all these permitted to have a sight of those trees. For the common voice is, that there be not above 3000 families which can claime and challenge by right of succession that priviledge to gather incense. And therefore all the race of them is called sacred and holy; for looke when they go about either cutting and flitting the trees, or gathering the incense, they must not that day come neere a woman to know her carnally; nay, they must not be at any funerals, nor

<sup>1</sup> Book xii. chap. 14. Holland's Translation, Lond. 1635, fol.



approach a dead corps, for being polluted. By which religion and ceremonious observation the price is raised and the incense is the dearer. Some say, these people have equall liberty in common to go into these woods for their commodities when they will; but others affirme that they be divided into companies, and take their turns by yeares. As concerning the very tree, I could never know yet the perfect description of it. We have waged warres in Arabia, and our Roman armie have entered a great way into that country. C. Cæsar, the adopted son of Augustus, wan great honour and glory from thence; and yet verily, to my knowledge, there was never any Latine author that hath put down in writing the form and fashion of the tree that carrieth incense. As for the Greeke writers, their bookes doe vary and differ in that point. Some give out, that it hath leaves like to a peare tree, only they be somewhat lesse, and when they come forth they be of a grasse green colour. Others say that they resemble the lentiske tree, and are somewhat reddish. There be again who write, that it is the very terebints and none else, that giveth the frankincense: of which opinion king Antigonus was, who had one of these shrubs brought unto him. King Juba in those books which he wrot and sent to C. Cæsar, son to the Emperor Augustus (who was inflamed with an ardent desire to make a voiage into Arabia, for the great fame that went thereof), saith, That the tree which beares frankincense hath a trunke or body writhen about, and putteth forth boughes and branches, like for all the world to the maple of Pontus. Item, that it yeeldeth a juice or liquor as doth the almond tree; and such are seene commonly in Carmania; as also those in Egypt, which were planted by the careful industrie of the Ptolomees, kings there. However it be, this is received for certaine, that it hath the very barke of a bay tree; some also have said that the leaves be as like. And verily such kind of trees were they which were seen at Sardis; for the kings of Asia likewise were at the cost and labour to transplant them, and desirous to have them grow in Lydia. The embassadours who, in my time, came out of Arabia to Rome, have made all that was delivered as touching these trees, more doubtfull and uncertaine than before. A strange matter, and wonderfull indeed, considering that twigges and branches of the incense tree have passed betweene; by the view of which impes, we may judge what the mother is: namely, even and round in the body, without knot or knar, and from thence she putteth out shoots.

“They used in old time to gather the incense but once a yere, as having little vent, and small returne, and lesse occasion to sell than now adaies; but now, since every man calleth for it, they feeling the sweetnesse of the gaine, make a double vintage (as it were) of it in one yere. The first, and indeed the kindly season, falls about the hottest daies of the summer, at what time as the Dog daies begin; for then they cut the tree where they see the bark to be fullest of liquor, and whereas they perceive it to be thinnest and strut out most. They make a gash or slit only to give more libertie; but nothing do they pare or cut cleane away. The wound or incision is no sooner made, but out there gusheth a fat fome or froth: this soon congeales and growes to be hard; and where the place will give them leave, they receive it in a quilt or mat, made of date-tree twigs, plaited and wound one within another wicker-wise. For elsewhere, the floore all about is paved smooth, and rammed downe hard. The former way is the better to gather the purer and clearer



frankincense; but that which falleth upon the bare ground proves the weightier. That which remains behind, and stickes to the tree, is parted and scraped off with knives, or such like yron tooles, and therefore no marvell if it be full of the shavings of the bark. The whole wood or Forrest is divided into certaine portions; and every man knowes his owne part: nay, there is not one of them that will offer wrong unto another, and encroch upon his neighbors. They need not to set any keepers to look unto those trees that be cut, for no man will rob from his fellow if he might, so just and true they be in Arabia. But, believe me, at Alexandria, where frankincense is tried, refined, and made for sale, men cannot look surely ynough to their shops and work-houses, but they will be robbed. The workeman that is employed about it, is all naked, save that he hath a paire of trouses or breeches to cover his shame, and those are sowed up and sealed too, for fear of thrusting any into them. Hood-winked he is sure enough for seeing the way to and fro, and hath a thicke coife or maske about his head, for doubt that he should bestow any in mouth or eares. And when these workmen be let forth againe, they be stripped starke naked, as ever they were borne, and sent away. Whereby we may see, that the rigor of justice cannot strike so great feare into our theeves here, and make us so secure to keepe our owne, as among the Sabæans the bare reverence and religion of those woods. But to returne again to our former cuts. That incense which was let out in summer, they leave there under the tree until the autumnne, and then they come and gather it. And this is most pure, cleane and white.

“A second vintage and gathering there is in the spring: against which time they cut the barks before in the winter, and suffer it to run out until the spring. This comes forth red, and is nothing comparable to the former. The better is called *Carpheotum*; the worse, *Dathiatum*. Moreover, some say, that the gum which issueth out of the young trees is the whiter; but that which comes from the old, is more odoriferous. There be others also of opinion, that the better incense is in the islands. But King Juba doth avouch constantly, that there is none at all in the islands. That which is round, like unto a drop, and so hangeth, we call the male incense, whereas in other things lightly we name the male, but where there is a female. But folk have a religious ceremonie in it, not to use so much as the tearme of the other sexe in giving denomination to frankincense. Howbeit, some say that it was called the male for a resemblance that it hath to cullions or stones. In very truth, that is held for the cheife and best simply, which is fashioned like to the nipples or teats that give milk, standing thick one by another: to wit, when the former drop that distilled, hath another presently followeth after, and so consequently more unto them, and they all seem to hang together like bigs. I read, that every one of these were wont to make a good handfull, namely, when men were not so hasty and eager to carry it away, but would give it time and leisure to drop softly. When it is gathered in this sort, the Greeks use to call it *Stagonias* and *Atomus*; but the lesser goblets they name *Orobias*. As for the small crums or fragments which fall off by shaking, we called manna (i. e. *Thuris*). And yet there be found at this day drops of incense that weigh the third part of a pound, that is to say, about thirty-nine Roman deniers<sup>1</sup>. It happened on a time, that King Alexander the Great being then but

<sup>1</sup> Or rather thirty-three and a scruple.



a very little child, made no spare of incense, but cast still upon the altar without all measure when he offered sacrifice. Whereupon Leonides, his tutor and schoolemaister, by way of a light reproofe, said unto him thus, Sir, you should in that maner burne incense, when you have once conquered those nations where there growes incense. Which rebuke and checke of his tooke so deep a print in Alexander's heart, and so well he carried it in memorie, that after he had indeed made conquest of Arabia, he sent unto the said Leonides, his tutor, a ship full fraught and charged with incense; willing him not to spare, but liberally to bestow upon the gods when hee sacrificed. To returne againe to our historie. When the incense is gathered (as is beforesaid) conveighed it is to Sabota, upon cammels' backs, and at one gate (set open for that purpose) is it brought into the citie. For by law forbidden it is on pain of death to take any other way. Which done, the priests there of the god whom they call Sabis, take the disme or tenth part of the incense, by measure, and not by weight, and set it apart for that god. Neither is it lawful for any man to buy or sell, before that duty be paied: which serves afterwards to support certaine publick expenses of the citie. For all strangers and travellers within the compasse of certain daies journey, if they come to the citie are courteously received, and liberally entertained at the cost and charge of the said god Sabis. Carried forth of the country it cannot be, but through the Gebanites; and therefore there is a custome paid to their king. The head citie of that kingdom, Thomna, is from Gaza (the next port-towne in Judæa toward our coast) seven-and-twentie miles fourscore times told: and this way is divided into sixty-two daies journey by camels. Moreover, besides tyth aforesaid, there be measures, bestowed upon the priests to their owne use and others likewise to the king's secretaries and scribes; and not only these have a share, but also the keepers, sextons, and wardens of the temple, the squires of the bodie, the guard and pensioners, the king's officers, the porters, groomes, and other servitors, pill and poll, and every one hath a snatch. Moreover, all the way as they travell; in one place they pay for their water, in another for fodder and provender, or else for their lodging and stable-room, and every where for one thing or other they pay toll: so as the charge for every camell from thence to the sea, upon our coast commeth to 688 deniers; and yet we are not come to an end of paiements; for our publicanes and customers also belonging to our empire must have a fleece for their parts. And therefore a pound of the best incense will cost sixteen deniers, of the second fifteen, and the third fourteen. With us it is mingled and sophisticated with parcels of a white kind of rosin, which is very like to it; but the fraud is soon found by the meanes above specified. The best incense is tried and knowne by these markes, viz. If it be white, large, brittle, and easie to take a flame when it comes neare a coale of fire; last of all, if it will not abide the dent of the tooth, but flie in pieces and crumble, sooner than suffer the teeth to enter into it."

Pliny also says that the Sabæans cooked their food with the wood of the frankincense-tree<sup>1</sup>; and that, "in the Trojan times, there were no ointments, neither was supplication made with frankincense"<sup>2</sup>.

ARRIAN (about A.D. 90) writes<sup>3</sup>, "Beyond Kane [Makalla] the bay called Sakhallites

<sup>1</sup> Book xii. ch. 17, Celsius.

<sup>2</sup> Book xiii. ch. 1, Celsius.

<sup>3</sup> Vincent's Translation of the *Periplus and Voyage of Nearchus*, Oxford, 1809.



[Makalla Bay.—G. B.] commences: it is of vast extent and of considerable depth, and forms the coast of the frankincense country, a mountainous and impracticable tract, incommoded with fogs and a dark atmosphere in all the parts where the trees grow that produce the frankincense. The trees are neither large nor lofty; but the substance exudes from the bark, and becomes consistent, like the gum that weeps from several of our trees in Egypt. The incense is collected by the king's slaves, condemned to the service as a punishment; for the county is unhealthy in the extreme, pestilential even to those who navigate on the coast, and certain death to the wretched sufferers employed in the collection, who, if they escape death from the climate, are sure to perish by want and neglect. The coast which forms the border of this country terminates at the promontory called Suagros [Ras Fartak], the largest cape in the world, and projecting towards the east. There is a garrison here for the protection of the country, and a harbour, on which are the storehouses for the frankincense collected here from the whole coast." . . . "From Suagros the adjoining bay of Omana [Bay of Al Kammar?—G. B.] takes a large sweep of considerable depth into the main, six hundred stadia in extent, and towards the termination of this, the shore is high, rocky and steep too, for five hundred stadia more. At this boundary is the established port for the reception of the Sakhaltic incense, called Moskha [Morbat or Merbat?—G.B.]; it is a place regularly frequented by the vessels from Kane [Makalla], whilst the fleets returning from Barugaza [Broach] and Limurike [Canara and Malabar], if they happen to lose the season, are obliged to lie here and exchange part of their cargo, such as wheat, oil (of sesamum), or cottons, for frankincense, which is supplied by the king's agents and factors. Throughout the whole tract, called Sakhaltic, frankincense lies piled up in heaps, without watch or guard to secure it, as if it were committed to some divine power for protection. For without the king's permission it is impossible to convey it on ship-board, either openly or clandestinely; even if a single grain were embarked it would be a marvellous chance if the vessel escaped seizure. From Moskha [Morbat or Merbat?] the coast extends fifteen hundred stadia more to the district of Asikho [Hafek of El Edresi]; and at the termination of this tract lie the seven islands of Zenobius [Curia Muria] in succession."

Again, of the country opposite, between Mount Elephant [Ras Fiel] and Aromata [Gardafui], he writes, "In these parts, the best and greatest quantity of frankincense is procured"<sup>1</sup>.

Arrian mentions ἀρώματα amongst the exports of Abaletes, and that the myrrh of the African coast was taken to the opposite coast of Arabia; and names frankincense amongst the exports of Malao (Zeyla?), Moundus, Mosullon, or Mossylon (Berbera), and of the ports of Barbaria. The frankincense of these latter ports he calls "Peratick," or "foreign." "But," observes Vincent<sup>2</sup>, "it cannot be admitted in that sense, as to the commodity itself, for it is noticed expressly as a native produce of the place. Still it will lead us to solve a difficulty already noticed in regard to these ports of Barbaria called *Ta pera*, which, by a slight correction of the text will signify the ports beyond the straits (Bab-el-Mandeb). The articles obtained here would naturally be styled *Peratick*

<sup>1</sup> Vincent's Translation of the *Periplus and Voyage of Nearchus*, Oxford, 1809.

<sup>2</sup> Vincent's 'Commerce and Navigation of the Ancients in the Indian Ocean,' Lond. 1807, vol. i. p. 140.



(from Pera, *beyond*), and would be known by this title in the invoices, and the market of Alexandria, in contradistinction to those obtained within the Straits of Bab-el-Mandeb. The author is writing to Alexandrians, and is consequently specifying the precise parts where those commodities were obtained which they knew by the name of Peratick." Arrian names frankincense also as an export of Tobai, near Aromata, and of Kane (Makalla) in Arabia. He names it also as an import of Barbarike, at the mouth of the Indus, amongst the exports of which he names costus, bdellium, spikenard, indigo, all exports of Kurrachee at the present day. We have already seen that he names frankincense as exported to Barygaza (Broach) and Limurike from Moskha (Merbat). But when speaking of the exports of Ozene (Ougein in Central India, where the *Boswellia thurifera* of Colebrooke abounds) to Barygaza (Broach)—onyx stones, murrhine vases, and cotton, &c.—he does not specify frankincense. Ozene transmitted also spike-nard, costus, and bdellium from Upper India to Barygaza; and amongst the imports of Barygaza are named also lycium, storax, melilotus, myrrh, and other aromata and unguents.

PTOLEMY<sup>1</sup> (about A.D. 150) places the Libanotophoros, or thuriferous region, between Makalla and Muscat, placing the Smyrnophoros to its west, behind Makalla.

DIOSCORIDES<sup>2</sup>, who merely describes drugs, says that frankincense is produced in that part of Arabia called Libanotophoros, and that the best is called "Stagonias," that the Indian kind is darker, and mentions other varieties, "Syagrian" &c.

The casual notices of frankincense by the Latin poets and historians are also very valuable in the present argument. It would be impossible to quote in this paper all the passages in which frankincense is named or its use implied by them; for they would simply double its bulk. The most pertinent of them are quoted by Stuckius in his 'Sacrorum Sacrificiorumque Gentilium Descriptio,' and in the 'Hierobotanicon' of Celsius, from which two writers most of the information given in modern "Cabinets," "Treasuries," and "Cyclopædias" concerning frankincense is taken without acknowledgment, and very often without intelligence; and as Celsius makes a determined effort to exhaust all the learning on the subject, he very well proves how impossible it is to be universally learned on even so infinitesimal a subject as frankincense. In the case of some of the Latin poets (Ovid, Horace, Virgil, Martial, and Statius) the word for frankincense is always catching the eye on the look out for it. It occurs frequently in Tibullus, Claudian<sup>3</sup>, and Apuleius; once or twice in Plautus, Juvenal, and Lucretius; once in Persius; and nowhere, so far as I have searched, in Terence. The single quotation each from Ausonius<sup>4</sup> and Florus<sup>5</sup>, which name the Lebanon as the habitat of the frankincense-tree, are quite hackneyed. It is continually occurring in Aurelius Prudentius Clemens<sup>6</sup>, whom I have never found quoted on the subject. This mass of quotations is direct evidence of the universal use of frankincense throughout the ancient world in the worship of the Gods.

These passages, all taken together, prove the universal trade of the nations of antiquity

<sup>1</sup> Geographia Ptolemæi: Basilæ, 1542. Orbis Antiqui tab. geograph. secundum Ptolemæum: Amstelodami, 1730.

<sup>2</sup> Διοσκορίδης. Interprete Marcello Vergilio: Coloniae, 1529. Et Ex Nova interpretatione, J. A. Sarraceni Lugdunæi, 1598.

<sup>3</sup> Miracula Christi.

<sup>4</sup> Monosyll. 346. 5.

<sup>5</sup> Lib. iii. 5. 29.

<sup>6</sup> Passio Eulaliæ. P.S. Vincentii Magorum munera.



for centuries in frankincense. In the way of this trade, however much its monopolists may have desired to make a mystery about it, the country from which it was procured must have become known to thousands of persons; and therefore great weight is to be given to the common consent which these passages prove that frankincense was procured from "Arabia," "the Arabians," "Sabæa," "the Sabæans," "Panchaia"<sup>1</sup>.

As, however, in ancient times, the whole commerce of the east and west was for centuries poured into and exchanged in the coast-cities of Arabia, a commerce so rich and rare, and which so struck the imaginations of men, that some of the sublimest allusions of the Hebrew prophets are derived from it, and its fame "vibrates in the memory" yet of all the countries of the Mediterranean and Arabian seas, many products of countries further east than Arabia may have been, and indeed were, received in the west or Mediterranean countries as the products of Arabia; but, as to frankincense, it is only necessary to reply here that it is always mentioned as a foreign production in ancient Hindoo books, according to Heeren<sup>2</sup>, and that to this day the people in the bazars of Western India say that it comes from Arabia, and that not, I believe, because it is simply the fact, but of the great myth of the ancient commerce of the Sabæans, which still lingers in the east.

The high honour in which the offering of frankincense was held, is shown by its being named as one of the three gifts of the "wise men from the east"<sup>3</sup>, the significance of which is well illustrated by the passages in Claudian and A. P. Clemens to which I have above alluded.

In the Revelation, xviii. 11-13, we have another confirmation of the importance of the trade in it when that book was written:—"And the merchants of the earth shall weep and mourn over her [Babylon]; for no man buyeth their merchandise any more: the merchandise of gold, and silver, and precious stones, and of pearls, and fine linen, and purple, and silk, and scarlet, and all thyine wood, and all manner of vessels of ivory, and all manner of vessels of most precious wood, and of brass, and iron, and marble, and cinnamon, and odours, and ointments, and *frankincense*, and wine, and oil, and fine flour, and wheat, and beasts, and sheep, and horses, and chariots, and slaves, and souls of men," . . . .

I believe that the Arabian writers Avicenna, Serapion, Edresi, Abulfeda, and Ibn Batuta all agree that frankincense is produced in the Hadramaut, behind Merbat and Sheba<sup>4</sup>. Serapion and Avicenna, misleading themselves by Dioscorides, say that it is produced in India also<sup>5</sup>. Abulfeda says that frankincense is found nowhere else but in Yemen. IBN BATUTA would appear to have seen the tree at Hafek or Hasik. His words are:—"Leaving Zofar (Dofar, Lee; Sephar of Bible?—G. B.), I proceeded to sea towards Amman, and on the second day put into the port of Hasik, where many Arab fishermen reside.

<sup>1</sup> "I know where the ISLES OF PERFUME are,  
Many a fathom down in the sea,  
To the south of sun-bright ARABY!"

<sup>2</sup> I have it in my note-book that Heeren asserts this, but have failed to verify the note for the purpose of this paper.

<sup>3</sup> Matt. ii. 11.

<sup>4</sup> Bocharti Geo. Sac. Traj. ad Rhenum, 1674; Lugd. Bat. 1692, lib. ii. c. 18.

<sup>5</sup> Bochart, *loc. cit.*; Garcia ab Horto, Aromat. et Simpl. Hist. lib. i. c. 6, Ant. 1579.



We have here the incense-tree. This tree has a thin leaf, which, when scarified, produces a fluid like milk: this turns into gum, and is then called *loban* or frankincense”<sup>1</sup>.

MARCO POLO<sup>2</sup> writes of the city of Escier or Escher (Sheher, Saher, Sahar):—“This district produces a large quantity of white frankincense of the best quality, which distils, drop by drop, from a certain small tree that resembles the *fir*. The people occasionally tap the tree or pare away the bark; and from the incision the frankincense gradually exudes, which afterwards becomes hard. Even when an incision is not made, an exudation is perceived to take place, in consequence of the excessive heat of the climate.”

“The frankincense is so cheap in the country as to be purchased by the governor at the rate of ten bezants the quintal, who sells it again to the merchants for forty bezants. This is done under the direction of the soldan of Aden, who monopolizes all that is produced in the district, and derives a large profit from the re-sale.”

Of Duflar (Dofar) he writes:—“Frankincense is likewise produced here, and purchased by the merchants.”

THEVET<sup>3</sup> says that frankincense is produced, with myrrh, in the country about Pecher (Sheher?) and Fartack, cities of the kingdom of Aden, that there are two sorts (one, which is gathered in the dog-days, whitish, pure, clean cut, and solid, and the other, collected in the spring, which is reddish), and that the tree resembles the resiniferous *firs*. But the figure which he gives of it is of an undoubted *Boswellia*, as figures go in these old books. In the background, it is important to observe, are clumps of *firs*.

GARCIA AB HORTO<sup>4</sup> says most positively that no frankincense is produced in India, and that all that is used in India, or imported into Portugal, comes from Arabia (he wonders that Dioscorides, followed by Avicenna and Serapion, should say it grows in India), that the Arabs call the darker kinds of frankincense Indian, that there are two kinds of frankincense, one that is produced on the mountains and the best, and the other, which is inferior and dark, produced in the plains, and that the tree is like the mastick,—the figure given of it in this edition being a copy of Thevet’s, *without* the background of *firs*.

GERARD<sup>5</sup>, merely copies from Thevet.

CLUSIUS<sup>6</sup> merely notes on Garcia ab Horto’s account of frankincense the invention of the synonym *olibanum* for it by Gerard in his translation of Avicenna, published at Venice A.D. 1490:—“The Arabs call it *Loban*, unde Gerardus Carmonensis fecit suum *Olibanum* (cap. 525, lib. ii. Avisenæ), which is wonderful, when that chapter in the Arabic copy has not *Loban* but *Conder*.” But this is not the first use of the synonym *olibanum* for frankincense. It is used by Pope Benedict IX. in 1033<sup>7</sup>.

STUCKIUS<sup>8</sup> says that frankincense comes from Arabia.

<sup>1</sup> Travels, translated by Lee.

<sup>2</sup> Travels, bk. iii. ch. 40, “On the Province of Aden,” Bohn’s series. Also Bergeron’s Collection.

<sup>3</sup> La Cosmographie Universelle: Paris, 1575.

<sup>4</sup> Aromatum et Simplicium Hist., Ant. 1579, *loc. supra cit.*

<sup>5</sup> The Herbal: London, 1597.

<sup>6</sup> Exoticarum Lib. Dec.: 1605.

<sup>7</sup> Italia Sacra auct. Ferd. Ughello: Ven. 1717. Glossarium Manuale ad Scrip. Mediæ et Infimæ Latinitatis: Halle, 1778.

<sup>8</sup> Sacrorum Sacrificiorumque Gentilium Descriptio: Tiguri, 1598.



ANTOINE COLIN<sup>1</sup> merely translates the Latin epitomes of Garcia, adding an annotation which is an epitome of the statements of Thevetius, and illustrated by a copy of his figure of the frankincense-tree.

In 'Purchas, His Pilgrimes' (London, 1627), NICHOLAS DOVENTON, Captain of the 'Peppercorne,' writes, March 1612:—"The eight and twentieth . . . wee anchored in rough ground in seven fathome, a mile and a half westward from Mount Felix" (Mount Elephant of the ancients, Ras Fieluk of the Arabs). "The nine and twentieth in the morning . . . the countrie people brought downe to our men to sell, some store of sheep, small goats, with some small frailes of olibanum and gumme arabick, all which they had at reasonable rates."

And Captain JOHN SARIS, in his Voyages, under March 1, 1611, writes:—"In the evening we had ground, standing in along the land to find the bay of Feluke. . . . Here are gummes of several sorts, very sweet in burning, also fine mats, well requested at Aden, Mocha, and the Indies; for ordinarily the Indian ships touch here both inward and outward, to buy thereof, and of the gummes"<sup>2</sup>.

HERBERT<sup>3</sup> writes of Arabia:—"But in the old time these were distinguished into the Sabæi, whence Guilandinus says was the queen that came to hear Solomon's wisdom, and the three Magi who had the honour of presenting their offerings to Christ. And it is not without reason that this part of Arabia abutting upon the Persian Gulf from against the Island of Bahrein, mentioned by Eratosthenes, where the city of Calach was (now called Obollach), as far as Muscat, was the Sabæan land, which, from the abundance of gold there found, was reputed Ophyr, though, indeed, both Sabæa and Ophyr are near Ganges. From the plenty of frankincense and myrrh, it was called *Thurifera Regio*, most abounding near the hilly country of Merbat and Segar (Sheher), neighbouring the land of Hadramat or Atramit, as Pliny and Pomponius Mela (lib. iii. c. 18), thus:—"Sabæi Arabiæ felicis tenent partem ostio maris Persici proximi Carmaniæ, ubi montes Asabi sunt:" albeit many contrarily suppose that Saba or Sheba (which Strabo, lib. xvi., calls Metroba) was in the western part of Arabia, near the Red Sea. I take leave to digress a little further. After the confusion of tongues, which was 120 years after the flood" &c.

Of Benjamin, he writes:—"Arabia has good, but Pegu and Siam better."

SALMASIUS<sup>4</sup> says that the word olibanum is from the Greek ὀλίβανος, and sums up the statements of Theophrastus, Pliny, and the Arabs in favour of Arabia being the land of frankincense.

BOCHART<sup>5</sup> says that frankincense is not obtained from India, or Africa, or Panchaia, or Mount Lebanon, but solely from Saba. Both sacred and profane writers testify to this. The thuriferous region lies between the Sachalitic Gulf and Syagrian promontory; and Cana (Makalla) is the emporium of the trade.

<sup>1</sup> Histoire des Drogues, Epiceries et Simples: Lyon, 1619.

<sup>2</sup> This passage is referred to by Vincent, 'Commerce and Navigation of the Ancients,' Lond. 1807, vol. i. p. 90.

<sup>3</sup> Travels: London, 1677.

<sup>4</sup> Plinianæ exercitationes et de Homonymis Hyles Iatricæ: Traj. ad Rhenum, 1689.

<sup>5</sup> Geographia sacra: Traj. ad Rhenum, 1674, and Lugd. Bat. 1692.



OVINGTON<sup>1</sup> writes:—"Arabia Felix . . . abounds with several kinds of drugs, with balsam and myrrh, incense, cassia, manna, dates, gold, frankincense, and pearl."

"Dofar . . . produces only some olibanum, coco-nuts, and butter."

"Seer (Sheher) . . . is much frequented by ships from several ports, viz. Muscatt, Gombroon, Suratt, and Gella (Zeyla), and some other places on the Abasseen shore, from whence they bring butter, myrrh, and slaves; and those from Muscatt and Suratt transport with them olibanum, and aloes, and what the port affords."

Aden: "they carry nothing from hence but coffee, aloes, olibanum, and myrrh; the last three of which are the products of the country."

Mocha exports "coffee, senna, and some aloes hepatica:" imports "from Casseen [Keshin, near Ras Fartak?] olibanum," "from Socotra aloes," and "from Gella [Zeyla] and other parts of Abasseen myrrh, and from Socachim [Suakin?] elephants' teeth and gold."

HAMILTON<sup>2</sup> writes:—"Cassin [Keshin, near Ras Fartak] that lies under the meridian of Cape Guardafoy, and under the prodigious high mountains of Megiddo, on the coast of Arabia." "The product of the country (besides common roots, and fruits, and animals) is myrrh and olibanum or frankincense, which they barter for coarse calicos from India; but they have no great commerce with strangers."

"Nor has Doffar any better trade."

He mentions Mount Felix under the name of "Baba-fileck," or "the Camel's Hump."

POMET<sup>3</sup> is supposed to assert that frankincense is a product of Mount Lebanon; and he indeed says this of male frankincense; but in a separate chapter on Mocha frankincense he says that it is brought to Europe by the East-India Company, and so called Indian frankincense.

CHARDIN<sup>4</sup> says "that the frankincense-tree, which resembles a large pear-tree, grows in Persia, particularly in Caramania, on the mountains. You find also there the terebinth-tree, the almond, and the wild chestnut."

CELSIUS, in his famous 'Hierobotanicon,' comes to the conclusion that Arabia is the native country of frankincense. He quotes from Fragosus:—"It is most true that frankincense does not grow in any part of India, since whatever frankincense is consumed in India, and whatever is conveyed thence to Portugal, is brought out of Arabia, where alone it grows, and is called Lovan. On which account, I believe that writers are mistaken, who consider that it is called Libanum in Greek, and olibanum in commerce, from the fact of its growing in Mount Lebanon"<sup>5</sup>.

LOBAT<sup>6</sup> says that olibanum is not only a production of Arabia, India, and of Mount Lebanon, but of Western Africa.

LINNÆUS referred (I take this statement at second hand) frankincense to an unascertained juniper; and scientific botanists after him boldly specified *Juniperus Lycia* as the

<sup>1</sup> Voyage to Suratt (1689): London, 1698.

<sup>2</sup> Account of the East Indies, 1688-1723, in Pinkerton's 'Travels.'

<sup>3</sup> Histoire des Drogues: Paris, 1694; translation, London, 1737.

<sup>4</sup> Voyage en Perse et l'Orient: Amsterdam, 1711.

<sup>5</sup> Olavi Celsii Hierobotanicon, sive de Plantis Sacrae Scripturae Dissertationes breves: Amstelodami, 1748,

<sup>6</sup> Nouvelle Relation d'Afrique: Paris, 1728.



tree; and, in fact, until a very few years ago (1832) *Juniperus Lycia* was generally held to be the frankincense-tree.

NIEBUHR is always cited as an authority in this controversy; and the statement attributed to him is:—"We could learn nothing of the tree from which incense distils, and Mr. Forskal does not mention it." But this is not what Niebuhr says, but only Heron's (Edinburgh, 1792) very free and easy translation of what he says. But even Heron's translation continues, "I know that it is to be found in a part of Hadramaut, where it is called oliban. But the Arabians hold their own incense in no estimation, and make use only of that which comes from India. Probably Arabian incense was so called amongst the ancients, because the Arabians traded in it, and conveyed it from India to the ports of Egypt and Syria."

Now, what Niebuhr says in the 'Description de l'Arabie,' Copenhagen, 1773, is, in epitome, this:—Anciently Arabia was not less celebrated for its incense than for its gold; but all the incense received from Arabia was not produced there. Arrian and others have shown that much was imported from Abyssinia and India, and from beyond it. Indeed it is chiefly cultivated in Arabia, about Merbat, Schähr (Sheher), and the kind called *Liban* by the Arabs, and frankincense by the English, which is the worst of all. The Arabs get other kinds from Abyssinia, Sumatra, Siam, Java, and amongst these what they call Bacher Java, and the English benzoin, and the poorest sort of which is esteemed better than the best frankincense. One may conclude from this, that many kinds passed in ancient times under the names of Arabian incense, although from countries far beyond it. In this way Arabian coffee is called, in Europe, Levant coffee. The Arabs do not set much on their olibanum; for they import the incense of India ["l'encens des Indes" (benzoin?)] and the mastic of Scio (p. 126).

Moses, he testifies, in Genesis, names the cities of Yemen and Hadramaut, as if he had personally known them. Hadramaut is the Hatzarmaveth of Moses, which signifies, in Hebrew, the Court of Death, and, in Arabic, the Region of Death. In the Hadramaut, Dabar, Merbat, and Hafeck export the best olibanum (pp. 245–255).

BRUCE, in the Atlas to his Travels (Edinburgh, 1805), figures a plant which he says is called *Angouah* by the people about the Tacazze, and believed by the Abyssinians to yield true frankincense; and he adds, "in reality it produces a gum much resembling it." It is undoubtedly the *Boswellia papyrifera* of Richard. But botanists seem never to have given Bruce the credit of the discovery of this plant. Stackhouse<sup>1</sup> lays no stress on the plant, merely observing, "Libanus vel Libanotos Theophrasti. This, according to Sprengel, is the *Amyris Kataf* of Linnæus [Forskål?]. It is to be regretted that the description of Theophrastus is so incorrect as not to ascertain the point." Royle<sup>2</sup> merely remarks that the *B. serrata* of Roxburgh is not Bruce's plant. Bruce observes that the frankincense land stretches from Abyssinia away to Cape Gardafui<sup>3</sup>.

COLEBROOKE, in 1807<sup>4</sup>, proved that an exudation allied to frankincense was yielded by the *Boswellia serrata* of Roxburgh, now known under the name of *B. thurifera*, Colebrooke. As soon as Colebrooke's discoveries became known, it was concluded that this

<sup>1</sup> Extracts from Bruce's Travels: Bath, 1815.    <sup>2</sup> Pharm. Journal, v. 541: 1845.

<sup>3</sup> Travels, vol. i. p. 356.

<sup>4</sup> Asiatic Researches, vol. ix. Calcutta, 1807; Linn. Trans. vol. xv



was the olibanum of commerce, and it was even denied that Arabia yielded any olibanum. But I will not anticipate.

DELILE<sup>1</sup>, in 1820, described a plant called *Kafal* by the Arabs of Fazogl, *Galgalaan* by the negroes of the country, and *Loban-adan-culán* in Sennar, and named it *Amyris papyrifera*.

In MILBURN'S admirable work on *Oriental Commerce*, published in 1825, it is stated that *Jedda*, *Aden*, and *Massowah* import benjamin, and *Zeyla* and *Berbera* export olibanum, and that olibanum is procurable in the Persian Gulf.

Of *Berbera* he writes that "a fair is held here from October until April, and the caravans arriving *from the interior* during that period bring large quantities of gum-arabic and myrrh. Olibanum is chiefly produced on the coast, between 'Barbora,' or 'Burbureea,' and Cape Gardafui, and exported in Arab vessels from a small port near Cape Felix [Mount Elephant of the ancients; Ras Fieluk; Cape Felix, or Felles, of the Portuguese; Jibbel Feel, Capt. Saris; Baba-fileck, Hamilton, *suprà*]. A small proportion of these articles reaches Bombay and Europe; the largest part goes up the Red Sea to Egypt."

Amongst the articles to be obtained at Calcutta and Bombay olibanum is not mentioned by him.

ENDLICHER, in 1838, described and figured his *Plösslea floribunda*<sup>2</sup>, obtained from Fazogl, and which Royle was one of the first to recognize as a *Boswellia*, and which is the same plant as Bruce's "*Angouah*" and Delile's *Amyris papyrifera*.

WELLSTEAD<sup>3</sup>, in 1838, and Johnston<sup>4</sup>, in 1842-43, both stated that large quantities of olibanum are exported from the Soumali coast. Wellstead says, "two kinds of frankincense are brought here for exportation to Hindostan, one called *Luban*, from Hadramaut, which is a powerful aromatic, used in the temples and houses for fumigation; the other *Luban mati*, less fragrant, but preferred for chewing." Again, "In the mountains behind Saher and Makallah are found dragon's-blood [Bdellium?] and frankincense trees. I have often seen the former, but never the latter."

HAINES<sup>5</sup> also did not find the frankincense-tree in his examination of the Arabian coast "commencing from the entrance of the Red Sea, and continuing so far as Messenaad, in latitude 15° 13' N. and longitude 53° 43' 25" E.," and he says that the frankincense exported from Makalla is imported from *Berbera*.

CRUTTENDEN<sup>6</sup>, in 1837, saw the frankincense-tree of Arabia, on his journey from Merbat to Dyreez, the principal town of Dejar, and in 1843 the frankincense-tree of the Soumali country<sup>7</sup>. He is reporting on the Mijjertheyn tribe of Soumalis, and says:—"During the hot season, the men and boys are daily employed in collecting gums, which process is carried on as follows: about the end of February, or beginning of March, the Bedouins visit all the trees in succession, and make a deep incision in each, peeling off a narrow strip of bark for about five inches below the wound. This is left for a month,

<sup>1</sup> F. Caillaud, Voyage à Méroë: Paris 1820, vol. ii.

<sup>2</sup> Travels in Arabia: Lond. 1838.

<sup>3</sup> Transactions of the Bombay Geo. Soc. xi.

<sup>4</sup> Trans. Bombay Geo. Soc. vii. 1846.

<sup>5</sup> Iconographia, 119-120; Nov. Stirp. Dec. n. 47.

<sup>6</sup> Travels in Southern Abyssinia: Lond. 1842-43.

<sup>7</sup> Trans. Bombay Geo. Soc. i.



when a fresh incision is made in the same place, but deeper. A third month elapses, and the operation is again repeated, after which the gum is supposed to have attained a proper degree of consistency. The mountain-sides are immediately covered with parties of men and boys, who scrape off the large clear globules into a basket, whilst the inferior quantity that has run down the tree is packed separately. The gum when first taken from the tree is very soft, but hardens quickly. The flame is clear and brilliant; and the traveller is frequently amused by seeing a miserable Bedowi family, cowering under a wretched hovel, eating their scanty meal by the light of half-a-dozen frankincense-torches<sup>1</sup>. Every fortnight the mountains are visited in this manner, the trees producing larger quantities as the season advances, until the middle of September, when the first shower of rain puts a close to the gathering of that year."

. The export, he goes on to say, is in the hands of "those never-failing speculators, the Banians of Porebunder (Kattiawar) and Bombay." At the close of the north-east monsoon they arrive at the coast, and settle at Feluk (Mount Elephant of the ancients, Cape Felix of the Portuguese, and Jibbel Feel of Capt. Saris), Bunder Marayah, and Bunder Khor, and other Bunders. "The Bedowins from the interior immediately visit them; and as there is no one to compete with them, they manage to engross the greater part of the trade." He estimates that the quantity annually exported is:—

To Bombay . . . . .	tons.
To Red Sea . . . . .	377
To Arabia . . . . .	235
	120
Total . . . . .	<u>732</u>

"The trees that produce *Laban* or frankincense are of two kinds, *Luban Meyti* and *Luban Bedowi*. Of these the *Meyti*, which grows out of the naked rock, is the most valuable, and, when clean packed and of good quality, it is sold by the merchants on the coast for 1¼ dollar per frasila<sup>2</sup> of twenty pounds. The *Luban Bedowi* of the best quality is sold for 1 dollar per frasila; of both kinds the palest colour is preferred. The trees vary greatly in height; but I never saw one above twenty feet, with a stem of nine inches in diameter. Their form is very graceful, and when springing from a mass of marble on the brink of a precipice, their appearance is especially picturesque."

He mentions also that myrrh is chiefly brought from Murrayhan in the interior, and sold at Bunder Murraayha, near where he also saw a few myrrh-trees.

In 1843, also, KEMPTHORNE and VAUGHAN made a short journey into the Soumali country, "from Bunder Marayah, the chief town of the Mijjertheyn Soumalis, near Ras Feeluk" (Mount Elephant, ancients; Cape Felix, Portuguese; and Jibbel Feel, Saris). Kempthorne's description of the frankincense-tree, which he saw here on the limestone mountains, three miles inland from Bunder Marayah, I have copied after my botanical description of it below<sup>3</sup>. Royle says<sup>4</sup> that "Bennet identified this plant (which is Crut-

<sup>1</sup> Compare Pliny, *suprà*.

<sup>2</sup> Compare Purchas, *loc. suprà cit.*

<sup>3</sup> See Trans. Bombay Geo. Soc. vi. and xiii.; Harris, Highlands of Æthiopia, vol. i. 417, 1844; Pharm. Journal, iv. 1844

<sup>4</sup> Pharm. Journal, v. 1845.



tenden's *Luban Meyti* also) with Endlicher's *Plösslea floribunda*, but on an examination of the bark only." Kempthorne says, "During the south-west monsoon, the pastoral tribes in the neighbourhood of Ras Feluk collect large quantities of frankincense, which they barter to the Banians, of whom a few reside in the villages along the Abyssinian coast. Boats from Maculla come and fetch the gums, which are exchanged for a coarse kind of cotton cloth worn by the Soumalis." And again, "I think that the localities from which the ancients obtained their principal supply of frankincense were situated on the almost inaccessible mountains of Adel, in Africa, facing the southern coast of Arabia; for the trees, as we saw them, extended over such a vast tract of land that large quantities of the gum even now must be collected annually, as in the days of the Greeks and Romans. The plant grows at the height of between 2000 and 3000 feet above the sea." He mentions that Cruttenden had before visited the country, but that Vaughan and he were the first Europeans who had ever visited the frankincense-forests of Adel. Vaughan states<sup>1</sup>, "The Luban-tree is a native of the eastern coast of Africa, and flourishes on the highlands which intersect the whole of the Soumali country, where I had an opportunity of seeing it in 1843, not far from Cape Gardafui." And he gives the following as the different kinds of Luban found by him in the bazar of Aden:—

*Luban maitee*, from Bunder Mait, collected chiefly by the Abardagahala Soumalis. *Luban nankur* or *aungure*, from Bunder Aungure and the country of Door Mahomed and the Abardagahala Soumalis. *Luban makur*, from the ports of Ras Rurree, Khor Bunder, Alholu, and Bunder Maryah, and Bunder Khassoom, in the country of the Wursangali and Mijjerthên Soumalis, about Cape Gardafui. This drug is collected in March, April, and May, and chiefly finds its way to Bombay through the *entrepôts* of Maculla and Shehr. *Luban berbera* or *muslika*, collected by the Aial Yunus and Aial Hamed Soumalis, and which is in agglomerated *dark, vitreous tears*, and largely used by the Arabs themselves; and *Luban Marbat*, or *Saharee Luban*, the frankincense of the libanotophorous region of Arabia, the highest-priced of all, and exported in enormous quantities to Bombay.

RICHARD<sup>2</sup>, in 1845, described and figured his *Boswellia papyrifera*, identifying it with Delile's and Endlicher's plants, which are identical with Bruce's *Angouah*. The Abyssinian name he states, on the authority of Dillon and Schimper, to be *Makker*. "It grows on the mountains which encase the Tacazze."

In 1847, CARTER published<sup>3</sup> a figure and description of the frankincense-tree of Arabia, with remarks on the misplacement of the libanotophorous region in Ptolemy's geography, a paper which of course decided the vexed question whether Arabia produced frankincense or not, and for the first time accurately fixed the position of the Arabian thuriferous region, but which actually remained unnoticed, until I drew attention to it a few years ago, as will be presently told. He placed it under Colebrooke's species; and hence probably, in part, the reason why it was overlooked; but it was a distinct technical species.

<sup>1</sup> Pharm. Journ. vol. xii. 1853.

<sup>2</sup> Voyage en Abyssinie, pendant 1839–1843, par M. Théophile Lefebvre, &c., vols. 4 & 5; Tentamen Floræ Abyssinice, auctore Achille Richard, Atlas, tab. 33.

<sup>3</sup> Journal of the Bombay Branch Royal Asiatic Society, vol. ii.



It was desirable to find out where his original specimens were; and on my inquiry he wrote to me, on the 1st of November last, that

“The original drawings of the Arabian frankincense-tree, I sent in to the Government of Bombay, for transmission to the Court of Directors, among seventeen original sketches, and eleven specimens of gums, my gatherings in the south-east coast of Arabia, with short descriptions of each, in April 1848; and, on the 28th of February 1851, I got the following reply through the Bombay Government, extracted from a dispatch of the Court of Directors:—‘Great credit is due to Assistant-surgeon Carter,’ &c.

“It was from the original sketch that I sent home to the Court that I *traced* the lithograph of the same, which appears with my little memoir on it. But I sent home delicately coloured drawings also.”

I applied at the India House, to be shown these specimens and drawings, but was informed that they did not appear to be any longer there.

My next question of Carter was, if he had himself seen the Arabian frankincense-tree *in situ*, or if merely specimens had been collected for him by the Arabs.

His reply, January 28th last [1869], was: “On the 25th December, 1844, I made my first excursion in the south-east coast of Arabia. It was to see the frankincense-trees growing at the foot of the great limestone cliffs, near the village of Merbat. They were then leafless; but the odour of the gum-resin was convincing, even before they were touched. The same was the case with *Boswellia serrata*, which covers the sides of the Ajunta range, which I traversed with Bháu Daji. The whole air was redolent with their fragrance. On the 21st of April 1846, I found the frankincense-tree growing on the *detritus* of the great white limestone cliffs of Ras Fartak, within a few feet of the sea. It was then in full foliage, but without flowers. On the 22nd of May following, a little further to the north-east, I got a Bedoo to go up into the limestone mountains, close to the shore, and bring me some branches in flower. He brought them, with some rooted stems also, which I brought to Bombay, and from which the plant in the Old Gardens at Bombay was obtained. Having specimens of the branches and leaves, which I had myself gathered just a month before, from the trees under Ras Fartak, I compared all, and found all to belong to the same species, and forthwith made the drawings on board, of which you have the lithograph.”

Carter, after identifying his plants with Colebrooke’s—with a query, however, and a doubt still further expressed in a foot-note—observes, “In addition to India and that part of Arabia which I shall presently point out, the frankincense-tree is found in great abundance in Eastern Africa, on the limestone mountains which extend westward from Cape Gardafui through the country of the Soumalis. I have seen a living specimen in foliage brought from thence, and large quantities of the gum, which is imported at Makalla for re-exportation to India. Both the produce of the tree of Africa and Arabia appear to be the same.”

“Ibn Batuta calls the tree *al Kundooroo*. The gum is called by the Arabs *Laban*. The Maharas call the tree *Maghrayt d’sheehaz*, the gum *sheehaz*.”

He then epitomizes the account given by Theophrastus of the frankincense hills and the tree and the manner of collecting its gum-resin, adding, “But for the disappearance of the Sabæans and their towns, I could not offer a more accurate description.”



“The gum is procured by making longitudinal incisions through the bark, in the months of May and December . . . On its first appearance, the gum comes forth white as milk, and, according to its degree of fluidity, finds its way to the ground, or concretes on the branch, . . . from whence it is collected by men and boys employed to look after the trees by the different families who possess the land in which they grow.”

He found the *Moql* or bdellium-tree growing with the frankincense, but not the myrrh-tree, as Theophrastus relates.

“The insalubrity of that part of Arabia . . . is fabulous . . . It is most invigorating and healthy, the abode of the Bedouins, and the resort of the lowland people of the coast during the hot season.”

Of the thuriferous district he writes:—“Coming from the north-east, we first meet with the frankincense-tree on the Sabhan mountains, in latitude  $17^{\circ} 30'$  north, and longitude  $55^{\circ} 23'$  east [near Merbat?], where the desert ends, and the wooded mountainous region commences; and following the coast, which runs south-west, we find the frankincense exported from the different towns gradually diminishes, after the bay of Al Kammar, until we arrive at Makalla, from whence none is exported from the interior of Arabia, and but little used, except what is brought from the African coast, opposite that town. By the same inquiry we learn that the produce of the Arabian trees is exported in largest quantities from places on that part of the coast which intervene the longitude and latitude mentioned (viz.  $17^{\circ} 30'$  north, and  $55^{\circ} 23'$  east) and the town of Damkote, in the Bay of Al Kammar,  $52^{\circ} 47'$  east longitude [Ras Fartak?]. Between these two points the trees are congregated in two distinct localities—on the summits and sides of the highest range of mountains near the coast, and on the plain between them and the sea; the former is called *Nedjee*, or high land, and the latter *Sahil*, or plains on the coast. The *Nedjee* is about two days' journey from the shore; it is the most elevated portion of the great limestone formation of this coast, which, from a height of 5000 feet here, descends in sudden and lofty steps upon the Arabian Sea. To get to it you first cross the *Sahil*, already mentioned, and then ascend a minor range, which is covered with long grass and trees, and, after passing a less fertile region called the *Gāthān*, at last arrive at the *Nedjee*, where there is no grass, and but few trees besides those which produce the frankincense. The soil is red and sub-argillaceous; and in consequence of its scarcity, the trees are generally found growing out of the crevices of the limestone-rock. It is from this part that the frankincense is chiefly brought, and, as I have before said, that the largest quantities of it are exported from the different towns on the coast, between the longitudes of  $52^{\circ} 47'$  and  $55^{\circ} 23'$  east.” “The libanophorous region therefore lies behind the towns on this part of the coast, where Theophrastus places it, and not as Ptolemy places it, in Oman.” I think this is hypercritical on Ptolemy; but it is invaluable as accurately limiting the frankincense-region of Arabia and demonstrating the extreme accuracy of Theophrastus.

That Haines did not find the frankincense-tree on the Arabian coast, between Aden and Makalla, confirms the accuracy of both Theophrastus and Carter.

When I was placed in charge of the Agri-Horticultural Society's “Old Gardens” in Bombay, in 1859, I found the tree which Carter had brought from Arabia growing



there, and labelled, by Stocks, *Boswellia papyrifera*; and in my catalogue of the Government Central Museum, published in 1862, I adopted *Boswellia papyrifera*, Richard, which Royle had called *Boswellia floribunda*, as the source of olibanum; for I had ascertained that *Boswellia thurifera*, Colebrooke, produced none of the olibanum of commerce, but only an oleo-resinous exudation. But I had not seen Endlicher's and Richard's descriptions and figures, nor probably had Stocks; and I therefore asked Colonel (then Captain) Playfair, at Aden, whether he could procure me any cuttings of the African frankincense-tree. Colonel Playfair sent me a large collection of several varieties of dried leaves and of cuttings, accurately labelled with their native names, with samples of the kinds of frankincense which they respectively yielded. At my request, he subsequently sent duplicates of his dried specimens to Kew. On the cuttings which were sent to me striking and leafing, I found that I had three kinds:—*Yegaar*, yielding *Luban maitee*, an undoubtedly new species, and *Mohr Add* and *Mohr Madow*, yielding *Luban sheheri*, the bulk of the olibanum exported from the Soumali country. Judging by the young leaves solely, I should have been inclined to consider Colebrooke's, Endlicher's, Richard's, and Carter's plants, and Roxburgh's *Boswellia glabra* all only more or less variations of one species, and *Yegaar* the only second species. Indeed, if I followed my own erring inclination, I should hold so now.

Amongst Playfair's dried specimens of *Mohr Add* and *Mohr Madow*, were the leaves of a variety of each, which he said yielded an inferior olibanum, called *Luban bedowi*.

Carter's plant never flowered with me, nor until last year would Playfair's. But he had planted duplicates of the cuttings he sent to me, in the romantic little gardens laid out by him near the celebrated tanks of Aden. They had not flowered before he left Aden for Zanzibar; but when passing Aden, in June 1867, he found that one of the plants had flowered, and he sent its flowers to Kew. When I saw these in July 1867, it was not known to which kind they belonged, as Playfair had not picked any leaves with them. I therefore, on my way back to Bombay, in November 1867, visited the gardens, and found from the gardener that it was *Mohr Madow* that had flowered the previous June. Seeing the plants were leafing too much, I left directions to water them less abundantly than they had been, and to send me any flowers that they produced. On reaching Bombay, I also stopped watering the plants in Victoria Gardens, the Agri-Horticultural Society's new Gardens in Bombay; and early in the monsoon of last year *Mohr Add* flowered. In September last, I was again at Aden, and then found *Yegaar* in full bloom. It is from these materials that I have, with Dr. Thomson and Professor Oliver's kind assistance, prepared the descriptions, and Mr. Fitch has drawn the figures, of the three species which I have named:—

*Boswellia Carterii* (Mohr Madow).

*Boswellia Bhau-Dajiana* (Mohr Add).

*Boswellia Frereana* (Yegaar).

In rearranging the genus I have also included Roxburgh's *B. glabra* under Colebrooke's *B. thurifera*.

*Mohr Madow* I have named as if Carter's plant; that is, as the specimens of his plant have disappeared from the India House, I have described it from my specimens of *Mohr*



*Madow*. If I did not name *Mohr Madow* as Carter's plant, certain as it is that it is the same species as his Arabian plant, on this being indisputably determined by the receipt of new specimens, it would become absorbed in *Mohr Madow* under its systematic name, and Carter's connexion with his own discovery would be lost sight of<sup>1</sup>.

*Mohr Add* is named after Dr. Bhau Daji, the distinguished Hindu physician of Bombay, well known in Europe also as an oriental scholar, and whose eminent services to his countrymen and city Sir Seymour Fitzgerald has most honourably recognized in making him sheriff of Bombay for the present year.

*Yegaar* I have named after Mr. W. E. Frere.

In 1867, Mr. Hanbury showed me a most interesting article on frankincense, in the 'Schweizerische Wochenschrift für Pharmacie' of 13th of May 1864, by Dr. Flückiger of Bern, who quotes a large number of authorities, especially German, on this controversy. He had had Carter's plant brought to his notice by Hanbury; and he concludes that it is the same plant as *B. papyrifera* of Abyssinia, and proposes in consequence to include both under the name of *B. sacra*. But Carter's plant is distinct from *B. papyrifera*; and moreover it is now plain that more than one species of African olibanum yields the olibanum of commerce, whereas Dr. Flückiger prematurely includes them all under *B. papyrifera*, a species not known to supply any of the olibanum of commerce. He had heard of the facts ascertained by Colonel Playfair and myself regarding the thuriferous Boswellias of the Soumali country, but only orally, through a mutual friend of his and Carter's, and hence, I believe, the error into which he is led.

#### Conclusions.

It will, I believe, be now agreed that Arabia produces frankincense, and in the very region generally indicated by the common opinion of the ancient world and so accurately limited by Theophrastus. Now that it has been demonstrated by Carter, that the libanotophorous region lies along the coast of Hadramaut, the agreement between the statements of the Bible, Herodotus, Theophrastus, Diodorus Siculus, Strabo, Pliny, Arrian, Ptolemy, the Arabs, Marco Polo, Bochart, and Celsius is very striking.

It will, I believe, be agreed also, as implied in the more ancient references to Arabia, and expressly asserted by Diodorus, Strabo, Arrian, and others of the ancients, and demonstrated with such fulness by Cruttenden, Kempthorne, and Vaughan, and the overwhelming evidence of modern travellers (beginning with Bruce) generally, that the Soumali country also produces frankincense, and probably the bulk of the olibanum of commerce. The agreement as to the region about Mount Elephant (Ras Fieluk, Cape Felix, Jibbel Feel), between Arrian, Capt. Doventon, and Capt. Saris in Purchas, Milburn, Cruttenden, Kempthorne and Vaughan, is indeed quite startling.

It will be admitted also, I believe, that *Boswellia Carterii* (*Mohr Madow*), which with *B. Bhau-Dajiana* (*Mohr Add*), the source of the bulk of the olibanum of commerce exported from the Soumali country, is the same species as the plant (*Maghrayt d'sheehaz*)

<sup>1</sup> Carter's (the Arabian) plant has flowered since this paper was read; and a figure of it, from the flowers kindly sent to me by Mr. Wellington Gray, B.M., the present Director of the Victoria Gardens, Bombay, is now added, after that of the Soumali *B. Carterii* or *Mohr Madow*.



which Carter found produced the frankincense of the Hadramaut—and also that *Boswellia thurifera* (including *B. glabra*) of India, and *B. papyrifera* of Abyssinia, whilst thuriferous species, are not known to yield any of the olibanum of commerce.

It is very surprising that so great weight of evidence in favour of frankincense being produced in Arabia Felix and the Soumali country should ever have been set aside for the idle fancy that India was the source of the olibanum of commerce. Twenty years ago, it was clearly demonstrated that Arabia produced it, and one at least of the plants which produced it was fully described and figured. The error has proved as inveterate as the fiction that frankincense was yielded by *Juniperus Lycia*. Colebrooke's discovery was in 1807. In volume i. of Woodville and Hooker's 'Medical Botany,' London, 1832, olibanum is still said to be derived from *Juniperus Lycia*; and it is added, "it is brought from Turkey and the East Indies, but that which comes from India is less esteemed." But in vol. ii. *B. serrata*, Rox. (*B. thurifera*, Colebrooke), is adopted as its source, and it is added, in reference to the new view, that olibanum is obtained from India, "but it is also brought from the Levant in casks and chests."

Fleming<sup>1</sup>, in 1810, wrote, "That naturalists should have remained in ignorance and in error, until almost the present day, respecting the tree which yields a substance so long known, and so universally used, must appear not a little surprising. Such, however, is the fact, and the merit of having discovered the true origin of this celebrated incense, is due to Mr. Colebrooke, who has ascertained and proved most satisfactorily, that the olibanum, or frankincense of the ancients, is not the gum-resin of the *Juniperus Lycia*, as was generally supposed, but the produce of our *Boswellia thurifera*."

In Waterson's 'Cyclopædia of Commerce,' in 1847, it is stated, "Olibanum comes from India. An Arabian kind formerly imported from the Levant is now seldom met with, and its origin is a matter of doubt."

Pereira, in the editions of his 'Materia Medica' previous to 1857, says that "olibanum is imported from India, in chests, and that African or Arabian olibanum is rarely met with in this country." But in the edition of 1857, by Taylor and Rees, it is said, "Strictly speaking, there does not seem to be any Indian variety [*i. e.* commercial ?] of this gum, but, like acacia and myrrh, it reaches Bombay from the Persian Gulf." Royle, in all the editions of his 'Manual of Materia Medica,' even in the posthumous edition of 1868, edited by Headland, says that there are two kinds of olibanum:—"Indian, which is the most esteemed," and "is imported in chests chiefly from Bombay; and African, which is no doubt produced on the hills of the Soumali coast westward, from Cape Guardafui, and carried to the Arabian coast, chiefly by native boats from Moculla." In Maunder's 'Treasury of Botany,' London, 1866, edited by Lindley and Moore, it is written, "*B. thurifera* furnishes the gum-resin known as olibanum, which is supposed to have been the frankincense of the ancients. African olibanum, a drug rarely met with in this country, has been conjectured with much probability to be the product of *B. papyrifera*." But the most surprising surrender to this false summons is that of the profession of interpreters of the Bible. Tristram, in his 'Natural History of the Bible,' London, 1867, writes, "Frankincense, the fragrant gum of an Indian tree, procured through

<sup>1</sup> Asiatic Researches, vol. xi.



Arabia. . . . though brought from Sheba, in Arabia, at a very early date. . . . yet we have no reason to believe the frankincense-tree grew in Arabia; at least it cannot be traced there now: and, as in the case of cassia and other spices, the Arabian merchants were not likely to be communicative in the secrets of their monopoly [!]. To the present day the best frankincense used in Turkey is imported through Arabia, from the Eastern Archipelago. It is also largely imported into Europe from Bombay, for use in the Romish and Greek ceremonials, but of inferior quality."

It is, I think, probable that other odoriferous gum-resins, oleo-resins, and balsams may have been confused with frankincense by ancient writers, as by modern ones. Niebuhr expressly confuses benjamin with frankincense, as does also Herbert before him; and this confusion, I believe, underlies the whole error of India being the source of the olibanum of commerce. Milburn and others confuse it with the mastic, which is irregularly imported in very large quantities into Bombay. It has been popularly confused with balm:—

"Let *India* boast her plants, nor envy we  
The weeping amber, or *the balmy tree*"<sup>1</sup>.

[(*Added* Dec. 3.) So Mrs. Manning, in her 'Ancient India,' vol. ii. p. 348, says "balm and myrrh may or may not have come from India."] And the predisposing cause of all this confusion has been the unfounded belief that Dioscorides says that frankincense comes from India. It is remarkable that the benzoin of Java is said not to be mentioned by any ancient writer; and yet it is inconceivable that such a fragrant balsam should not have been known to them, and I cannot help suspecting that benzoin at least was largely used as frankincense in ancient times. It is used throughout Japan, China, Burmah, Siam, India, and Arabia, at this day, with frankincense. Books say that frankincense is still the sweet perfume "of our catholic churches;" but Stackhouse says that it is not now used, benjamin being substituted for it, an assertion which every inquiry of my own contradicts. In the Malayan language, the same word is used for frankincense and benzoin<sup>2</sup>. Dioscorides, also, as has been shown, distinguishes an Indian frankincense; and so, when Colebrooke's discovery came, it was accepted as settling the controversy. But I question whether some variety of the African frankincense was not the Indian frankincense of Dioscorides.

I have given a few extracts above, showing the change in the trade-routes between Europe and the East; and these changes also help to explain how it has come to be believed that India produces the olibanum of commerce. Errors from such changes are very common in connexion with commercial articles: calumba, East-Indian senna, and balsam of Peru are illustrative instances. The similarity between the Hebrew, Arabic, and Greek names for frankincense and Mount Lebanon probably led to the error of Ausonius, Florus, Pomet, and others, that Mount Lebanon produced frankincense. Celsius quotes an Orphic verse and passages from Euripides and Athenæus which also assert or imply that frankincense was a product of Syria. And the error seems to

<sup>1</sup> " . . . . . lacrymatis cortice myrrhas."—*Ovid*. "The Bee and the Orange-Tree," Fairy Tales, D'Aulnoy, trans. Planché: Lond. 1855.

<sup>2</sup> Marsden's Dict. of the Malayan Language; Crawford's Grammar and Dict. of the Malay Language.



survive in the nations of the Mediterranean shores; for at the Universal Exhibition of Paris, in 1867, I saw several bottles of frankincense labelled "olibanum, so called because it comes from Mount Lebanon." I also saw there aconite, labelled "Aconitum Nepaulus, so named because its root is the famous poison of Nepaul."

The 'Oxford Encyclopædia' says that olibanum is *quasi* Oleum Libani, being distilled from the bark of a tree growing on Mount Lebanon!

It would be presumption in me to enter into the etymology of the synonyms of frankincense. I have been unable even to discover when the English word frankincense came first to be used<sup>1</sup>. But I cannot help asking if *thus* and *tus* are really the same word—why the Italian for frankincense should be *olibano*, as if formed from the Greek or Arabic—if there be any connexion, and what its significance may be, between the Arabic words "Cunder," "Al-Kundooroo," and Sanscrit "Cundurū," for frankincense, and the Greek *χόνδρος*—and why the Bay of Al Kammar is so named.

Burton<sup>2</sup> mentions that "*Lubban*" is the Soumali for milk, and a term of reproach. It will have been observed that the names of the different varieties of Soumali frankincense are identical with the names of the Bunders from which they are exported. Have the Bunders given their names to the varieties of frankincense, or these to the Bunders? Cruttenden says that the myrrh of the Soumalis comes from a place in the interior of their country called Murrayhan, and is exported from Bunder Murrayha—with which name no variety of frankincense corresponds. Does this indicate any etymological connexion with myrrh, the links of which the Soumalis themselves have lost? Also, what is the derivation of the name of the Soumali port of Berbera? The correspondence between some of the synonyms of frankincense and the words used in different languages for the slaying or burning of sacrificial victims is very interesting. But I have only to observe, in connexion with this, two things that have always struck me in Bombay, viz. that the burning of the dead, in the form of the pyre, and the manner in which the body is burned, very forcibly suggests that the practice is derived from human bloody sacrifice, and that the use of sweet odours, in religious rites generally, originated in sanitary precautions. They do not merely mask bad smells, but correct them; and they wonderfully refresh the spirits from the depression which they fall into in crowded places like churches. They also drive out vermin. Nothing so quickly clears your bed in Bombay of mosquitos as burning a little olibanum or myrrh in it. The Protestant churches there are

<sup>1</sup> Minsheu, London, 1599, has "frankincense—encensio." Cotgrave, London, 1632, has "frankincense—encens. F. in drops—*cliban*." Steph. Skinner, M.D., Etymol. Ling. Angl., London, 1671, has "frankincense, thus, *q. d.* Incensum, *i. e.* Thus libere seu liberaliter, ut in sacris officiis par est, adolendum." Rob. Brady, M.D., 'An Introduction to the Old English History and Glossary,' London, 1684, has no mention of frankincense. Gower, in his story of Leucothea, from Ovid's "Methamor," turns her "into a flour was named golde" (Confessio Amantis, Pauli, ed. Lond. 1857, lib. v.).

<sup>2</sup> 'First Footsteps in East Africa,' London, 1856. In the preface to this work, Burton says that an expedition into the Soumali land was first proposed by Sir Charles Malcolm in 1849, and that the command of it was offered to and accepted by Carter in 1851, but that after Sir Charles Malcolm's death the project was given up; and that when Burton proposed his expedition in 1854, Stocks was appointed to it as botanist, but died before it started. The *savans* who went with the "Abyssinian Army" had no time for work, so swift was Lord Napier's march to Magdala and back.



infested by mosquitos, as by a plague; and I was often asked how to get rid of them, and always answered that the ugly and irreverent punkahs were of no use, and that the only remedy was the immemorial and most beautiful rite of burning frankincense. A pot of holy basil is placed before every Hindu home; and the mother of the house may be seen every morning, after having ground the corn for the day, and performed her simple toilet, walking round and round the four-horned altar, on which the pot of holy basil is set, invoking the blessings of heaven on the father of her children and on them.

## DESCRIPTIO.

### Genus BOSWELLIA.

Roxburgh, Pl. Corom. iii. p. 4, t. 207; Benth. & Hook. Gen. Plant. i. p. 322. [*Libanus*, Colebrooke in As. Res. ix. p. 377, t. 5. f. 1. *Plösslia*, Endlicher, Nov. Stirp. Dec. 47; Iconog. t. 119, 120.]

*Calyx* parvus, plerumque 5- interdum 6- non sæpe 7-, rarissime 4- v. 10-dentatus, persistens. *Petala* tot quot calycis divisiones, basi angustata, patentissima, imbricata. *Discus* annularis, crenatus, campanulatus v. explanatus. *Stamina* sepalis duplo numerosiora, plerumque 10, brevia, basi disci inserta, alterna interdum breviora. *Ovarium* 3-, creberrime 4-, interdum 5-loculare; stylus brevis, stigmatibus 3-, 4- v. 5?-lobo; ovula in loculis 2, pendula. *Drupa* 3-, 4-, 5-gona, 3-, 4-, 5-valvis, valvis a pyrenis secedentibus; pyrenis osseis, 1-spermis, ab axi persistente solutis. *Semina* compressa, pendula, margine membranaceo, testa membranacea; cotyledones contortuplicatæ, multifidæ; radice supra.

Arbores cortice sæpe papyraceo, thuriferæ. *Folia* decidua, apices versus ramulorum conferta, patentia, alterna, imparipinnata, foliolis oppositis, serratis v. integerrimis. *Racemi* v. *paniculae* axillares v. terminales, simplices v. compositi. *Flores* albi, v. rubicundi, v. virides, v. vix luteoli, v. cerei.

Species 5, Nubiæ, Abyssiniæ, Berberæ, Arabiæ, Indiæque incolæ.

### Sectio I. *Plantæ plus minus pubescentes, disco campanulato.*

#### Subsectio a. *Racemi simplices.*

#### 1. BOSWELLIA CARTERII, Birdwood, n. sp. (Tab. XXIX. et XXX.)

DIAGNOSIS.—*Ramuli* terminales, pubescentes vel tomentosi; *foliola* 7–10-juga, ovato-oblonga, undulata vel crenato-undulata, late rotundata vel basi truncata. *Racemi* simplices, fasciculati, foliis breviores.

*Fructus*  $\frac{1}{4}$  ad  $\frac{1}{2}$  poll. longus, obovato-obtusus.

Carter, Journ. Bombay Br. Roy. As. Soc. ii. 1847. *B. thurifera*, Colebrooke?

*Habitat* in montibus Soumali, “Mohr Madow” incolarum, *Playfair*; et in montibus Hadramaut in Arabia, “Maghrayt d’sheehaz” apud Maharas, *Carter*.

*Descriptio*.—Arbor parva; petiolus pubescens; foliola aut crenato-undulata et omnia pubescentia, aut obscure serratula vel integerrima et glabra supra, et velutina interdumque pallidiora infra, longa circa  $1\frac{1}{2}$  poll. et lata circa  $\frac{3}{4}$  poll., foliolo terminali sæpe grandiore. Corolla patens, petala alba vel cerea, discus roseus, ovarium disco carnosio roseo arcte adpresso semiimmersum.

*Remarks*.—The above description is taken from the specimens of leaves collected for *Playfair* from the “Mohr Madow” of the Soumalis, and the young plants growing in



the Victoria Gardens from cuttings of the same, and the flowers gathered by Playfair in June 1867 from the young plants growing in the Aden Garden from cuttings of the same, and sent by him to the Herbarium at Kew.

The tree found by Carter growing in the limestone formation about Merbat and Ras Fartak, the "Maghrayt d'sheehaz" of the Maharas, is probably a smaller tree in habit. The plant which he brought from the Hadramaut to Bombay, is to this day growing there in the Victoria Gardens; and whilst it is almost impossible to distinguish its leaves from those of the "Mohr Madow" of the Soumalis, except from their being smaller and more crumpled, it is not more than half the height of the plants of "Mohr Madow" propagated in the Victoria Gardens from the cuttings sent to Bombay by Playfair, and which are already about 9 feet high. In "Maghrayt d'sheehaz," the leaves have sometimes five pairs only of leaflets.

Playfair's dried specimens of leaves of "Mohr Madow," sent to Kew and Bombay, include two very distinct varieties,—one crenate, undulate, and pubescent on both sides; the other undulate and obscurely serrulate or almost entire, and velvety and paler below and glabrous above. The plants of "Mohr Madow" in the Victoria Gardens and in Playfair's Garden at Aden have as yet shown only the former variety of leaf, and the plant "Maghrayt d'sheehaz" in the Victoria Gardens never has shown any other; but from the analogy of *B. thurifera* and *B. Bhou-Dajiana* ("Mohr Add") I am led to believe that the two kinds of leaves included in Playfair's dried specimens of "Mohr Madow" are only varieties of leaf of one species, and not leaves of two distinct species of *Boswellia*. I have therefore included the description of both leaves in my description of *B. Carterii*, but *not without uncertainty*.

## 2. BOSWELLIA BHAU-DAJIANA, Birdwood, n. sp. (Tab. XXXI.)

DIAGNOSIS.—*Ramuli* terminales, modice puberuli vel glabri; *foliola* 7–10-juga, oblongo-lanceolata vel oblonga, late rotundata vel basi truncata, aut serrata et pubescentia, aut obscure serrulata et infra incana, supra glabra. *Inflorescentia* in simplicifasciculatis racemis. *Fructus* immaturus oblongo-contractus basi.

*Habitat* in montibus Soumali, "Mohr Add" incolarum, *Playfair*.

*Descriptio*.—Arbor parva; folia aut pubescentia, foliolis serratis, aut supra glabra et infra incana foliolis obscure serratulis vel integerrimis, longa 1 poll. ad  $1\frac{1}{2}$  et 2 poll. et lata  $\frac{1}{3}$ – $\frac{1}{2}$  poll.; 5 vel 6 racemi in quoque fasciculo, foliis paulo breviores; flores numerosissimi, corolla vix patentissima, petala alba v. viridula; discus valde pubescens, virescens, ovarium disco concavo haud adpresso semiimmersum; drupa subclavata.

*Remarks*.—Playfair's dried specimens of leaves of "Mohr Add," sent to Bombay, include two distinct varieties, the leaflets in one being serrulate and downy, in the other obscurely and remotely serrulate or entire, and hoary beneath, and glabrous above. The latter is the only variety of leaf sent by him to Kew. But in one of his dried specimens of "Mohr Add" sent to Bombay, both these varieties of leaf are seen in the same specimen. The plants in the Victoria Gardens all showed the pubescent and serrate variety of leaf until last year, when one threw out both the varieties of leaf described, and a third variety also of intermediate character. The plant from which I gathered the flower



represented in my plate of *B. Bhau-Dajiana* showed at that time only the serrate and pubescent variety of leaf; but I have figured beside it two other varieties of leaves which I subsequently found *either on this same plant, or other plants of the same species growing near it.* It would be more satisfactory if I were less uncertain on this point, especially as my ground for including the two kinds of "Mohr-Madow" leaves sent to me by Playfair under the species *B. Carterii* is the all but absolute certainty that analogous varieties of leaf are produced by *B. Bhau-Dajiana* or "Mohr Add." It must be distinctly borne in mind, therefore, that with the leaves no flowers have ever been seen of the variety, either of "Mohr Madow" or "Mohr Add," in which the leaflets are more or less entire, and hoary below, and glabrous above, and that it may be an error to include them as varieties respectively of *B. Carterii* and *B. Bhau-Dajiana*. But analogous variations of leaf are conclusively authenticated in the case of *B. thurifera*, *infra*.

The serrate downy variety of leaflet in *B. Bhau-Dajiana* is very like the young leaflets of *B. Carterii*; but the leaflets in the latter, young and old, are always more or less undulate, whereas in the former they are always quite flat. In the former, also, the leaflets are narrow and more lanceolate, in the latter broad and more oval; and in the mass of foliage these differences make a distinction.

*B. Carterii* [*i. e.* "Mohr Madow"] and *B. Bhau-Dajiana* ["Mohr Add"] yield the bulk of the olibanum exported from the Soumali country under the name of "Laban-Sheheri," "possibly," writes Playfair, "because it is principally taken to Sheherr and Makalla markets." Vaughan<sup>1</sup> says "Luban Shaharee" is the term given to Arabian frankincense, which is also yielded by *B. Carterii* [*i. e.* "Maghrayt d'sheehaz"]. Both the glabrous-above hoary-beneath variety (?) of *B. Carterii* [*i. e.* "Mohr Madow"] and of *B. Bhau-Dajiana* ["Mohr Add"] yield, according to Playfair, the "Luban Bedowi" of the Soumalis, which is also mentioned by Cruttenden, but nowhere by Vaughan.

Subsectio  $\beta$ . *Racemi compositi.*

3. BOSWELLIA POPYRIFERA, Richard, Tent. Flor. Abyss., Voyage en Abyssinie par Lefebvre, &c., iv. p. 140, tab. 33.

DIAGNOSIS.—*Foliola* 4–10-juga, pubescentia. *Inflorescentia* racemosa, racemis paniculatis.

*Amyris papyrifera*, Delile, Cent. Plant. d'Afrique; Cailliaud, Voyage à Méroé, ii. p. 293.

*Plösslea floribunda*, Endlicher, Nov. Stirp. Mus. Vind. Dec. no. 47, tab. 119, 120.

Bruce, Travels, vii. p. 334, tab. 48, "Angouah."

*Habitat* in Senaar et Soudan, et Gondar, in convallibus fluviorum Taccaze et Mareb, "Angouah" incolarum, Bruce; "Kafal Galgalaam" et "Loban-adam-coulam," Delile; "Makker," [Dillon et Schimper apud Richard.

*Descriptio*.—Arbor magna; foliola lanceolata, acuta, dentata, longa 1 poll. ad 2 et 3 poll.; calyx longe dentatus; corolla reflexa; petala longa, reflexa; pistillus basi contractus; drupa clavata.

*Remarks*.—Of the tree named "Angouah" in Bruce's 'Travels,' he says, "The Abyssinians believe it to be that which bears the true frankincense; in reality it produces a

<sup>1</sup> Pharm. Journ. xii. *sup. cit.*



gum much resembling it." Richard says of *B. papyrifera*, "It distils a resin which, when burnt, gives the odour of the incense of India, which, indeed, as every one says, is produced by another species of the genus, named *B. serrata*, Roxb."

4. BOSWELLIA THURIFERA, Colebrooke, Asiatic Researches, ix. p. 377, t. 5.

DIAGNOSIS.—*Foliola* 8–14-juga, dentata, serrata, vel plus minus obscure et remote serrulata, pubescentia v. glabra. *Inflorescentia* racemosa, racemis compactis, plerumque dense compositis, foliis multo brevioribus. *Fructus* late ellipticus, triquetrus, basi vel apice non contractus.

*B. serrata* et *B. glabra*, Roxburgh, Flor. Ind. ii. p. 383, 384.

*B. glabra*, Roxburgh, Cor. ii. t. 207.

Var.  $\alpha$ . *Foliola* ovato-oblonga, truncata vel late rotundata basi, serrata, infra pubescentia.

Var.  $\beta$ . *Foliola* lineari-lanceolata, oblique contracta basi, nonnunquam obscurissime vel remote serrulata, propemodum glabra.

*Habitat* in montibus Indiæ tropicæ, "Salai," "Saleh" incolarum; Oude et Rohileund, *Royle*; Behar, *Hooker*; Concan, *Stocks*; Kattyawar, Khandeish, *H. M. Birdwood*.

*Descriptio*.—Arbor parva; petala patentia, infra pubescentia, valde rosacea, v. albida; stamina alterna breviora; discus ruber, v. inconspicuus.

*Remarks*.—The natives of India recognize the two varieties of this plant, of which Roxburgh made two species, and distinguish between their gum-resins. What I have seen of it has been either stalactiform, like the runnings of a wax candle, or in small tears, and always so soft that, when kept in a bottle, in a short time it has run into an oleo-resinous mass, with the smell of frankincense, but more turpentine. I often and perseveringly tried to get regular tears of olibanum from this plant, but never succeeded in getting anything else than soft, oleo-resinous "runnings" from it, which, even after months' exposure on the trunk, still remained quite soft.

In Khandeish the olibanum produced by this plant is sold under the name of "Dup-Salai" [*i. e.* incense of Salai] in the village bazars. But I have never myself seen it exposed for sale. I have had samples sent to me from all parts of India, and all soft and always melting at last into a mass.

The most remarkable character of this plant is the way in which its leaves and *flowers* vary. Sometimes the inflorescence is in loose cymes, sometimes gathered into a knotty head or capitulum. In a plant brought by my brother from Kattyawar, the petals were reduced to mere scales, the disk very fleshy, red, and prominent, and the stamens tending to abortion.

Sectio II. *Frutex glaber, glaucus, disco explanato.*

5. BOSWELLIA FREREANA, Birdwood, n. sp. (Tab. XXXII.)

DIAGNOSIS.—*Folia* omnia glabra et glauca; *foliola* 3–6-juga, late ovata, elliptica, valde obtusa utrinque, undulata. *Inflorescentia* in racemis compositis, foliis multo longior. *Fructus* ovato-oblongus.

*Habitat* in montibus calcareis Soumaliensis regionis prope "Bunder Murayha," *Cruttenden*, *Kemphorne*, et *Vaughan*; "Yegaar" Soumaliensium, *Playfair*.



*Descriptio.*—Arbor parva; folia et flores omnia citrum et terebinthum grate redolentia; corolla valde et rigide patens, stellata; petala basi contracta, et acuta, smaragdina; discus explanatus; stamina circa marginem inserta, rigide erecta in floribus recentioribus, et super disco supine jacentia (velut radii rotæ) in deflorescentibus; antheræ rubræ; pistillus omnino liber et super discum conspicue elevatus, velut metula.

*Remarks.*—This is a strongly marked species, the source of the “Louban Maitee” of the Soumalis. It is unmistakably this plant which Kempthorne describes. It is evidently also Cruttenden’s “Luban Meyti.”

Kempthorne says, “The tree is one of the most extraordinary plants I ever saw, quite a *lusus naturæ* of the vegetable world, for the trees actually grow out of the sides of the almost polished rocks. . . . The trees were about 40 feet high, the stem was about 2 feet in circumference, rising straight up, with a bend outwards of 6 or 7 inches. They are attached most firmly to the rocks by a thick oval mass of substance, about a foot or so in diameter, something resembling a mixture of lime and mortar. Branches spring out rather scantily at the top, and extend a few feet down the stem; the leaves are 5 inches or so long, and  $1\frac{1}{2}$  broad, narrowing and rounding towards the point, but not serrated at the edges; the upper surface is of a rich dark shining green, while the lower is of a lighter hue; they are thin and smooth, and crimped like that beautiful species of seaweed so often found on the coast of England. The tree has four layers of bark, the outer being coarse and loose, like that of the beech, while the next two are as it were glued to the trunk and delicately fine, resembling oiled paper or gold-beater’s skin, and of a bright amber-colour; this bark is perfectly transparent, and can be stripped off easily in large sheets; the natives use it for writing on; the inner bark of all is an inch or so in thickness, adhering closely to the stem; it is tough, not unlike leather, and striped red and white, and yields a strong aromatic perfume. The timber is white, soft, porous, and of little use, except as firewood. A deep incision into the bark causes the odoriferous gum to exude in large quantities, which is of a milky white, and of the consistency of honey; but it soon hardens by exposure to the atmosphere. It is a remarkable fact that not a single frankincense-tree did I perceive growing upon any other rocks than those of almost pure limestone. . . . It is my opinion that the trees on the Adel coast are different from the species as described so ably by Dr. Carter” (Trans. Bombay Geo. Society, xiii. 1857). This description of Kempthorne’s well shows how we should understand the descriptions of old writers. The present Governor-General of Mozambique informed me, quite in the style of Sir John Maundeville, “that copal grew in the earth just like potatoes.”

Vaughan writes:—“The hill-ranges on the eastern coast of Africa are composed entirely of white limestone, in some parts so compact as to resemble limestone. This appears to be the soil most genial to the tree, and in no instance did I find it growing in sand or loam. The tree is first met with at a few miles inland from the coast, and at an altitude of about 300 feet above the level of the sea. Its appearance is strikingly singular, seeming at first sight to be destitute of roots and clinging to the hard uncreviced rock by masses of a rhomboidal and fantastically shaped wood with the most obstinate adherence. The stem is nearly at right angles with this substance, ascending almost



invariably in an upright direction, and attaining the height of from 12–15 feet. At the base the circumference is equal to that of a man's thigh, gradually tapering towards the top, where it shoots off its branches and leaves" (Pharm. Journ. and Trans. xii. 1853).

As I saw this plant in Playfair's garden at Aden in September last, in young leaf and covered with bloom, I was much struck by its elegant singularity. The long racemes of green star-like flowers, tipped with the red anthers of the stamens (like aigrettes of little stars of emerald set with minute rubies), droop gracefully over the clusters of glossy glaucous leaves; and every part of the plant (bark, leaves, and flowers) gives out the most refreshing lemon-like fragrance.

It gave me the most lively pleasure to find the flowers which I had been so long seeking of so charming an originality, and in such a romantic spot; for Playfair's garden is a mere angle<sup>1</sup> in the shadow of two pumice rocks, which tower hundreds of feet above it, guarding in their shadows<sup>2</sup> the store of water for the garrison and town; and green leaves, shade, and water make Paradise in the east.

<sup>1</sup> "..... et quod  
Angulus iste feret piper et thus ocius uva."

*Hor. Epist. lib. I., xiv. 22–23.*

<sup>2</sup> Herbert, Travels, Lond. 1677, describes Aden as "a town low in its situation and sulphureously shaded by the high and barren mountain Cabobarra, whose brazen front so scorches this miserable place."

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Tab. XXIX. *Boswellia Carterii*—"Mohr Madow."

XXX. *B. Carterii*—"Maghrayt d'sheehaz."

XXXI. *B. Bhau-Dajiana*—"Mohr Add."

XXXII. *B. Frereana*—"Yegaar."

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#### POSTSCRIPT.

CARTER'S plant ("Maghrayt d'sheehaz") was not before me when I was preparing this paper (see pp. 138, 139), and my description of *B. Carterii* was, and is, the description of "Mohr Madow." A flowering specimen of "Maghrayt d'sheehaz" was subsequently received from Mr. Gray, B.M., the present Director of the Victoria Gardens, Bombay, when it was found that in it *the stamens are inserted into the side of the disk*, but it was too late to add the character to the description of the species *Boswellia Carterii* and of the genus. This character therefore distinguishes the Arabian (*Maghrayt d'sheehaz*) from the Soumali (*Mohr Madow*) variety of *B. Carterii*.

G. B.



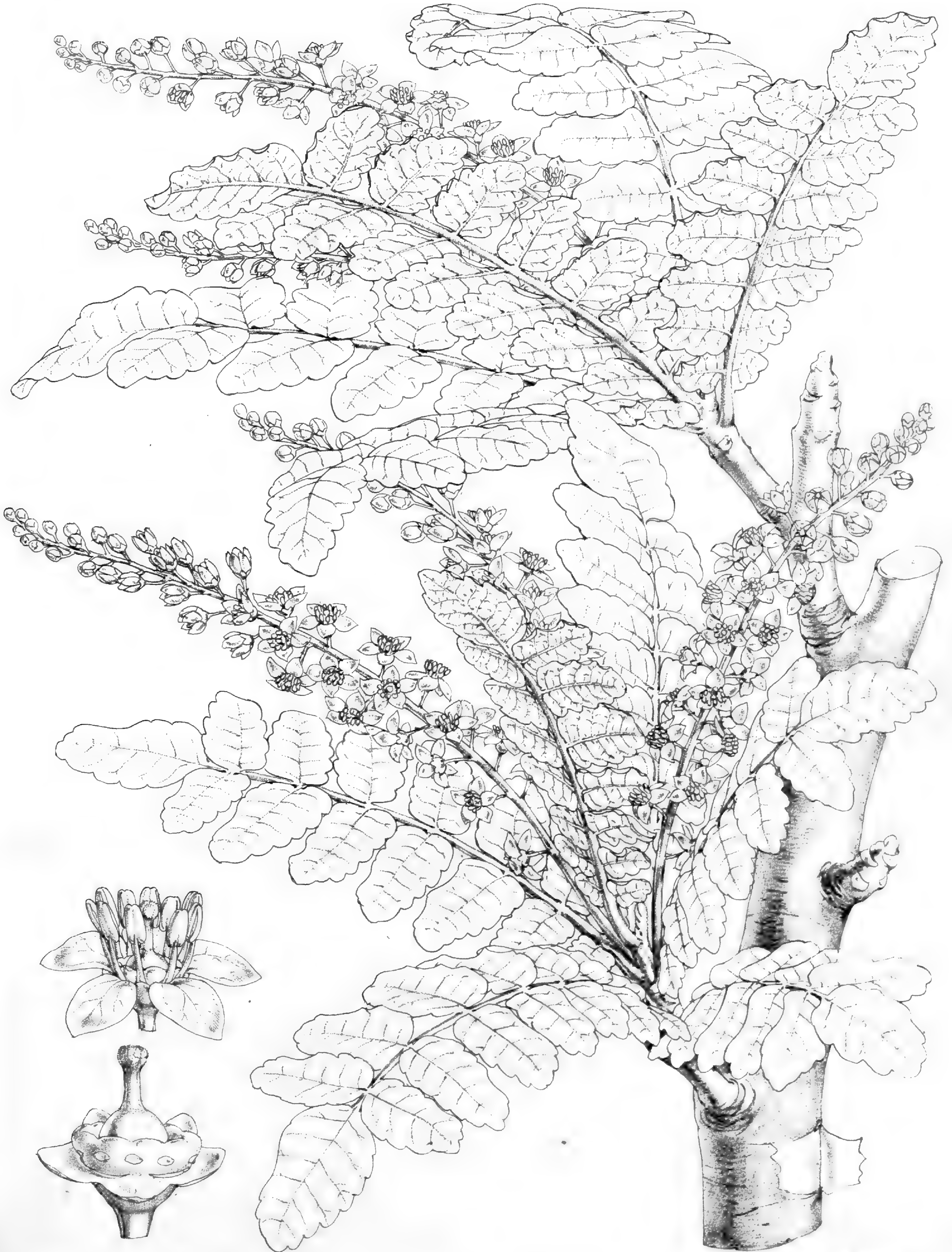


W E Fitch del et lith.

J N Fitch imp

*Boswellia Carterii*. Birdwood.  
*Mohr Meadow, of the Somalis.* - Playfair.





W. H. Fitch, del. et lith.

*Boswellia Carterii*. Birdwood.  
*Maghrayt d' Shehar, of the Maharas. Carter*

J. N. Fitch imp.





W. H. Fitch, del et lith.

*Boswellia Bhau Dajiana*. Birdwood.  
*Mohr-Add., of the Soumalis. Playfair.*

J. N. Fitch, imp.





W. H. Fitch, del. et lith.

*Boswellia Frereana*, Birdwood.  
*Yegaar*, of the *Soumatis*. — Playfair.

J. N. Fitch, imp.



IV. *On some Species of the Genus Agaricus from Ceylon.*

By the Rev. M. J. BERKELEY, M.A., F.L.S., and C. E. BROOME, Esq., F.L.S.

(Plates XXXIII. & XXXIV.)

Read November 19th, 1868.

THANKS to the exertions of Mr. Thwaites, in addition to those of König in the last century, and of Dr. Gardner, Mr. Thwaites's predecessor in the direction of the Gardens at Peradeniya, no member of our British Colonies bids fair to be more thoroughly known, as regards its fungology, than Ceylon. The species collected by König were published in the 'Annals of Natural History,' vol. x. 1842; while those of Dr. Gardner, together with some of Mr. Thwaites's earlier communications, have been described in Sir W. J. Hooker's 'London Journal of Botany,' 1847, p. 495, and the 'Kew Garden Miscellany,' 1854, p. 229, &c., and we have 1200 packets of Fungi from Mr. Thwaites, on which we are now occupied. The last communication was accompanied by some very beautiful and correct drawings of some of the Hymenomycetous Fungi, two or three of which are so interesting, either from beauty or singularity, that we are induced to lay them before the Society, and at the same time to give characters of a few other species which are worthy of more immediate record, or because the drawings throw light on the character of species already described.

It is remarkable that we cannot identify a single species, with the exception of one or two which are very widely distributed, with any of those of which Dr. Hooker made drawings in Sikkim and the contiguous districts.

We have now in our possession a large number of more or less finished coloured sketches of Hymenomycetous tropical or subtropical fungi; and we trust that the time is not far distant when it will be considered quite as necessary, in publishing floras of our colonies, to give complete lists of the cryptogamic as of the phænogamic plants. The species which we have selected for description are the following:—

1. *AGARICUS (AMANITA) HEMIBAPHUS*, Berk. & Br. Pileo e campanulato expanso glabro obtusissime umbonato flavo, sursum coccineo, margine sulcato crenato; stipite farcto, (basi excepta attenuata) subæquali, pallide flavo, e volva crassa bilobata oriundo; annulo supero deflexo striato lato; lamellis albis segmentiformibus adnexis. (Thwaites, Ceylon, n. 700.)

*Hab.* On the ground, July 1868, Peradeniya.

Pileus nearly 3 inches across, yellow, the upper half of a beautiful scarlet; margin deeply sulcate; stem 4 inches high,  $\frac{1}{2}$  an inch thick, attenuated as in *Phallus* and its allies at the very base, where it sinks into the strongly incrassated bilobed volva, which gives off a few short fibres.

This belongs to the first section of the subgenus *Amanita*, in which it is remarkable for the great thickness of the volva and the attenuated base of the stem.



2. A. (LEPIOTA) DOLICHAULUS, Berk. & Br.: pileo carnosio expanso umbonato, centro glabro, alias punctato-squamuloso, margine lacerato appendiculato, carne alba immutabili; stipite elongato stricto, (basi excepta) subæquali, apice penetrante; flocculoso-punctato cavo; annulo amplissimo deflexo lacerato; lamellis latis ventricosis remotissimis. (Thwaites, Ceylon, no. 694.)

*Hab.* On the ground amongst grass, July 1868, Peradeniya.

Whole plant, with the exception of the pallid umbo and scales of the pileus, white. Pileus 4 inches across; flesh nearly  $\frac{1}{2}$  inch thick; stem 8 inches high,  $\frac{1}{3}$  thick, slightly bulbous at the base, where there are occasionally a few fragments of the ring. Gills  $\frac{1}{2}$  inch broad in the centre; spores  $\cdot 00057$  inch long. Mycelium thread-like, white.

Allied to *Agaricus gracilentus*, but differing in the appendiculate ragged margin, the very broad persistent ring, and the deep pit in which the apex of the stem is sunk, as in *A. procerus*.

3. A. (LEPIOTA) MANICATUS, Berk. & Br.: pileo convexo obtusissimo carnosio, toto floccoso-verrucoso, verrucis centro pyramidatis, in margine diffracto appendiculato angustioribus; carne alba; stipite subæquali stricto, subter anulum angustum superum floccoso-manicato, deorsum pubescente, hic illic leviter squamuloso, solido; lamellis lanceolatis pallide carneis approximatis acie crenulatis. (Thwaites, Ceylon, no. 691.)

*Hab.* On the ground, July 1868, Peradeniya.

Pileus  $2\frac{1}{2}$  inches across; stem 2 inches high,  $\frac{1}{3}$  thick, yellowish-brown like the pileus; gills  $\frac{1}{4}$  inch broad in the centre.

Allied to *Agaricus hispidus*, from which it differs in the split appendiculate margin, the thicker flesh, and the curious muff on the stem just below the ring. According to the characters given by Fries in the 'Epicrisis,' there should be an umbo in *A. hispidus*; but there is no trace of one in the drawing deposited in the Swedish Museum.

4. A. (LEPIOTA) THELOIDES, Berk. & Br.: pileo e campanulato expanso fortiter umbonato subcarnoso squamulis nigris notato, margine sulcato; carne alba immutabili; stipite fistuloso tenui glabro candido, annulo angusto infero persistente; lamellis antice latioribus, postice attenuatis subremotis candidis. (Thwaites, Ceylon, no. 688.)

*Hab.* On the ground, July 1868, Peradeniya.

Pileus nearly 3 inches across; stem  $3\frac{1}{2}$  inches high,  $2\frac{1}{2}$  lines thick; stem collecting a little soil at the base by means of the white mycelium; margin of pileus slightly inflexed. Spores  $\cdot 0003$ – $\cdot 0004$ .

Allied to *Agaricus clypeolaris*, but differing in the smooth stem, sulcate margin, and decidedly remote gills.

5. A. (LEPIOTA) PARDALOTUS, Berk. & Br.: pileo carnosio depresso squamis fuscis notato, centro pyramidatis, margine punctiformibus; stipite subvalido subæquali solido fibrilloso, basin versus fusco-punctato; annulo evanido; lamellis approximatis ventricosis. (Thwaites, Ceylon, no. 693.)

*Hab.* On the ground, Peradeniya, July 1868.

Pileus  $2\frac{1}{2}$  inches across, dark brown except occasionally in the interstices of the scales;



stem 2 inches high,  $\frac{1}{2}$  inch thick, white, sometimes slightly thickened below and subcespitose; gills ventricose,  $\frac{1}{4}$  inch broad, white.

A much stouter species than *Agaricus cristatus*, and much more fleshy, and, except that the gills are not sinuated behind, approaching *Tricholoma*.

6. A. (COLLYBIA) SPARSIBARBIS, Berk. & Br.: esculentus; pileo carnoso fortissime umbonato convexo virgato-striato marginem versus floccis liberis aspero, umbone glabro fusco, carne alba; stipite valido subradicante, præmorso, basi marginato-bulboso hic illic sulcato; lamellis angustioribus postice rotundato-adnexis pallidis. (Thwaites, Ceylon, no. 697.)

*Hab.* On the ground, Peradeniya, July and August 1868.

Pileus  $5\frac{1}{2}$  inches across, deep brown in the centre, then paler; stem white, (including the bulb, half of which is buried in the soil) 4 inches high,  $\frac{2}{3}$  inch thick halfway up. Gills  $\frac{1}{4}$  inch broad, rounded, behind free.

Evidently nearly allied to *Agaricus eurhizus*, Berk. Lond. Journ. Bot. 1847, p. 483 (Gardner, no. 43), but differing in the hairy margin of the pileus and the absence of the long root and ring. The Himalayan *A. napipes*, Berk., with its long root, is also very nearly related.

7. A. (VOLVARIA) DIPLASIUS, Berk. & Br.: pileo hemisphærico subcarnoso obtusissimo sericeo-floccoso e volva brunnea bilobata oriundo, margine inflexo lævi; stipite solido sursum attenuato, deorsum cum basi volvæ adnato; lamellis ventricosis postice attenuatis remotissimis candidis. (Thwaites, Ceylon, no. 689.)

*Hab.* On wood and on soil about decayed roots, Peradeniya, July 1868.

Pileus 3 inches or more across, delicately floccose, white; volva rising from a thick white-lobed mycelium; stem 3 inches high, nearly an inch thick at the base,  $\frac{1}{3}$  at the apex, round which there is a broad free space. Spores  $\cdot 0003$  inch long.

This beautiful species is clearly allied to *Agaricus bombycinus*. Its nearest ally, perhaps, is a Jersey species, collected by Mr. Michael Angelo Taylor, the characters of which may be given as follows:—

- A. (VOLVARIA) TAYLORI, Berk. & Br.: pileo campanulato obtuso livido ab ipso apice striato-rimoso tenui e volva spadicea bilobata oriundo; stipite solido pallido subæquali; lamellis sinuatis antice latis, postice valde attenuatis roseis.

Pileus  $1\frac{3}{4}$  inch high and broad; stem  $2\frac{1}{2}$  inches high,  $\frac{1}{4}$  thick.

8. A. (VOLVARIA) TERASTIUS, Berk. & Br.: pileo ex hemisphærico late campanulato l. expanso carnoso livido leviter virgato rimosove, margine fisso e volva crassa tessellata oriundo; stipite sursum attenuato albo solido; lamellis pallide carneis ventricosis liberis. (Thwaites, Ceylon, no. 689 bis.)

*Hab.* On the ground, Peradeniya, July 1868.

Pileus 4 inches across. Volva irregularly ruptured, extremely thick, connate, with the base of the stem brown, paler within, pointed at the base; the edge, when ruptured, broken so as to expose the white internal substance; the surface split into large sub-



hexagonal areae, which are pale and striated at the margin, brown and verrucose in the centre, calling to mind the outer coat of some *Lycoperdon*; stem 3 inches high,  $\frac{2}{3}$ – $\frac{1}{2}$  inch thick at the base,  $\frac{1}{2}$ – $\frac{1}{3}$  thick above.

This is one of the most curious species in the multitudinous genus *Agaricus*; it is undoubtedly allied to *A. bombycinus*, but, unfortunately, we have not been able to find any spores on the gills, which are, perhaps, in an imperfect condition.

9. *A. (PHOLIOTA) MICROMERES*, Berk. & Br.: cæspitosus; pileis subhemisphæricis depressiusculis glabris, margine annulo crenato appendiculato, lamellis adnatis argillaceis acie candidis; stipitibus fistulosis flexuosis glabris. (Thwaites, Ceylon, no. 690.)

*Hab.* On dead wood, Peradeniya, July 1868.

Densely cespitose; pilei yellowish, slightly depressed in the centre, fringed with the ring, which separates entirely from the stem,  $\frac{1}{3}$ – $\frac{1}{2}$  inch across; stems paler, 1 inch high, scarcely a line thick; spores yellow-brown,  $\cdot 00025$  inch long.

A minute species, apparently allied to *Agaricus pudicus*.

10. *A. (PSALLIOTA) SPILOCEPHALUS*, Berk. & Br.: pileo expanso carnosio umbonato, albido, centro squamulisque punctiformibus atro-purpureis, margine striato, carne alba; stipite pallido sursum attenuato striato, floccis intricatis araneosis farcto; annulo amplo supero; lamellis atro-purpureis liberis. (Thwaites, Ceylon, no. 698.)

*Hab.* On the ground, Peradeniya, July and August 1868.

Pileus 4 inches across; stem 3 inches high,  $\frac{2}{3}$  thick in the middle, marked with dark streaks.

Allied to *A. campestris*. Apparently the same as Gardner's no. 65. Differing from all its allies, except *A. silvaticus*, in the hollow stem, which, in this case, is curiously stuffed with delicate threads.

Mr. Thwaites, amongst other matters of interest, has sent a very fine drawing (no. 688 *bis*) of *Lentinus stenophyllus*, Berk. Lond. Journ. Bot. 1847, p. 495, tabb. 17, 18. f. 1. It appears from the drawing and the accompanying specimens, that the pileus, when first developed, is covered with acute warts in the centre, while the margin has a single row of large floccose wart-like scales. The upper part of the stem, moreover, is pitted with minute black specks.

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## EXPLANATION OF THE PLATES.

### PLATE XXXIII.

Figs. *a.* *Agaricus hemibaphus.* | Figs. *b.* *A. manicatus.* | Figs. *c.* *A. diplasius.*

### PLATE XXXIV.

*Agaricus terastius.*









E. M. Williams, lith

Vincent Brooks, Day & Son, Imp

*Agaricus terastius*, B. & Br



V. *On the Similarity between the Genus Draparnaldia and the Confervoid Filaments of Mosses.* By J. BRAXTON HICKS, M.D., F.R.S., F.L.S., &c.

(Plate XXXV.)

Read March 4th, 1869.

IN the Transactions of this Society for 1862, I made some observations on the gonidia and confervoid filaments of the mosses. Amongst other matter, I alluded to the close resemblance there was between the branchings of some of these filaments, when grown in water, to some of the forms of the *Draparnaldiæ*, particularly instancing that known as *D. tenuis*. I there said, "The length of each cell of the filament varies extremely, according to external conditions. Under moisture and heat it is very much increased, so that it may be twenty or thirty times longer than wide; and sometimes the more terminal cells are elongated into delicate hairs, bearing a striking resemblance to the so-called cilia of the *Draparnaldiæ*." Further on, "Some of the filaments, which I had grown in water, branched in a manner very similar to *Draparnaldia tenuis* (*Stygeoclonium tenue*, Kützing); indeed, had it not been for its known origin, I should instantly have regarded it as such. . . . it seems a point worthy of further research, whether or not that genus, or at any rate the above species, may not have its origin from moss in some one of its phases. Nor should this, in our present state of knowledge, be considered a wild speculation; for we know nothing of the agamic growth of *Draparnaldia*: we have nothing to militate against its being one mode of vegetative growth of a form altogether distinct; and this is not more extravagant than the known fact that these confervoid filaments can produce and spring from Mosses. I again remark, we know so little of the whole possible life-history of these simpler plants, that our want of knowledge of a precedent cannot be quoted against it."

These remarks were illustrated in the plates accompanying that paper (by Tab. 57. fig. 1 *b*, fig. 4, fig. 9).

I now bring forward some more facts, which tend to strengthen the opinion I then expressed. Whilst I was watching the growth of the gonidia of some moss (probably *Neckera*), their tendency to linear growth was very evident; but instead of continuing to elongate in one line, they formed branches in the manner represented at Tab. XXXV. figs. 1 & 2. Later on the branching became still more marked, and the component cells narrower and more attenuated (fig. 3), so as to bear a close resemblance to the less vigorous branches of *Draparnaldia tenuis*, tapering remarkably to the end, in the cells of which the chlorophyll became almost invisible.

It is noteworthy that while some of the gonidia took on this form, some proceeded to divide by both "parietal" and "free-cell" formation (fig. 4).

Besides this, I had evidence of the formation of zoospores from these "free-cell"



growths. This is important (although not embraced in the subject of this communication), because I had before noticed their formation only immediately from the contents of the filaments.

In May 1868, a large mass of the radicles of a moss was sent to me, possessing all the appearance of a *Draparnaldia*—so much so that, when I first observed it, I named it such, thinking it had simply attached itself to the radicles of moss. However, on closer inspection, I found that it actually was a part of the radicle, which was readily distinguished also by the red-brown colour of the cell-wall.

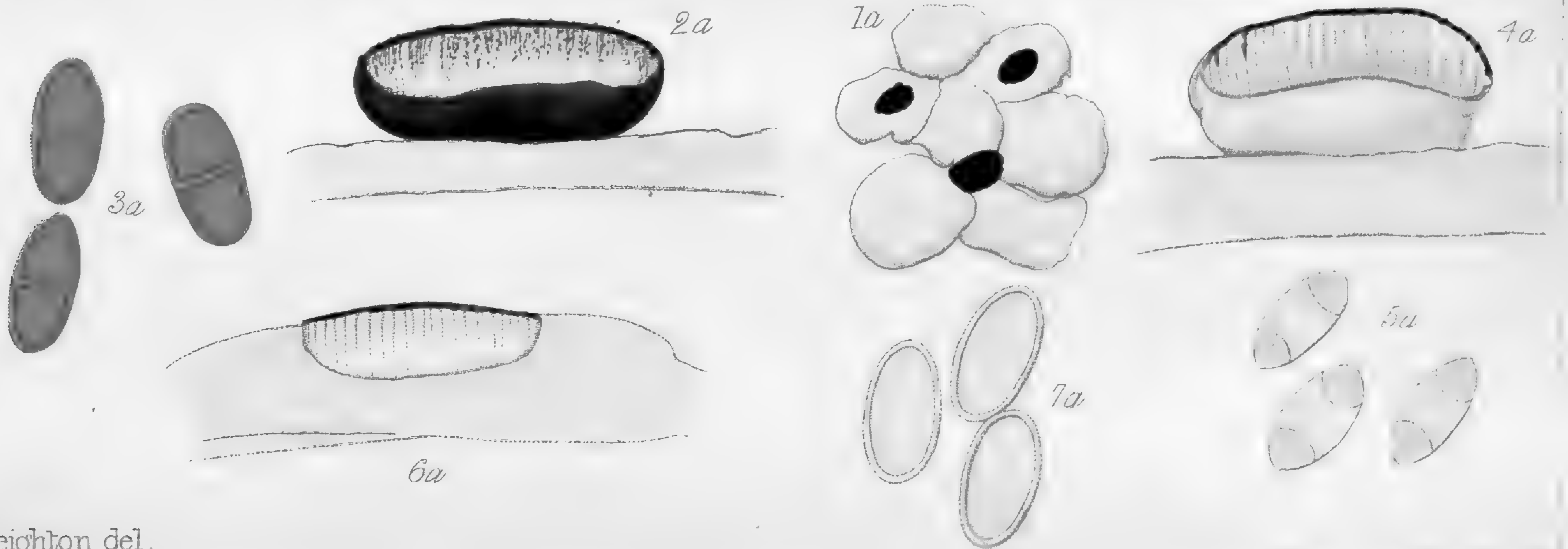
The mode of origin has been attempted to be shown at fig. 5 *a*. Rapidly the cells became narrow and elongated, the cell-wall colourless, filled with chlorophyll, though towards the extremities the green was paler, till in the terminal cells it was nearly colourless. The end of a branch I have drawn at fig. 6. It shows a tendency to symmetry in the branchings. In this specimen the excessive elongation of the terminal cells so as to form cilia was not marked; and this was probably owing to another interesting phenomenon: most of the lateral branches terminated by a short group of branches (fig. 7), each having its terminal cell enlarged, and more or less rounded.

Most of these terminal cells ultimately burst, and at the same time the water around these branches became crowded with small zoospores. These zoospores were of the same shade as the contents of the terminal cells. I am not able to say that they were seen actually to escape from these ruptured terminal cells; but the inference seems reasonable that they come from within them—the more so because the tint of the chlorophyll in both was similar, there were only these kinds of zoospores in the water, and they were all of the same size. If it be a fact that these filaments did produce zoospores, it forms another link with the *Draparnaldiæ*, which have been already observed by Mr. Currey to produce zoospores.

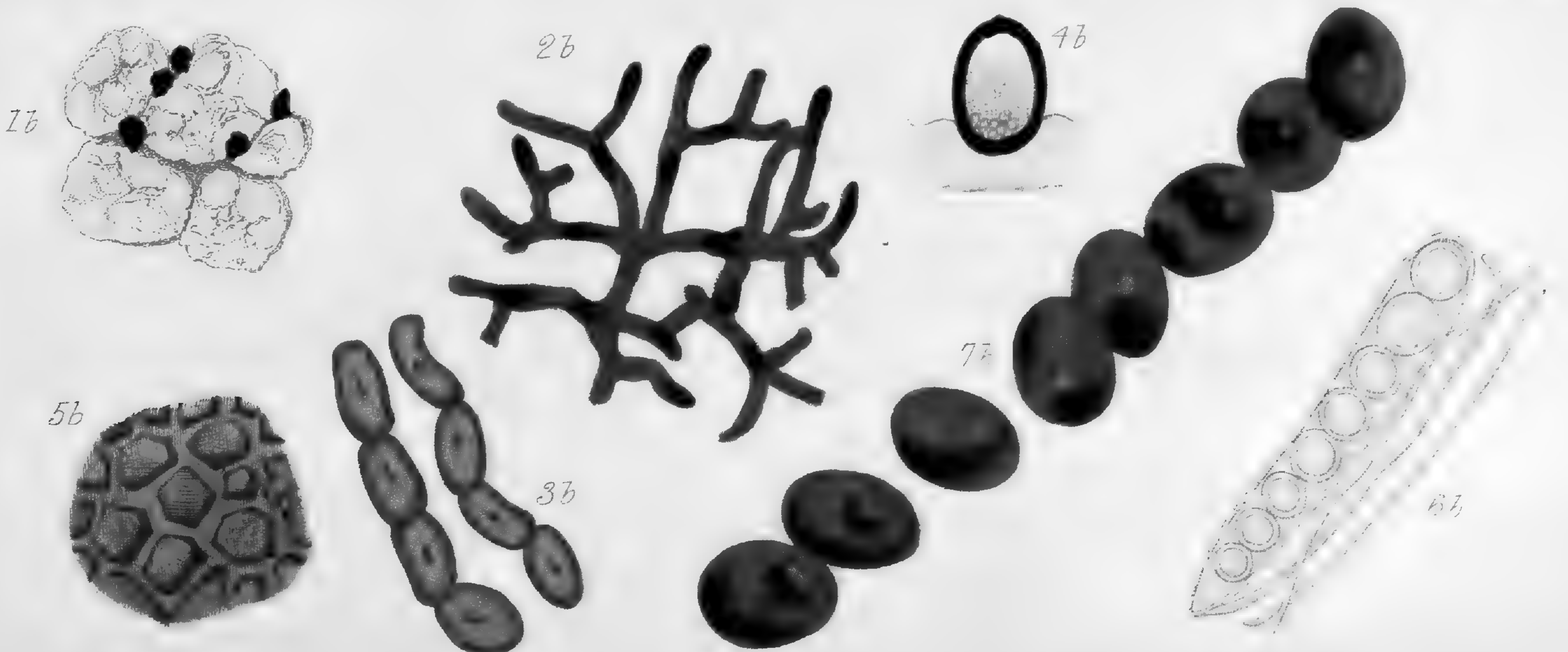




J.B.Hicks del.



W.A.Leighton del.



W.A.Leighton del.



VI. *Notes on the Lichens of the Island of Saint Helena.*  
*By the Rev. W. A. LEIGHTON, B.A., F.L.S., F.B.S. Edin.*

(Plate XXXV.)

Read January 21st, 1869.

AMONGST the unarranged Lichens in the Hookerian Herbarium at Kew, is a small collection of Lichens from the Island of Saint Helena, gathered by Dr. W. Burchell in the year 1809, which I have been requested by Dr. Hooker to examine and name. Though not numerous, they are highly interesting and instructive, as well from their insular locality itself, as more especially from their approximate similarity to the "*Lichenes Amazonici et Andini*," of Mr. Richard Spruce (see Linn. Trans. vol. xxv. p. 433 *et seq.*).

I am informed that Dr. Burchell took great pains in their collection, from which I should conclude that he gathered every thing he saw, so as to render his collection as complete and comprehensive as circumstances permitted. From the condition of the specimens, they would appear to have been collected in haste within a circumscribed time; and many of them are not in a good state, sterile and broken.

Subsequently Mr. J. C. Melliss, who has resided on the island for many years, forwarded to me for examination a collection which he had also made. This contains many similar to those of Dr. Burchell's gatherings, and adds several others. I have indicated the collectors by initials, B. and J. C. M. We may conclude that we have now a fair knowledge of the lichen-flora of the island, though no doubt the rocks, if well searched, would yield many additions; and this labour Mr. Melliss undertakes to accomplish on his return to St. Helena. The whole of both collections are deposited at Kew.

LEPTOGIUM TREMELLOIDES (Fr.). In fructification. B., J. C. M.

CLADONIA PYXIDATA, Fr., forma *fimbriata* (*denticulata*). (K —, C —.) B.

C. PYXIDATA, Fr., forma *pityrea* (*decorticata*). (K —, C —.) J. C. M.

C. PYXIDATA, Fr., forma *chlorophæa*. (K —, C —.) J. C. M.

Imperfect fragments of what appears to be

C. AGGREGATA (Sw.), Eschw. (K —, C —.) B.

ROCCELLA TINCTORIA, Ach. J. C. M.

R. PHYCOPSIS, Ach. (K yellow, C red, but not soredia). B., J. C. M.



- USNEA BARBATA, Fr., forma *florida*, Fr. Sterile. B., J. C. M.
- U. BARBATA, Fr., forma *hirta*, Fr. Small and sterile. B., J. C. M.
- U. BARBATA, Fr., forma *ceratina*, Schær. Diminutive but fertile. B., J. C. M.
- U. LÆVIS (Eschw.). Sterile. B.
- RAMALINA SCOPULORUM, Ach. Subulate form. J. C. M.
- R. ANGULOSA, Laur. (K f +, C +.) Fertile.  
Longwood. B.
- R. ANGULOSA, Laur. (K f +, C +.) Fertile. Forma *gracilentata*. B.
- R. ANGULOSA, Laur. (K f +, C +.) Fertile. Forma *humilis dilatata*.  
On rocks close to the Round Tower on Ladder Hill, September 28th, 1809. B.
- R. POLLINARIA, Ach. Sterile.  
On gumwood trees in Longwood, September 1815. B.
- R. POLYMORPHA, Ach. Various states. J. C. M.
- R. CERUCHIS, D.N. Fertile. B.
- STICTINA CROCATATA (Ach.). Sterile. J. C. M.
- S. TOMENTOSA (Sw.). Fertile, diminutive specimens. B., J. C. M.
- S. TOMENTOSA (Sw.), Dél. St. t. 6. f. 19. Fertile. B.
- STICTA AURATA, Ach. Sterile. B., J. C. M.
- Broken fragments in fruit of probably  
RICASOLIA HERBACEA, D. N. B.
- PARMELIA SAXATILIS, Ach. Broken fragments, amongst which *Erioderma unguigerum*  
(Born.) is intermixed. B.
- P. SAXATILIS, Ach. Broken fragments, sterile. B.  
(Corticola), J. C. M.
- P. LÆVIGATA, Ach. Sterile. B.
- P. PERLATA, Ach., and var. *ciliata*, D.C. J. C. M.
- PHYSICIA FLAVICANS, D.C. Sterile. B., J. C. M.
- P. LEUCOMELA, Mich. Fertile. B.  
Forma *angustifolia* (Mey. & Flt.). Sterile. J. C. M.
- P. SPECIOSA, Fr. Fertile. B.  
Var. *hypoleuca*, Ach. Fertile. J. C. M.



*P. PICTA* (Sw.). Sterile. J. C. M.

*PANNARIA RUBIGINOSA*, Dél. B., J. C. M.

*ERIODERMA UNGUIGERUM* (Bor.), Fée. B., J. C. M.

*CORA PAVONIA* (Web.). Sterile. B., J. C. M.

Two imperfect sorediate thalli, forming what were formerly termed *Lepraria ochracea* and *flava*. J. C. M.

On a fragment of volcanic rock are:—*Parmelia conspersa*, Ach., forma *Mougeotii*, Schær. (sterile); another sterile *Parmelia* in scattered fragments, which may be possibly *incurva*, Fr.; *Lecanora aurantiaca* (Lightf.), forma *erythrella* (Ach.). B.

The following species appear to be new and undescribed:—

*LECANORA PERSONATA*, Leight., n. sp.: thallus crustaceus, albo-sulphureus, glebuloso-areolatus, glebulis confertis aut sæpius dispersis, lobatis, subradiato-effiguratis, ambitu inciso-crenatis, plano-convexis, minute tuberculoso-furfuraceis; apothecia fusco-nigricantia, innata, plana, margine thallino integro demum excluso; sporæ 8, incolores, oblongæ; paraphyses confertæ, distinctæ, breves, crassiusculæ; gelatina hymenea iodo pallide cærulescens at thecis fuscatis.

Ad saxa volcanica. B.

In general appearance like *L. frustulosa*, Dicks, and *L. argopholis* (Whlbn.); but those have chemical reaction K +, C +, whilst *personata* has K yellow, C orange red. The surface of the thallus is minutely rimulose with flattened tubercles, which give it an amylaceous or chaffy, almost pulverulent, aspect; but it is not really pulverulent.

See Plate XXXV. fig. 6 a, section of thallus and apothecium; 7 a, spores magn. 1200.

*LECIDEA APPROXIMANS*, Leight., n. sp.: thallus crustaceus, tenuis, albidus vel pallide fuscescens, contiguo rimosus, areolis subconvexis lævigatis; apothecia parva, prominentia, sessilia, nigra, plana, marginata; hypothecium fuscum; sporæ 8, fuscae, ellipsoideæ vel oblongæ, 1-septatæ; gelatina hymenea iodo intense cærulescens.

Ad saxa volcanica. B.

In general aspect similar to some states of *L. disciformis*, Fr., but differing in the nature of the hypothecium and the size of the spores, which approximate to those of *L. stellulata*, Tayl., with which, however, it has no other affinity. The chemical reaction of the thallus is K orange, C reddish.

See Plate XXXV. fig. 1 a, thallus; 2 a, section of apothecium; 3 a, spores magn. 1200.

*LECIDEA LACTESCENS*, Leight., n. sp.: thallus crustaceus, tenuior, albidus, lacteus, rimulosus, lævis, areolis planis vix subconvexis; apothecia parva, prominentia, sessilia, nigro-fusca, plana, vix marginata, tandem convexa aut sphaerica, subpedicellata, margine



obliterato; hypothecium incolor; sporæ 8, incolores, ellipsoideæ, utroque apice loculum præbentes; gelatina hymenea iodo intense cærulescens.

Ad saxa volcanica. B.

Sometimes I have fancied that the polar nuclei of the spores are united by a minute tube similar to the nuclei of the spores of the tribe Placodei; but I have failed in perfect vision, so as to speak with full certainty on this peculiarity. The chemical reaction of the thallus is K +, C +.

See Plate XXXV. fig. 4 *a*, section of apothecium; 5 *a*, spores magn. 1200.



VII. On *Sphæria tartaricola*, Nyl., a new British Fungus.  
By the Rev. W. A. LEIGHTON, B.A., F.L.S., F.B.S. Edin.

(Plate XXXV.)

Read January 21st, 1869.

IN August 1866 I observed on the perpendicular face of the wall bounding the turnpike-road and the grounds of Hengwrt, near Dolgelley, North Wales, a patch of lichen about 2 inches in diameter, which I at the time thought was *Lichen candidus*, E. Bot. 1138, to which it had a considerable general resemblance. Subsequent examination under the microscope proved this supposition to be incorrect, and that I had found a totally different thing. Regarding the thallus and the fructification as appertaining to each other, I could not refer my plant to any described lichen, and submitted it to Dr. W. Nylander. That learned lichenist replied that the thallus was that of *Lecanora tartarea* (Linn.), and that what appeared to be the fructification was in reality a *Sphæria* growing parasitically on it, and which he believed to be a *nova species*, and requested me to figure and describe it under the name of *Sphæria tartaricola*, Nyl.

The *Sphæria* grew in the interstices of the areolæ of the thallus (see Plate XXXV. fig. 1 *b*), and never on the surface. But on examining the latter with a lens, it was found to be overspread here and there with a dark filamentous radiating network, which, under the microscope, appeared as in fig. 2 *b*; but a higher power elicited that the filaments were composed of minute articulate irregularly oblongo-moniliform cells, each containing a small nucleus (see fig. 3 *b*), and were no doubt the mycelium of the *Sphæria*. The perithecium was of an oblongo-conical shape, black in colour, in vertical section as fig. 4 *b*, and in structure as fig. 5 *b*. This contained a mass of slender paraphyses filled with minute granules and linear asci, containing eight spherical spores, at first colourless, and with iodine turning yellow (see fig. 6 *b*); but subsequently, in maturity, and when discharged from the ascus, of an oblong shape and a dark bright-brown colour, with a minute, paler, rounded nucleus in their interior (see fig. 7 *b*, magn. 1200).

The only specimen observed was collected, and is deposited in the national herbarium at Kew.

**SPHÆRIA TARTARICOLA**, Nyl. Parasitica; mycelio superficiali nigro-fusco radiante ramossissimo articulato, cellulis oblongo-moniliformibus nucleolatis; peritheciis oblongo-conicis nigris inter interstitia matricis conspicue protrudentibus, ascis linearibus; sporidiis 8 simplicibus sphæricis vel oblongis, primo incoloribus tandem in maturitate fuscis, minute nucleolatis.

Parasitic on thallus of *Lecanora tartarea* (Linn.), on a wall at Hengwrt, near Dolgelley, North Wales, August 6, 1866.







VIII. *The Lichens of Ceylon collected by G. H. K. THWAITES, Esq., Ph.D., F.R.S., F.L.S., Director of Royal Botanic Garden, Peradeniya, Ceylon. Examined and determined by the Rev. W. A. LEIGHTON, B.A., F.L.S., F.B.S. Edin.*

(Plates XXXVI. & XXXVII.)

Read January 21st, 1869.

I HAVE the honour to lay before the Society the results of the examination of an extensive and important collection of lichens, made with singular skill and judgment by Dr. Thwaites, in the central province and southern portions of the island of Ceylon. The collection is apparently a fairly complete one, although, without doubt, many additions may still be reasonably expected to be made to some of the tribes and genera by future and further researches. As it is, it affords very many lichens hitherto undescribed and new to science. With a very few exceptions, the lichens all grew on the barks of various trees.

Mr. Thwaites (*in litt.* Dec. 13, 1868) says, "The localities here most favourable for lichens are open forests, or the margins of dense forests. Except the *Thelotremata*, most of which affect the bark of old tree-trunks, the greater number of our epiphytal species grow best upon healthy young trees, whose bark is sometimes quite covered with lichens, adding, I think, greatly to their beauty, and apparently not impairing their health.

"The range of elevation in which *most* of our species of lichens occur, is from little above sea-level to 4000 feet; many ascend much higher, and even to 8000 feet; but at the last-named elevation the number of species is comparatively small."

The epiphyllous lichens, of which a large quantity has been forwarded to me, are as yet unexamined, and I hope to lay them before the Society in a future paper.

The following Table will exhibit a synoptical view of those comprised in this paper:—

Lichinei .....	Pterygium .....	1		Pannaria .....	4
Collemei .....	{ Leptogium .....	5		Coccocarpia .....	2
	{ Collema .....	1		Erioderma .....	2
Caliciei .....	{ Sphinctrina .....	1		Lecanora .....	6
	{ Trachylia .....	1	Lecanorei .....	Urceolaria .....	1
Sphærophorei .....	Sphærophoron .....	1		Dirina .....	1
Bæomycei .....	Bæomyces .....	1		Pertusaria .....	9
Cladonieï .....	Cladonia .....	3		Thelotrema .....	21
Stereocaulæi .....	Stereocaulon .....	1		Ascidium .....	7
Roccellei .....	Roccella .....	1		Gyrostomum .....	1
Usnei .....	Usnea .....	3	Lecideei .....	{ Cœnogonium .....	5
Ramalinei .....	Ramalina .....	2		{ Lecidea .....	11
Peltigerei .....	{ Nephromium .....	1		{ Graphis .....	31
	{ Peltigera .....	1		{ Helminthocarpon .....	1
	{ Asteristion .....	1	Graphidei .....	{ Opegrapha .....	1
	{ Stictina .....	9		{ Platygrapha .....	9
Parmeliei .....	{ Ricasolia .....	1		{ Arthonia .....	4
	{ Parmelia .....	7		{ Glyphis .....	5
	{ Physcia .....	7		{ Chiodecton .....	4
Gyrophorei .....	Umbilicaria .....	1	Pyrenocarpei .....	{ Verrucaria .....	17
Pyxinei .....	Pyxine .....	2		{ Endococcus .....	1
				{ Trypethelium .....	5
				Total .....	199



In the accompanying plates the spores have been all magnified alike, 600 linear.

1. *PTERYGIUM ZEYLANENSE*, Leight., n. sp. : thallus luridus seu pallido-castaneus, opacus, radiatus, centrifugus, laciniis angustis dichotomo-multifidis, adpressis, convexis, grosse longitudinaliter rugulosis, confertis, imbricatis, subtus pallidior, longitudinaliter rugulosus, versus centrum rhizinis densis fusco-nigris conglomeratis; apothecia terminalia, subpedicellata, lecanorina, extus rugosa, disco subconcaviusculo pallide rufo, margine subincurvo minute granulato, tandem lacerato-diformi; paraphyses graciles, distinctæ; sporæ 8, ellipticæ, incolores; hypothecium pallide fuscum.

Ad saxa super ripas rivulorum, Ambagamowa, Ceylon.

Duplo major quam *P. centrifugum*, Nyl. (Anzi, Lich. Langob. 311!), atque thallo membranaceo fragili non cartilagineo et firmo. Facie externa *Physciæ* cujusdam, at interna satis diversa. Cellulas paralleles longitudinales paucas exhibet, granulis gonimis uniformiter diffusis pluribus moniliformi-concretis. Gelatina hymenea iodo violacee tincta.

Plate XXXVI. fig. 1, sporæ magn. 600.

2. *LEPTOGIUM TREMELLOIDES*, Fr.

Central Province.

3. *L. CALLITHAMNION*, Nyl. Syn. i. 126.

On trunks of palms, Peradeniya.

4. *L. CYANESCENS*, Nyl.

Central Province.

5. *L. SATURNINUM*, Nyl.

Habgalla, 6000 ft. alt.

6. *L. PHYLLOCARPUM* (Pers.), var. *macrocarpum*, Nyl., = Lindig, Lich. N. Gran. 87! & 126!

Central Province, 5000 ft. alt.

7. *COLLEMA NIGRESCENS*, Ach.

Central Province.

8. *SPHINCTRINA MICROCEPHALA*, Nyl.

Peradeniya; rare.

9. *TRACHYLIA LEUCAMPYX*, Tuck., = Wright's Lich. Cubæ, 21!

Peradeniya.

10. *SPHÆROPHORON AUSTRALE*, Laur.

Central Province, 6000–8000 ft. alt.

11. *BÆOMYCES RUFUS*, Ach.

Neuvara Eliza, 7000 ft. alt.



12. CLADONIA DELICATA, Flk., var. *subsquamosa*, Nyl. (K +, C -.)  
Central Province, 5000-8000 ft. alt.
13. C. DIGITATA, Hoffm., var. *\*macilenta*, Hoffm. (K +, C -.)  
Central Province, 6000-8000 ft. alt.
14. C. FLORKEANA, Fr., var. *\*bacillaris*, Ach. et Auct. (K -, C -.)  
Central Province, 6000-8000 ft. alt.
15. STEREOCAULON PASCHALE, Fr.  
Central Province, 5000-8000 ft. alt.
16. ROCCELLA MONTAGNEI, Dél.  
On trees near sea-coast; exported occasionally.
17. USNEA BARBATA, Fr., varr. *hirta*, *ceratina*, et *dasypoga* (=Fellm. Lich. Lappon. Orient. 49).  
Central Province, 5000-8000 ft. alt.
18. RAMALINA SCOPULORUM, Ach.  
Central Province.
19. R. ANGULOSA, Laur.  
Damboul, 2000-3000 ft. alt.
20. NEPHROMIUM HELVETICUM, Ach.  
Ceylon (a very morsel only).
21. PELTIGERA SPURIA, DC.  
Central Province, 5000-7000 ft. alt.

ASTERISTIUM, Leight. nov. gen.

*Thallus* parum evolutus, solum apothecia recipiens et marginans, albus vel albidus, circa 6-stellato-divisus atque repandus, subtus sordidus, membranaceus, subceraceus, subtiliter pulveraceus; *apothecia* rotundata, sparsa aut confluentia, plana, depressa, adnata, cinnabarina, singula centro thalli stellato-divisi circumjacentis atque marginantis immersa, primum membrana thallina alba (tamen a thallo omnino discreta) tecta, dein dirumpente, irregulariter dilacerata persistente, erecta atque connivente; *sporæ* 8, in ascis, fuscescentes, lineari-oblongæ, 3-4- vel 5-septatæ; *paraphyses* distinctæ, confertæ, iodo pallide lutescentes.

22. A. ERUMPENS, Leight.: species unica cognita notisque allatis dignota. *Thallus* erumpens e cortice arboris in quo crescit maxime simillimus Fungo cuidam (e. g. *Æcidio grossulariæ*).

Central Province.

Affinitas cum *Solorina* et præcipue *Solorinella*.

Plate XXXVI. fig. 2, *sporæ* magn. 600.



23. STICTINA ARGYRACEA, Dél., et var. *intricata*, Dél.

Habgalla.

24. S. FRAGILLIMA (Bab.), var. *subpunctulata*, Nyl., thallo impresso-punctulato.

Central Province, very abundant.

25. S. FULIGINOSA (Ach.).

Habgalla.

26. S. CROCATATA (Linn.).

Central Province.

27. S. TOMENTELLA, ?

Habgalla.

28. S. QUERCIZANS (Mich.), var. *peruviana*, Dél.

Habgalla, 5000 ft. alt.

29. S. BOSCHIANA (Mont.).

Central Province.

30. S. CILIARIS (Mont. et v. d. B.).

Central Province.

31. RICASOLIA HERBACEA, D. N.

Central Province, common.

32. PARMELIA PERLATA, Ach. (K +, C +.)

Central Province.

33. P. PERLATA, Ach., var. *ciliata*, DC. (K +, C +.)

Central Province.

34. P. CRINITA, Ach. (K +, C +.)

On top branches of old tamarind-trees, Peradeniya.

35. P. REVOLUTA (Flk.). (K yellow, C red.)

Central Province.

36. P. LÆVIGATA, Ach. (K +.)

Central Province.

37. P. LÆVIGATA, Ach., var. *cervicornis*, Tuck.

Central Province.



38. *PARMELIA KAMTSCHADALIS*, Eschw., var. *Americana*, Mont.

Central Province, 6000–8000 feet alt.

39. *PHYSCIA FLAVICANS*, D.C., sterile.

Central Province.

40. *P. LEUCOMELA*, Mich.

Central Province, on steep banks, 5000–7000 feet alt.

41. *P. SPECIOSA*, Fr.

Central Province, very abundant.

42. *P. SPECIOSA*, Fr. var. *hypoleuca*, Ach.

Central Province.

43. *P. STELLARIS*, Fr.

Central Province.

44. *P. PICTA* (Sw.).

Common in Ceylon.

45. *P. BARBIFERA*, Nyl.

Central Province, 5000–8000 feet alt.

46. *UMBILICARIA VELLEA* (Linn.), sterile.

Central Province.

47. *PYXINE MEISNERII*, Tuck.

Habgalla, 5000 feet ; Peradeniya.

Hypothecium fuscum crassum ; paraphyses distinctæ iodo violacee tinctæ ; sporæ 8, fuscae.

Plate XXXVII. fig. 107.

48. *P. COCCIFERA* (Fée), sterile.

On trunks of cocoa-nut-trees, Peradeniya.

49. *PANNARIA LEIOSTROMA*, Nyl.

Central Province, abundant.

Plate XXXVI. fig. 3, sporæ magn. 600.

50. *P. RUBIGINOSA*, Dél.

Ceylon.

51. *P. NIGRO-CINCTA*, Mont.

Dolosbagey.

52. *P. PHOLIDOTA*, Mont.

Central Province.



## 53. COCCOCARPIA PARMELIOIDES (Hook., Mont.).

Central Province.

## 54. C. SMARAGDULA (Hook., Mont.).

Habgalla, 5000 ft. alt.

## 55. ERIODERMA POLYCARPUM, Fée.

Central Province, 5000-7000 ft. alt.

## 56. E. UNGUIGERUM, Bor.

Ceylon.

## 57. LECANORA TARTAREA, Ach., corticola.

Central Province.

## 58. L. SUBFUSCA, Ach., states (K + .)

Central Province.

59. L. ANGULOSA, Ach., forma *chlarona*, Ach. (K + .)

Central Province.

## 60. L. VARIA, Ach. (K + .)

Central Province.

## 61. L. ATRA, Ach.

Central Province.

## 62. L. PUNICEA, Ach.

Central Province, not uncommon.

## 63. URCEOLARIA SCRUPOSA, Ach.

Central Province.

## 64. DIRINA CERATONIA, Fr.

Peradeniya.

## 65. PERTUSARIA CUCURBITULA, Mont. (K + , C + .)

Central Province.

## 66. P. PAPILLULATA, Nyl. (K yellow, then orange-red.)

Central Province.

## 67. P. VERRUCOSA, Fée. (K + , C + .)

Central Province.

## 68. P. ALBIDELLA, Nyl. (K - C -.)

Peradeniya.

Sporæ 2, granulis sphaericis repletæ.



69. *P. LEIOPLACA*, Schær. (K — , C — .)

Central Province.

Sporæ 3.

70. *P. LEIOPLACELLA*, Nyl. (K — , C — .)

Central Province.

Sporæ 8.

71. *P. CRYPTOCARPA*, Nyl. (K — , C — .)

Ceylon.

Sporæ 4.

72. *P. VELATA*, Turn. (K — , C red.)

On cocoa-nut-trees, Peradeniya.

Spora 1.

73. *P. QUASSLÆ*, Fée. (Disk of apothecium K yellow, then orange-red.)

South of island.

Sporæ 2.

74. *THELOTREMA GLAUCESCENS*, Nyl., = Wright's Lich. Cubæ, 151!, 152!

Habgalla.

Paraphyses distinctæ, iodo lutescentes; sporæ 8, fuscæ; hypothecium nullum.

Plate XXXVII. fig. 104.

75. *T. LEPTOPORUM*, Nyl., = Wright's Lich. Cubæ, 128!

Paraphyses curtæ, iodo lutescentes; sporæ 8, incolores, iodo cærulescentes.

Plate XXXVII. fig. 103.

76. *T. MICROPORUM*, Mont.

South of island.

Paraphyses confertæ, distinctæ, iodo lutescentes; sporæ 8, incolores, iodo cærulescentes; hypothecium pallidum.

Plate XXXVII. fig. 102.

77. *T. SPHINCTRINELLUM*, Nyl.

N. Eliya, 7000 ft. alt.

Paraphyses distinctæ, iodo lutescentes; sporæ 8, incolores, iodo fuscæcentes.

Plate XXXVII. fig. 101.

78. *T. PLATYSTOMUM*, Mont.

South of island.

Paraphyses vix distinctæ, iodo lutescentes; sporæ 8, incolores, iodo violacæe tinctæ.

Plate XXXVII. fig. 100.



79. *T. CONCRETUM*, Fée, = Lindig, Lich. Nov. Gran. 59!

Habgalla.

Paraphyses distinctæ, iodo lutescentes; sporæ 8, incolores, iodo cærulescentes; hypothecium pallidum.  
Plate XXXVII. fig. 99.

80. *T. CALVESCENS*, Fée.

Habgalla.

Paraphyses distinctæ, graciles, iodo lutescentes; sporæ 8, incolores, iodo cærulescentes.  
Plate XXXVII. fig. 98.

81. *T. OLIVACEUM*, Mont.

Central Province.

Paraphyses distinctæ, iodo non tinctæ; sporæ 8, incolores, iodo cærulescentes.  
Plate XXXVII. fig. 97.

82. *T. GLAUCOPALLENS*, Nyl.

Central Province.

Paraphyses distinctæ, iodo lutescentes; sporæ 8, incolores, iodo non tinctæ.  
Plate XXXVII. fig. 96.

83. *T. COMPUNCTUM*, Sm.

Central Province; Habgalla.

Paraphyses distinctæ, iodo lutescentes; sporæ 8, incolores vel fuscescentes, iodo luteo-fuscescentes.  
Plate XXXVII. fig. 95.

84. *T. AUBERIANUM*, Mont.

South of the island.

Paraphyses distinctæ, iodo non tinctæ; sporæ 4, fuscescentes.  
Plate XXXVII. fig. 94.

85. *T. PUNCTULATUM*, Nyl. L. Exot. 222.

Ceylon.

Paraphyses distinctæ, iodo lutescentes; sporæ 8, incolores, iodo cærulescentes.  
Plate XXXVII. fig. 93.

86. *T. PHÆOSPORUM*, Nyl.

Central Province.

Paraphyses distinctæ, iodo non tinctæ; sporæ 8, fuscæ.  
Plate XXXVII. fig. 92.

87. *T. MYRIOTREMA*, Nyl. (*Th. album*, Fée, = Wright, Lich. Cubæ, 127!).

Central Province.

Paraphyses distinctæ, iodo lutescentes; sporæ 8, incolores, iodo cærulescentes; hypothecium fuscum.  
Plate XXXVII. fig. 91.



88. *T. CAVATUM*, Nyl., var. *confertum*, Nyl.

South of the Island.

Paraphyses distinctæ, iodo lutescentes; sporæ 8, incolores, iodo cærulee obscuratæ; hypothecium nigrum carbonaceum.

Plate XXXVII. fig. 90.

89. *T. SUBCONCRETUM*, Leight., n. sp.: thallus albido-glaucescens, cartilagineus, crassissimus, irregulariter effusus, lævigatus, minute albido-granulato-innato-punctatus; apothecia sparsa, parum prominentia, immersa, ostiolo minuto perforato aperto, margine thallino crassiusculo tumido, margine proprio integro crassiusculo tumido concreto; discus planus, fuscus; sporæ 8, oblongæ, primo incolores, 1-septatæ, cellulis irregulariter nucleolatis, tandem nigro-fuscæ, septo cellulisque obscuratis, iodo non tinctæ.

Central Province.

Paraphyses distinctæ, iodo leviter lutescentes.

Plate XXXVI. fig. 4.

90. *T. PAPILLATUM*, Leight., n. sp.: thallus pallide lutescens, lævigatus, tenuis, subnitidus; apothecia minuta, parum fusco-papillata, ostiolo minutissimo punctiformi, aperto, margine thallino crassiusculo pallide-fusco integro, margine proprio albido-farinoso convergente; sporæ 8?, incolores, elongato-oblongæ aut ellipsoideæ, 6-8-cellulosæ, mediocres, iodo violacee aut fusce tinctæ.

Central Province.

Paraphyses confertæ, distinctæ, iodo non tinctæ.

Plate XXXVI. fig. 5.

91. *T. EXANTHISMOCARPUM*, Leight., n. sp.: thallus albido-fuscescens, irregularis; apothecia prominentia, plano-depressa, albo-pulverulenta, maxime dilatato-aperta, margine thallino erecto crasso irregulariter granulato-lacerato furfuraceo vel pulverulento, margine proprio a thallino omnino libero atque discreto ceraceo connivente, radiato-lacerato aperto; discus planus aut subconcavus, albo-glauco-pruinosis; sporæ 8, maximæ, cylindrico-fusifformes, incolores, multi(27)-cellulosæ, iodo violacee tinctæ.

Central Province.

Species maxime singularis et nullis aliis speciebus cognitis confundenda. Perithecium thallinum iodo cærulescens at non proprium. Perithecium thallinum primo clausum, deinde stellatim lacero-dehiscens persistens. Paraphyses distinctæ, iodo lutescentes.

Plate XXXVI. fig. 6.

92. *T. ELACHISTOTERON*, Leight., n. sp.: thallus pallide lutescens, minute granulato-rugosus, subnitidus, margine nigricante irregulari limitatus; apothecia minutissima, prominentiis granularibus immersa, ostiolis minutissimis numerosis apertis, margine thallino crassiusculo elevato albido, margine proprio albido membranaceo promi-



nente; sporæ 2, pallide virescentes, magnæ, elongato-ellipticæ, apice altero subatenuatæ, murali-divisæ, iodo non tinctæ.

Central Province.

Paraphyses distinctæ, graciles, iodo non tinctæ.

Plate XXXVI. fig. 7.

93. *T. DISCIFORME*, Leight., n. sp.: thallus albido-glaucescens, tenuis, lævigatus, subnitidus; apothecia urceolato-scutelliformia, verrucis sparsis orbicularibus hæmiphæricis lævigatis, ostiolo magno dilatato-aperto, margine thallino crassiusculo elevato subceraceo pallide fulvescente integro, margine proprio tenui elevato albo erecto; discus planus, dilatatus, niger, albo-pruinosis; sporæ 2 aut 4, incolores aut pallide virescentes, cylindrico-ellipticæ, apice utroque attenuatæ, murali-divisæ (seriebus transversis 24 cellulis 3, 2, aut 1, in quavis serie) iodo non tinctæ.

Central Province.

Paraphyses distinctæ, iodo non tinctæ.

Plate XXXVI. fig. 8.

94. *T. ALBIDIFORME*, Leight., n. sp.: thallus lutescens, tenuis, opacus, rugosus, verrucis sparsis orbicularibus turgescens subdepressis, ostiolo mediocri aperto, margine thallino crassiusculo subceraceo subalbido-pruinoso, margine proprio discreto integro albo-farinoso incurvato subpruinoso; spore 8, incolores, maximæ, cylindrico-fusiformes, multi(21)-cellulosæ, iodo cærulescentes.

Central Province.

Paraphyses distinctæ, graciles, iodo lutescentes.

Plate XXXVI. fig. 9.

95. *ASCIDIUM DEPRESSUM*, Nyl.

Central Province.

Paraphyses distinctæ, iodo non tinctæ; sporæ 1 vel 2, pallide virentes, iodo leviter cærulescentes.

Plate XXXVII. fig. 87.

96. *A. PERTUSARIÆFORME*, Leight., n. sp.: thallus sordide cinerascens, tartareus, crassus, rugulosus, sparsim granulatus, hinc inde rimoso-areolatus; apothecia in protuberantiis thallinis majusculis inæqualibus discretis depresso-umbilicatis, margine crassissimo turgido granulato-inæquali, ostiolo minuto infundibuliformiter perforato obsolete marginato; sporæ 1 vel 2, maximæ, incolores, elongato-cylindricæ, apice utroque rotundatæ, 11-12-septatæ, iodo cærulescentes.

Central Province.

Facie externa generaliter simillima *Pertusariæ fallaci*. Perithecium dimidiatum, fuscum, basi deficiens.

Paraphyses graciles, distinctæ, iodo læviter lutescentes. Thallus hydrate kalico ochracee tinctus.

Plate XXXVI. fig. 10.

97. *A. THELOTREMOIDES*, Leight., n. sp.: thallus albido-glaucescens, concretus, effusus, lævigatus, opacus; apothecia in protuberantiis thallinis leviter elevatis parvis



depresso-umbilicatis discretis vel subconfluentibus immersa, margine crasso tumido lævigato, ostiolo mediocri acute marginato; sporæ 8, incolores, oblongo-ellipticæ, 8-9-cellulosæ, cellulis centralibus binucleolatis, iodo cærulescentes.

Central Province.

Facie externa generaliter simillima *Thelotremati concreto*. Perithecium dimidiatum, fuscum, basi deficiens. Paraphyses graciles, distinctæ, iodo non tinctæ. Thallus hydrate kalico ochracee tinctus.

Plate XXXVI. fig. 11.

98. *A. PUNCTULATUM*, Leight., n. sp.: thallus sordide olivaceus, verrucoso-rugulosus, rimulosus, opacus, effusus; apothecia in protuberantiis thallinis parvis confertis valde depressis immersa, margine tumido lævigato, ostiolo magno aperto tenui vel obsolete marginato; sporæ 8, mediocres, incolores, oblongæ, 6-cellulosæ, iodo cærulee fuscatae.

Central Province.

Paraphyses distinctæ, iodo non tinctæ. Species insignis, non aliis facile confundenda.

Plate XXXVI. fig. 12.

99. *A. PACHYSTOMUM*, Leight., n. sp.: thallus olivaceus, tenuis, minute verrucoso-granulosus; apothecia in protuberantiis thallinis mediocribus sparsis depresso-hemisphæricis lævigatis, ostiolo mediocri rotundato-perforato crasso atque valde prominente margine circumcincto; spora 1, incolor, fusiformi-cylindræa, apicibus subattenuata, irregulariter et tenuiter subseptata, nebulosa, minutissimis murali-divisionibus, iodo cærulescens.

Ad cortices, south of the island.

Perithecium dimidiatum, nigrum, basi deficiens. Paraphyses distinctæ, gracillimæ, longissimæ, iodo non tinctæ.

Plate XXXVII. fig. 29.

100. *A. GRANULOSUM*, Leight., n. sp.: thallus sordide olivaceus, vix crassus, minute verrucoso-granulosus; apothecia in protuberantiis thallinis minutis sparsis numerosissimis conico-hemisphæricis lævigatis, ostiolo minuto perforato margine tenuissimo circumcincto; spora 1, incolor, maxima, oblongo-cylindræa, 17-septata, iodo cærulescens.

Ad cortices, south of the island.

Perithecium dimidiatum, fuscum, basi deficiens. Paraphyses distinctæ, iodo non tinctæ.

Plate XXXVII. fig. 30.

101. *A. CHONESTOMUM*, Leight., n. sp.: thallus fusco-olivaceus, tenuis, rugulosus, minute verrucoso-granulosus; apothecia in protuberantiis thallinis mediocribus sparsis conico-hemisphæricis subdepressis lævigatis; ostiolum magnum, infundibuliforme, apertum, fundo nudans perithecii ostiolum nigrum minutum tenuiter marginatum; sporæ 8, incolores, elongato-oblongæ 5-cellulosæ, iodo cærulescentes.

Ad cortices, south of the island.

Perithecium dimidiatum, infra deficiens, subcarbonaceum. Paraphyses distinctæ, iodo non tinctæ.

Plate XXXVII. fig. 31.



102. *GYROSTOMUM SCYPHULIFERUM*, Fée=Wright, Lich. Cubæ, 166!

Peradeniya.

Paraphyses distinctæ, iodo non tinctæ; sporæ 8, incolores, iodo fuscescentes.

Plate XXXVII. fig. 106.

103. *CÆNOGONIUM IMPLEXUM*, Nyl.

Ceylon.

104. *C. LEPRIEURII* (Mont.)105. *C. RETISTRIATUM*, Leight., n. sp.: filamentis thallinis breviarticulatis ramosis interplexis; elementa obducentia retistriata; sporæ 8, ellipsoideæ, incolores, 1-septatæ.

Ceylon, ad truncos et ramulos arborum.

106. *C. CORRUGATUM*, Leight., n. sp.: filamentis thallinis gracilibus ramosis interplexis indistincte articulatis; elementa obducentia grosse corrugata; apothecia non visa.

Central Province, ad terram et saxa.

107. *C. CANCELLATUM*, Leight., n. sp.: filamentis thallinis crassiusculis brevibus, simplicibus vel sparsim ramosis, apicibus glomerato-globosis, articulationibus brevibus; elementa obducentia minute cancellata; apothecia non visa.

Nuwara Eliya, Central Province, ad truncos et ramulos arborum.

The above three novæ species all belong to the section of the genus "thallo adnato, pannose expanso."

108. *LECIDEA LUTEA*, Schær.

Central Province.

109. *L. PARVIFOLIA*, Pers.

Central Province, 5000-7000 ft. alt.

110. *L. PARVIFOLIA*, Pers., var. *corallina*, Tuck.

Central Province.

111. *L. PIPERIS*, Spr.

Habgalla, Central Province, 5000 ft. alt.

112. *L. VERNALIS*, Ach.

Peradeniya.

113. *L. ANOMALA*, Fr.

Central Province, abundant.

114. *L. FUSCELLA*, Fr.

Habgalla, 5000 ft., Peradeniya.



115. *L. DOMINGENSIS* (Pers.), Nyl. = Wright, Lich. Cubæ, 231!

Habgalla, 5000 ft.

Paraphyses distinctæ, graciles, iodo non tinctæ; sporæ 2 vel 3, incolores, cellulis sæpe nucleolatis, iodo lutescentes; asci iodo cærulescentes.

Plate XXXVII. fig. 105.

116. *L. LEUCOXANTHA*, Spr.

Habgalla, Central Province, 5000 ft. alt.

Paraphyses graciles, distinctæ; thecæ iodo cærulescentes; spora 1, incolor.

Plate XXXVII. fig. 108.

117. *L. DISCIFORMIS*, Fr.

Peradeniya, common.

118. *L. MEGASPORA*, Leight., n. sp.: thallus albido-lutescens vel albido-virescens, rugulosus, granulatus, lævigatus, nigro limitatus; apothecia maxima, sessilia; discus planus, dilatatus, rufus, margine crasso integro erecto nigro circumcinctus; hypothecium nigro-fuscum; sporæ 2, maximæ, incolores, cylindræo-oblongæ, 1-septatæ, subincurvatæ, cellulis repletis granulis hyalinis sphericis; paraphyses graciles, confertæ, granulis interspersis; gelatina hymenea iodo vinose fusca.

Habgalla, 5000 ft. alt.

Proxime affinis *L. marginiflexæ*, Tayl., at dignota apotheciorum colore, sporis duplo majoribus atque chemica reactione diversa; *marginiflexa* iodo violacee tincta.

Plate XXXVI. fig. 13.

119. *GRAPHIS ANGUILLIFORMIS*, Tayl.

South of the island.

Paraphyses distinctæ, graciles, iodo non tinctæ; sporæ 8, incolores, iodo cærulescentes; hypothecium integrum, nigrum, carbonaceum.

Plate XXXVII. fig. 82.

120. *G. GLYPHIZA*, Nyl.

South of the island.

Paraphyses distinctæ; sporæ 8, incolores vel leviter fuscescentes, iodo non tinctæ; hypothecium integrum, nigro-fuscum.

Plate XXXVII. fig. 83.

121. *G. LEIOGRAMMA*, Nyl.

South of the island.

Paraphyses distinctæ; sporæ 8, incolores vel leviter fuscescentes, iodo lutescentes; hypothecium vix ullum, tantum discoloratio pallido-fusca.

Plate XXXVII. fig. 84.



122. *G. CONTEXTA*, Pers.

Peradeniya.

Paraphyses distinctæ, iodo non tinctæ; sporæ 8, incolores, iodo fuscescentes; hypothecium nullum aut tantum pallidissime fuscum, cartilagineum.

Plate XXXVI. figg. 80 et 81.

123. *G. GRACILIS* (Eschw.), Fée, Ess. t. 11. f. 5.

Kandy.

Paraphyses distinctæ, iodo non tinctæ; sporæ incolores, iodo non tinctæ; hypothecium nullum.

Plate XXXVI. fig. 79.

124. *G. SCRIPTA*, Ach., var. *subvirginea*, Nyl.

Central Province.

125. *G. SCRIPTA*, Ach., Nyl. Scand. 252.

Central Province.

126. *G. SCRIPTA*, Ach., var. *pulverulenta* (Pers.), Nyl. Scand. 252.

Central Province.

127. *G. SCRIPTA*, Ach., var. *serpentina* (Ach.), Nyl. Scand. 252.

Central Province.

128. *G. NIGRO-GLAUCA*, Leight., n. sp.: thallus pallido-lutescens, tenuis, subcrustaceus, opacus, subpulverulentus, effusus; lirellæ mediocres, emergentes, fere sessiles, plus minusve thallo lateraliter obtectæ aut potius albido-pruinosa, simplices, rectæ, vix flexuosæ, utroque apice acute attenuatæ; proprio margine turgescente, suberecto; epithecio rimiformi clauso, deinde hiascente atque glauco-pruinoso; hypothecio carbonaceo, integro; sporæ 8, incolores, mediocres, elongato-ellipticæ, 10-cellulosæ, iodo cærulee fusca.

Central Province.

Paraphyses distinctæ, iodo non tinctæ. Facie externa maxime affinis *G. subvirgineæ*, Nyl. (Leight., Lich. Amaz. Linn. Trans. xxv. p. 452), at notis allatis dignota, tamen dubitandum si non sit potius hujus varietas sporis latioribus varians.

Plate XXXVI. fig. 14.

129. *G. CONNATA* (Eschw.).

Ceylon.

130. *G. INTRICATA*, Eschw. (Fée, Ess. t. 9. f. 3).

Central Province.

Plate XXXVII. fig. 85.



131. *G. CONGLOMERATA*, Fée (Ess. t. 13. f. 1).

Central Province.

Paraphyses distinctæ, granulosa, iodo lutescentes; spora 1, pallide virens, tandem fusca, iodo obscure  
cærulescens; hypothecium laterale, tenue.

Plate XXXVII. fig. 89.

132. *G. HETEROCARPA*, Fée.

Central Province.

Paraphyses confertæ, indistinctæ, minute granulosa, iodo non tinctæ; spora 1, pallide virens, iodo fusca;  
hypothecium crassum, laterale.

Plate XXXVII. fig. 88.

133. *G. STRIATULA*, Ach.

Central Province.

Paraphyses distinctæ, iodo non tinctæ; sporæ 8, incolores, iodo cærulescentes.

Plate XXXVII. fig. 86.

134. *G. SUBSTRIATULA*, Nyl.

Central Province.

Paraphyses distinctæ, iodo non tinctæ; sporæ 2-3-4-6, incolores, iodo cærulescentes; hypothecium late-  
rale.

Plate XXXVI. fig. 78.

135. *G. AFZELII*, Ach.

Central Province and south of the island.

Paraphyses distinctæ, iodo non tinctæ; sporæ 8, incolores, 2-4-cellulosa, iodo lutescentes; hypothecium  
crassum, carbonaceum, laterale, basi deficiens.

Plate XXXVII. figs. 76 &amp; 77.

136. *G. POITÆI*, Fée.

Central Province, Peradeniya, and south of the island.

Paraphyses distinctæ, iodo non tinctæ; spora 1, incolor, iodo cærulescens; hypothecium tenue, laterale.

Plate XXXVII. fig. 86\*.

137. *G. INTRICANS*, Nyl. = Lindig, N. Gran. 53!

Central Province.

Paraphyses distinctæ, iodo lutescentes; sporæ 8, fuscæ, 4-6-cellulosa; hypothecium laterale, tenue.

Plate XXXVII. fig. 75.

138. *G. DIVIDENS*, Nyl.

Central Province.

Paraphyses distinctæ, iodo lutescentes; sporæ 8, incolores, iodo cærulescentes; hypothecium laterale, in-  
curvatum, crassum.

Plate XXXVII. fig. 74.



139. *G. TRICOSA*, Ach.

Central Province.

Paraphyses confertæ, indistinctæ, granulosa; sporæ 8, leviter fuscescentes, iodo luteo-fuscescentes.

Plate XXXVII. fig. 74 *bis*.140. *G. BALBISII*, Fée.

Central Province.

Paraphyses confertæ, graciles, distinctæ, iodo non tinctæ; sporæ 8, pallide luteæ, iodo cærulee fusca.

Plate XXXVII. fig. 73.

141. *G. COLUBROSA*, Nyl.

Tropical, south of the island.

Paraphyses confertæ, indistinctæ, granulis interspersis, iodo non tinctæ; sporæ 8, incolores, iodo cærulescentes; hypothecium fuscum, laterale, basi deficiens.

Plate XXXVI. fig. 72.

142. *G. DIMORPHODES*, Nyl. MS., n. sp.: thallus galactino-albidus, glaucescens, crustaceus, dilatatus, lævigatus vel rimoso-areolatus, nitidus, linea tenuissima nigro-fusca limitatus; lirellæ sessiles, concolores, margine thallino turgescente omnino obtectæ, maxime dendriticæ vel pluries radiato-divisæ, valde elongatæ, flexuosæ, undulatæ atque intricatæ, angustatæ, apicibus obtusis, intus incolores; epithecium primo rimiforme clausum, dein apertum planiusculum vel concaviusculum carneo-rufum; hypothecium incolor, inconspicuum, basi pallide fuscis gonidiis; sporæ 8, incolores, parvæ, ovales, 4-cellulosæ, cellulis aliquando binucleolatis iodo cærulescentes.

Central Province.

Paraphyses distinctæ, iodo lutescentes. Ad stirpem *Medusularum* pertinens.

Plate XXXVI. fig. 15.

143. *G. CÆSIO-RADIANS*, Leight., n. sp.: thallus sordide pallido-lutescens, tenuis, subcrustaceus, opacus, subpulverulentus, effusus; lirellæ emergentes, depresso-innatæ, thallo lateraliter obtectæ, albo-pruinosa, stellato-radiatæ atque intricatæ, ramis rectis aut subundulatis, simplicibus aut bi- vel trifurcatis, apicibus acute attenuatis; margine thallino subtumido albo-pulverulento, erecto, ætate oblitterato; epithecio rimiformi, plus minusve aperto, deinde hiascente, cæσιο-pruinoso, ætate maxime dilatato, cæσιο-suffuso, plano, marginem thallinum oblitterante; hypothecium laterale basi deficiens; sporæ 8, incolores, deinde fusca, oblongæ, 7-8-cellulosæ, cellulis binucleolatis iodo cærulee fusca.

Central Province.

Ad stirpem *dendriticæ* pertinens. Paraphyses distinctæ, iodo non tinctæ.

Plate XXXVI. fig. 16.

144. *G. NEMATOIDES*, Leight., n. sp.: thallus fuscus, purpuraceus, tenuis, inæqualis, evanescens; lirellæ albo-pulverulentæ, graciles, sessiles, longitudinaliter subparallelæ, lineares, apicibus attenuatæ, simplices aut subradiato-conglomeratæ, divaricato-



ramosæ vel tantum apicibus breviter furcatæ, flexuosæ, undulatæ; epithecium clausum, rimiforme; perithecium integrum, nigrum carbonaceo-fuscum; sporæ 8, incolores, elongato-oblongæ, 6-cellulosæ, iodo cærulescentes.

Dolosbagey (subtropical) and south of the island (tropical).

Paraphyses distinctæ, confertæ, iodo non tinctæ vel tantum lutescentes. Ad stirpem *frumentariæ* pertinens.

Plate XXXVII. fig. 32.

145. *G. SIMULANS*, Leight., n. sp.: thallus albido-glaucescens, lævis, tenuis, subnitidus; lirellæ in massis mediocribus sparsis confertæ, radiatæ, gyratæ vel contortæ, subinnatæ, breviter furcato-ramosæ, margine thallino albido erecto tenui circumcinctæ; epithecium apertum, planum, rufum; perithecium nullum; sporæ 8, incolores, parvæ, oblongæ, 5-cellulosæ, cellulis 2-3-nucleolatis, fere murali-cellulosæ, iodo cærulescentes.

Kandy.

Paraphyses distinctæ, iodo non tinctæ. Forma externa assimilans *G. dividenti*, Nyl., tamen notis allatis dignota. Ad stirpem *Medusularum* pertinens.

Plate XXXVII. fig. 33.

146. *G. SUBINUSTA*, Leight., n. sp.: thallus sordide lutescens, tenuis, lævis, subnitidus; lirellæ immersæ, latæ, nigræ, difformi-stellato-conglomeratæ, margine thallino tenui acuto erecto circumcinctæ; epithecium nigrum opacum, latum, apertum, planum; perithecium fusco-nigrum, lateribus tenue, basi crassum; sporæ 8, incolores vel vix fuscescentes aut tandem fuscæ, cylindræ, apice uno attenuatæ, transversim 11-oblongo-cellulosæ, iodo non tinctæ.

Peradeniya.

Paraphyses confertæ, vix distinctæ, granulis numerosissimis interspersis, iodo non tinctæ. Facie externa valde simillima *G. inustæ*, Ach., tamen perithecio diverso atque sporis majoribus dignota. Ad stirpem *dendriticæ* pertinens.

Plate XXXVII. fig. 34.

147. *G. SUBDIVIDENS*, Leight., n. sp.: thallus albido-glaucescens aut lactescens, lævigatus, subnitidus; lirellæ fuscæ, flexuosæ, divaricato-ramosæ, innatæ, margine thallino albido tumido erecto circumcinctæ; epithecio concavo, aperto, fusco; hypothecium nigro-fuscum, integrum; sporæ 8, pallide fuscescentes, elongato-oblongæ, 6-cellulosæ, iodo non tinctæ.

Central Province.

Ad stirpem *Medusularum* pertinens. Paraphyses distinctæ, iodo non tinctæ.

Plate XXXVI. fig. 7.

148. *G. FISSO-FURCATA*, Leight., n. sp.: thallus albido-glaucescens vel lactescens, lævigatus, subnitidus; lirellæ fissurino-erumpentes, angustatæ, e centro longe radiantes, ramis valde elongatis undulatis flexuosis bi- vel trifurcato-divisis, apice acutissimo plerumque furcato, margine thallino turgescente, margine proprio tenui erecto;



epithecium valde angustatum, rimiforme, fuscum; hypothecium laterale, fuscum, basi deficiens; sporæ 2 (una quam altera major), pallide lutescentes, oblongo-cylindricæ, 12-cellulosæ (fere septatæ), cellulis transversim 4-nucleolatis singulari vel duplici serie, iodo cærulescentes.

Nuwarra Eliya, 6000 ft. alt.

Ad stirpem *Fissurinarum* pertinens. Paraphyses distinctæ, iodo lutescentes.

Plate XXXVI. fig. 18.

149. *G. SUBMARCESCENS*, Leight., n.sp.: thallus sordide olivaceus, tenuis, lævigatus, subnitidus, effusus, circa lirellas repandus et ibidem furfuraceo-substriatulus; lirellæ simplices vel divaricato-ramosæ, plus minusve subradiatæ, erumpentes, margine thallino crassiusculo furfuraceo-substriatulo circumcinctæ, marcido-fulvæ, margine proprio tenuissimo; epithecium rimiforme, subhiascens; hypothecium laterale, paululum fuscum, vix conspicuum, basi deficiens; sporæ 8, fuscae, parvæ, lineari-oblongæ, 3-4-septatæ, iodo non tinctæ.

Central Province.

Ad stirpem *Fissurinarum* pertinens. Paraphyses distinctæ, iodo non tinctæ.

Plate XXXVI. fig. 19.

150. *HELMINTHOCARPON LEPREVOSTII*, Fée (Suppl. t. 35. f. 11).

Central Province.

Paraphyses confertæ, indistinctæ, minute granulosæ, iodo lutescentes; sporæ 8, pallide virentes, iodo cærulee fuscescentes; hypothecium integrum, crassum.

Plate XXXVI. fig. 71.

151. *OPEGRAPHA SIDERELLA*, Ach.

Central Province.

152. *PLATYGRAPHA INTERRUPTA*, Fée.

South of island (tropical).

Paraphyses vix visibiles, iodo lutescentes, vix cærulee tinctæ, sporæ 8, incolores; hypothecium crassum, nigro-fuscum.

Plate XXXVI. fig. 70.

153. *P. MEGISTOCARPA*, Leight., n. sp.: thallus pallide fulvescens, tenuis, lævigatus, subnitidus; apothecia sessilia, nigra, rotundata vel oblonga vel elongato-oblonga, subrectiuscula, plana vel subconvexiuscula, maxima, subpruinosa; margine thallino tenui, mediocri, erecto, albido, integro vel flexuoso-crenulato; sporæ 8, incolores, dein fuscescentes, oblongo-fusifformes, 6-8-cellulosæ; paraphyses confertæ, tamen distinctæ, moniliformes; hypothecium crassum, nigrum; gelatina hymenea iodo vinose fulvescens aut lutescens.

Ceylon.

Plate XXXVI. fig. 20.



Forma *rotundata*, Leight. : apothecia rotundata vel oblonga, margine thallino crassiore integro; sporæ 6-cellulosæ.

Plate XXXVI. fig. 21.

154. *P. GEMMATA*, Leight., n. sp. : thallus flavido-virescens, opacus, granulosis vel subleprosus et rimosulus, effusus; apothecia sessilia, nigra, rotundata oblonga vel difformia, lobata simplicia vel divaricato-lobata, obtusa; margine thallino albo, crasso, tumido, crenato; sporæ 8, incolores, dactyloideæ, 2-septatæ; paraphyses distinctæ, iodo cærulee obscuratæ; hypothecium nigro-fuscum.

Peradeniya.

Plate XXXVI. fig. 22.

155. *P. AULAXERPETA*, Leight., n. sp. : thallus albido-glaucescens, tenuis, lævigatus, nitidus, linea fusco-nigra limitatus; apothecia nigra, innata, angustata, serpentinoidee flexuosa, valde elongata, apice attenuata, subconcauscula, margine thallino crassiusculo integro; sporæ 8, incolores, elongato-oblongæ, 6-cellulosæ, iodo cærulescentes; paraphyses confertæ, distinctæ; gelatina hymenea iodo lutescens; hypothecium marginibus supernis et basi paululum fuscum.

Ceylon.

Plate XXXVI. fig. 23.

156. *P. DENDROIDES*, Leight., n. sp. : thallus albido-glaucescens vel olivaceus, lævigatus, subrugulosus, tenuis; apothecia sessilia, dendritice radiata, ramis undulatis simplicibus aut uni-vel bifurcato-divisis, apicibus attenuatis, plana vel subconcauscula, glauco-pruinosa, margine thallino tenui crassiusculo; sporæ 4-8, incolores, dein fusciscentes, oblongæ, 5-6-cellulosæ, iodo fuscae; paraphyses confertæ, vix distinctæ; gelatina hymenea iodo lutescens; hypothecium nigro-fuscum, basi crassum, lateribus tenue.

Ceylon (South).

Plate XXXVI. fig. 24.

157. *P. FRACTUOSA*, Leight., n. sp. : thallus albido-fulvescens, rugosus, tenuis, subnitidus; apothecia nigra, glauco-pruinosa, subsessilia, subinnata, flexuosa, oblonga vel rotundato-oblonga, obtusa, confluentia, pseudo-radiatim aut dendritice disposita atque quasi seriatim fractuosa, margine thallino distincto integro crassiusculo; sporæ 8, fusciscentes, elongato-oblongæ, 6-7-8-cellulosæ, iodo cærulescentes; paraphyses distinctæ, iodo non tinctæ; hypothecium vix conspicuum, tantum paululum fusciscentes.

Central Province.

Plate XXXVI. fig. 25.

158. *P. GALACTINA*, Leight., n. sp. : thallus galactinus, lævissimus, crassiusculus, subtartareus, effusus; apothecia nigra, interruptim radiata, simplicia vel subdendritico-ramosa, immersa, apicibus obtusis; epithecium concavum, fusco-nigrum, spurie marginatum; hypothecium fuscum, lateraliter tantum decoloratum, basi crassum fuscum;



sporæ 8, incolores, tandem fuscae, ellipsoideæ, parvæ, 4-cellulosæ, cellulis aliquando binucleolatis, iodo non tinctæ.

Ad saxa in rivis. South of the island.

Paraphyses distinctæ, iodo non tinctæ.

Plate XXXVII. fig. 35.

159. *P. MELANOSTALAZANS*, Leight., n. sp. : thallus lutescens vel olivaceus, crassiusculus, lævis, effusus, subnitidus ; apothecia immersa, valde dendritico-ramosa, gracilia, apicibus magnopere obtusis ; epithecium nigrum, tenuiter pruinatum, planum, apertum, thallo sursum elevato undulatum circumcinctum ; hypothecium crassum, nigrum, carbonaceum ; sporæ 8, incolores, elongato-oblongæ, 8-cellulosæ, iodo luteo-fuscescentes.

Ad cortices. South of the island.

Paraphyses confertæ, granulis interspersis, iodo luteo-fuscescentes.

Plate XXXVII. fig. 36.

160. *P. STICTOIDES*, Leight., n. sp. : thallus lutescens, tenuis, lævis aut minute granulosus, subnitidus ; apothecia erumpentia, rotundo-diformia vel radiato-confluentia ; epithecium planum, dilatatum, plumbeo-pruinatum, innatum, margine prominente crasso niveo pulverulento circumcinctum ; sporæ 8, incolores, parvæ, oblongæ, 3-septatæ, iodo fuscescentes ; hypothecium fuscum ; paraphyses distinctæ, iodo lutescentes.

Ad cortices. South of the island.

Facie externa assimilans fungo vocato *Stictis radiata*.

Plate XXXVII. fig. 37.

161. *ARTHONIA CINNABARINA*, Wallr.

Paradeniya.

162. *A. SUBVENOSA*, Leight., n. sp. : thallus albidus vel albus, tenuis, sublævigatus, vix farinosus, linea nigra limitatus, circa apothecia turgescens ; apothecia fusca, in prominentiis depressis thallinis immersa, punctiformia, in seriebus linearibus mediocribus simplicibus vel divaricato-ramosis vel versiformibus consociata ; sporæ 8, maximæ, incolores, obovatæ, murali-divisæ vel cellulosæ, iodo cærulee virescentes ; gelatina hymenea iodo vinose rubens.

Ceylon.

Plate XXXVI. fig. 26.

163. *A. PELLÆA*, Leight., n. sp. : thallus sordide fulvescens, opacus, tenuis, lævigatus, rimulosus, margine fusco cinctus ; apothecia fusco-nigra, rotundo-diformia, plana, sparsa ; sporæ 8, maximæ, fuscae, lineari-obovatae, 7-medio-septatæ (aliquando 9-septatæ), iodo vinose rubescentes.

Ceylon.

Plate XXXVI. fig. 27.



164. *A. SUBILICINA*, Leight., n. sp.; thallus sordide vel albido-cinerascens, subnitidus, tenuis, lævigatus, linea fusca limitatus; apothecia nigra vel nigro-fusca, rotundata et rotundo-vel versiformi-diformia, depresso-convexiuscula, innata vel aliquando subsessilia, atque margine thallino tenuissimo farinaceo circumcincta, quasi a thallo laxata atque sursum curvans; sporæ 8, lineari-obovatae, 7-medio-septatae, incolores, cellulis murali-divisis, dein fuscae atque cellulis simplicibus non murali-divisis.

Peradeniya.

Plate XXXVI. fig. 28.

165. *GLYPHIS HETEROCLITA*, Mont.

Peradeniya.

Paraphyses confertae, indistinctae; sporæ 8?, incolores vel leviter fuscescentes, iodo fusco-lutescentes; hypothecium fuscum.

Plate XXXVI. fig. 69.

166. *G. LABYRINTHICA*, Ach.

Ceylon, from level of sea up to 2000 ft.

Paraphyses confertae, indistinctae, iodo lutescentes; sporæ 8, incolores, 4-6-cellulosae, tandem leviter fuscescentes.

Plate XXXVI. fig. 68.

167. *G. CONFLUENS*, Mont.

Central Province.

Paraphyses distinctae, iodo lutescentes; sporæ 8?, incolores, iodo caerulecentes; hypothecium fuscum.

Plate XXXVI. fig. 67.

168. *G. GYRIZANS*, Leight., n. sp.: thallus sordide olivaceus, effusus, lævigatus, opacus; stromata alba, rotundato-diformia, sparsa vel confluentia, depressa, albo-pruinosa; apothecia linearia, angustata, conferta, innata, in gyratis vel contorto-reduplicatis massis, caesio-pruinosa, intus nigra; sporæ 8, incolores, leviter fuscescentes, lineari-oblongae aut obovatae, 8-cellulosae, cellulis bi-trinucleolatis, iodo fuscescentes; paraphyses confertae, indistinctae, granulis interspersis.

Peradeniya.

Plate XXXVII. fig. 38.

169. *G. SUBTRICOSA*, Leight., n. sp.: thallus pallide olivaceus, tenuis, lævigatus; stromata alba, depressa, membranacea, rotundo-vel oblongo-versiformia; apothecia medusuliformia, primo erumpentia, dein plana vel subconcaviuscula, radiato-vel stellatim intricato-ramosa, fusca, caesio-pruinosa, intus nigro-fusca; sporæ 8, parvae, obovato-oblongae, incolores, dein leviter fuscescentes, iodo lutescentes; paraphyses indistinctae, iodo lutescentes.

Peradeniya.

Plate XXXVII. fig. 39.



170. *CHIODECTON HYPOCHNOIDES*, Nyl. (K —.) = Lindig, N. Gran. 61.

Peradeniya.

Paraphyses distinctæ, iodo vinose fuscescentes, apicibus cærulescentes; sporæ 8, incolores.

Plate XXXVI. fig. 66.

171. *C. FARINACEUM*, Fée. (K —.)

South of the island.

Paraphyses distinctæ, iodo vinose fuscescentes; sporæ 8, incolores, iodo non tinctæ.

Plate XXXVI. fig. 65.

172. *C. SPHÆRALE*, Ach. (K —.)

Peradeniya.

Paraphyses indistinctæ; sporæ 8, incolores, iodo leviter cærulescentes.

Plate XXXVI. fig. 64.

173. *C. FEEL*, Meisn. (K —.)

Central Province.

Paraphyses indistinctæ, iodo leviter lutescentes; sporæ 8, incolores aut ætate fuscæ, 4-8-cellulosæ.

Plate XXXVI. fig. 63.

174. *VERRUCARIA CEYLONENSIS*, Mass.

Ceylon.

Perithecium crassissimum, carbonaceum, dimidiatum, basi incurvatum; paraphyses graciles, iodo lutescentes; sporæ 8, in ascis linearibus, incolores, similes sporis *V. epidermidis*, iodo lutescentes.

Plate XXXVII. fig. 40.

175. *V. TROPICA*, Ach.

Central Province, very abundant.

Perithecium nigrum, integrum. Paraphyses paucae, distinctæ, granulis interspersis, iodo fuscescentes; sporæ 8, pellucidæ, iodo fuscescentes.

Plate XXXVI. fig. 62.

176. *V. CATERVARIA*, Fée.

Central Province.

Perithecium nigrum, tenue, integrum; paraphyses distinctæ, granulis interspersis, iodo lutescentes; sporæ 8, pellucidæ, iodo fuscescentes.

Plate XXXVI. fig. 61.

177. *V. MARGINATA*, Hook. (*complanata*, Mont.).

Central Province.

Perithecium dimidiatum; paraphyses distinctæ, gracillimæ, iodo non tinctæ; sporæ 8, fuscescentes.

Plate XXXVI. fig. 60.



178. *V. ASPISTEA*, Ach. (non Fée), = forma *V. nitidæ*, Schrad., var. *nitidellæ*, Flk., see Nyl. Pyrenoc. p. 46.

Ceylon.

Perithecium integrum, crassum; paraphyses graciles, discretæ, iodo lutescentes; sporæ 8, incolores, anguste ellipsoideæ, 4-loculares.

Plate XXXVI. fig. 59.

179. *V. AGGREGATA*, Fée.

Central Province.

Perithecium dimidiatum, tunica crassa nigra; paraphyses distinctæ, deliquescentes, iodo non tinctæ; sporæ 4 incolores, tandem fuscæ.

Plate XXXVI. fig. 58.

180. *V. PUNCTELLA*, Nyl.

Central Province.

Perithecium integrum, nigrum; paraphyses distinctæ, iodo vinose rubentes; sporæ 8, fuscæ.

Plate XXXVI. fig. 57.

181. *V. SANTENSIS*, Tuck.

Central Province.

Perithecium integrum, crassum; paraphyses distinctæ, graciles, iodo lutescentes; sporæ 8, incolores atque fuscescentes.

Plate XXXVI. fig. 56.

182. *V. DESQUAMESCENS* (Fée).

Central Province.

Perithecium dimidiatum, pallido-fuscum, cartilagineum; paraphyses distinctæ; sporæ 8, incolores, 3-5-7-septatæ, iodo lutescentes.

Plate XXXVI. fig. 55.

183. *V. INNATA*, Nyl.

Central Province, Peradeniya.

Perithecium dimidiatum, fuscum, tunica pallida; paraphyses distinctæ, iodo non tinctæ; sporæ 8, incolores, iodo lutescentes.

Plate XXXVI. fig. 54.

184. *V. VARIOLOSA*, Pers.

Central Province.

Plate XXXVI. fig. 53, spora.

185. *V. BORBONICA*, Nyl.

Central Province.

Perithecium integrum, nigrum, patens; paraphyses distinctæ, graciles, iodo vinose rubentes; sporæ 8, primo pallidæ globose nucleolatæ in 12 seriebus, postea fuscæ indistinctæ 3-septatæ nucleolis vix visibilibus.

Plate XXXVI. fig. 52.



186. *V. DUPLICANS*, Nyl.=Lindig, N. Gran. p. 40.

Central Province.

*Perithecium* integrum, nigrum, crassum, carbonaceum; paraphyses graciles, iodo vinose rubentes; sporæ 2, fuscae.

Plate XXXVI. fig. 51.

187. *V. ASPISTEA*, Fée (non Ach.).

Central Province.

*Perithecium* integrum, nigrum; paraphyses paucae, distinctae, iodo vinose rubentes; sporæ 8, 7-septatae, cellulis nucleolatis, fuscescentes.

Plate XXXVI. fig. 49.

188. *V. ASPISTEA*, Fée (non Ach.), var. *astroidea*=*Parmentaria astroidea*, Fée.

Central Province.

*Perithecium* integrum, nigrum; paraphyses graciles, distinctae, iodo vinose rubentes; sporæ 8, incolores aut tenuiter luteae, nucleolatae in 8-9 seriebus transversis.

Plate XXXVI. fig. 50.

189. *V. EMERGENS*, Leight., n. sp.: thallus pallido-lutescens, laevigatus, subnitidus, effusus; apothecia parva, omnino thallo obtecta, apice tantum emergente, fusco-nigra; perithecio integro nigro, ostiolo minuto vix conspicuo; sporæ 8, mediocres, fuscescentes, oblongo-ovatae, 7-septatae, cellulis 3-4 nucleolatis; paraphyses distinctae, iodo vinose rubescentes.

Peradeniya, elev. 1600 feet.

Plate XXXVII. fig. 41.

190. *V. THWAITESII*, Leight., n. sp.: thallus pallido-lutescens, laevigatus, nitidus, effusus; apothecia maxima, nigra, conico-hemisphaerica, basi thallo obtecta, perithecio nigro crassissimo integro cartilagineo, ostiolo magno depresso conspicuo; sporæ 8, maximae, incolores, dein fuscescentes, elongato-oblongae, 7-septatae, cellulis nucleolis sphaericis hyalinis repletis; paraphyses longissimae, graciles, distinctae, iodo vinose rubescentes.

Ceylon.

This, the first Ceylon lichen I ever examined, I dedicate to the learned Curator of the Royal Botanical Garden at Peradeniya, to whose kindness we owe this fine collection of tropical lichens.

Plate XXXVII. fig. 42.

191. *ENDOCOCCUS GRAPHIDICOLUS*, Leight., n. sp.: thallus alienus; perithecium minimum, globosum, integrum, nigrum, carbonaceum, nitidum; paraphyses nullae; sporæ 8, incolores, obovato-oblongae, 1-2 septatae, cellula anteriore majore, iodo fuscescentes.Supra thallum *Graphidis anguilliformis*, Tayl. South of the island.

Plate XXXVII. fig. 43.

192. *TRYPETHELIUM SCHIZOSTOMUM*, Leight., n. sp.: thallus pallido-lutescens, laevigatus, inaequalis, subnitidus, effusus; apothecia in prominentiis thallinis irregularibus



confluentibus inclusa, ostiolo magno aperto, margine irregulari-fisso erecto crassiusculo; sporæ 8, parvæ, incolores aut fuscescentes, late ovatæ, 4-cellulosæ, cellulis trinucleolatis, iodo non tinctæ.

Central Province.

Species insignis et dubitanda an ad hoc genus an ad *Thelotrema* potius referenda sit.

Plate XXXVII. fig. 44.

193. *T. UBERINUM*, Fée.

South of the island.

Plate XXXVI. fig. 48.

194. *T. MEGASPERMUM*, Mont.

South of the island.

Paraphyses distinctæ, paucæ, granulis interspersis, iodo non tinctæ; sporæ 4, incolores, iodo non tinctæ; asci iodo fuscescentes.

Plate XXXVI. fig. 47.

195. *T. PALLESCENS*, Fée.

South of the island.

Plate XXXVI. fig. 46.

196. *T. SPRENGELII*, Ach.

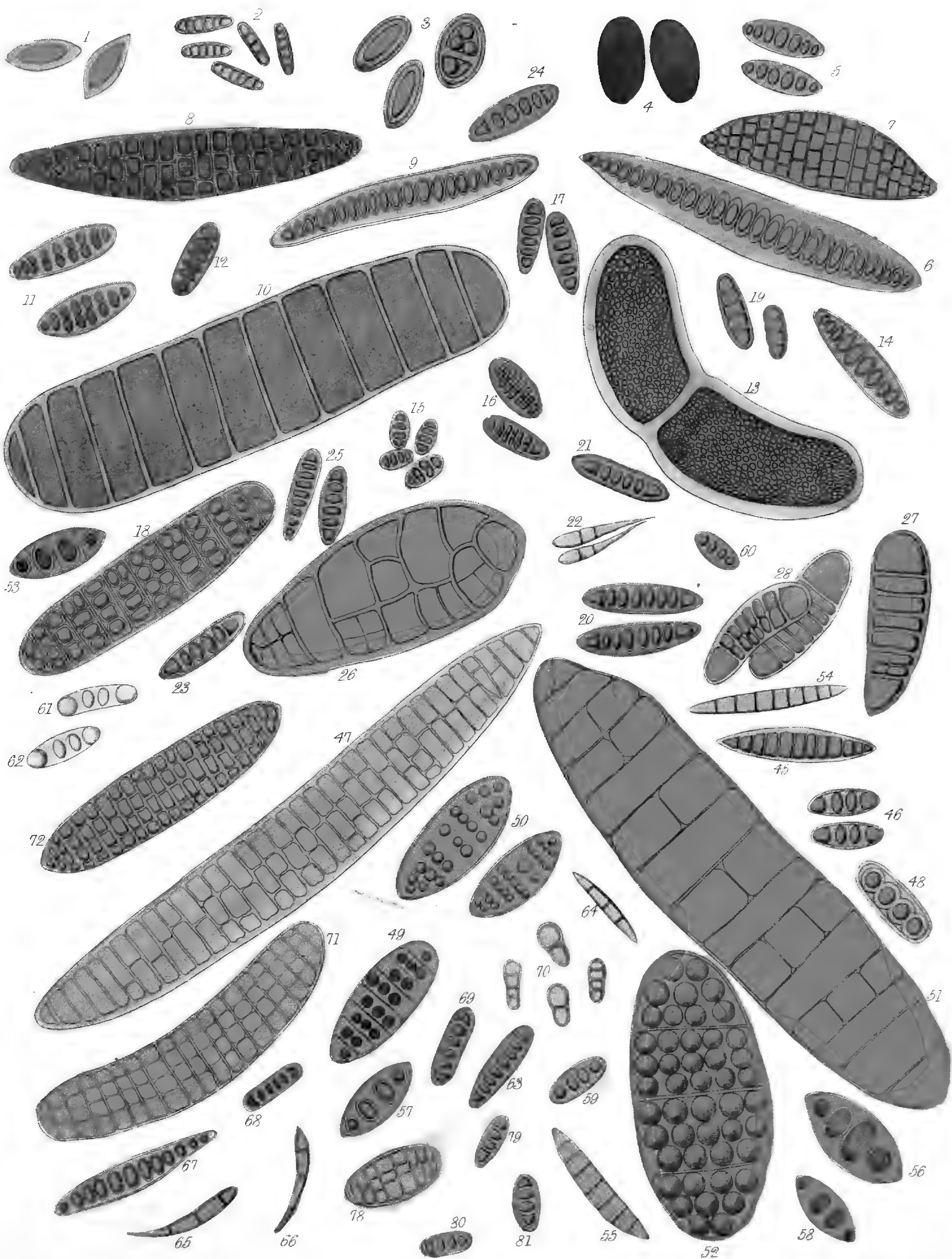
Peradeniya.

Plate XXXVI. fig. 45.





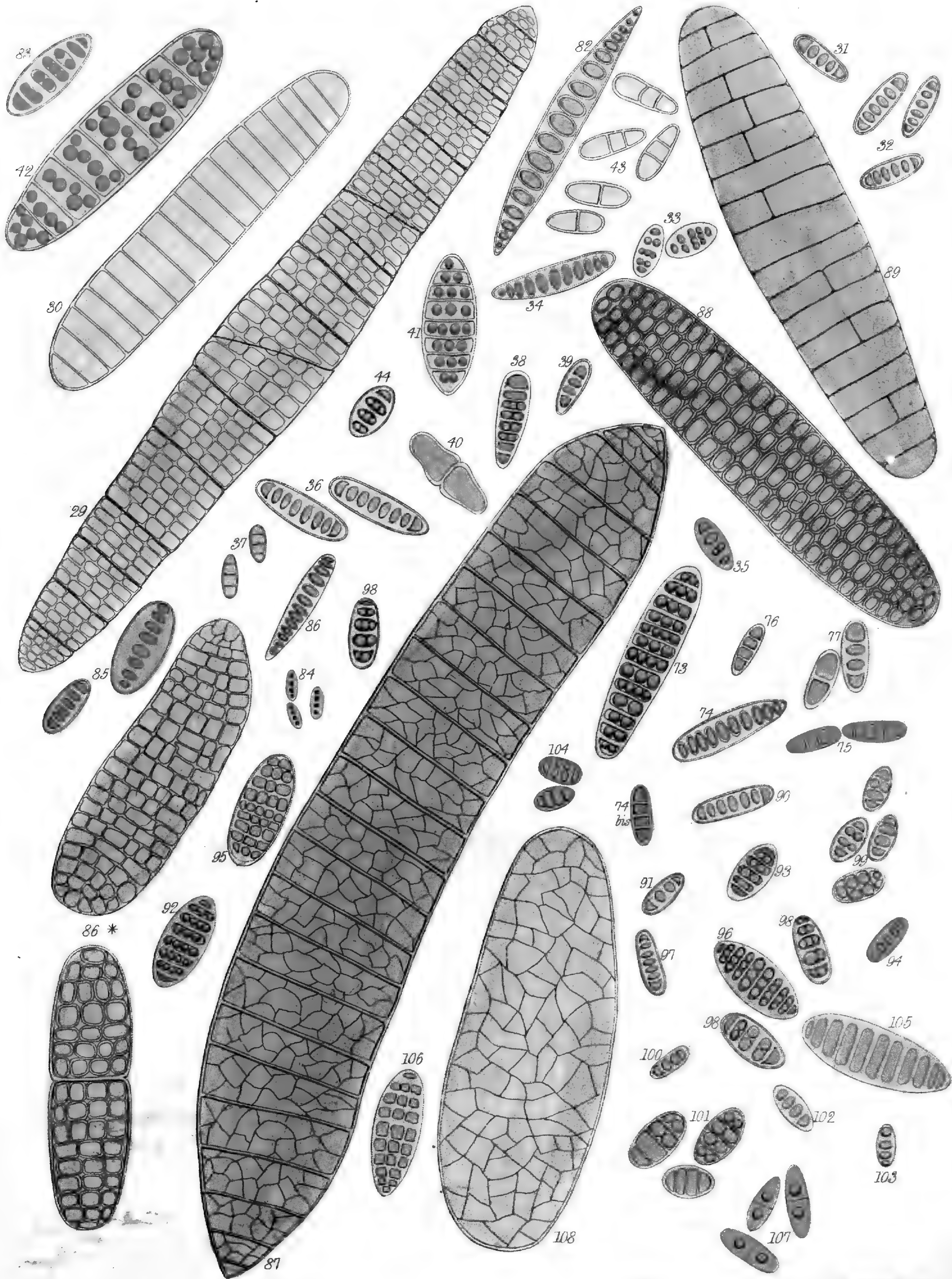




W. Leighton del.

G. Jarmen sc.





W. Leighton del.

G. Jarman sc.



IX.—*On the Genera Gœtzia and Espadea.* By JOHN MIERS, Esq., F.R.S., F.L.S.,  
Dignit. & Commend. Ord. Imp. Bras. Rosæ.

(Plate XXXVIII.)

Read June 17th, 1869.

THE genus *Gœtzia* was first described by Wydler in 1830, when he gave a drawing of the typical species, founded on a plant discovered by him in Puerto Rico in 1828, which he referred to *Ebenaceæ* (Linn. v. 423, tab. 8). *Espadea* was established and figured by Richard in 1838 (Fl. Cub. ii. 147, tab. 65), the typical species having been brought from Cuba in 1835 by Ramon de la Sagra. Although classed by Richard in *Verbenaceæ*, it does not belong to that family, as shown by M. Bocquillon (Adans. iii. 262), who, however, was unable to determine its true position. The plants of these genera have a common resemblance to *Chrysophyllum*, having bright, coriaceous, alternate leaves, with closely parallel nerves, as in that genus; their inflorescence is extraaxillary, either on solitary pedicels or in short 2–3-flowered racemes. The calyx in *Gœtzia* is globosely tubular, with six lanceolate erect segments, and is fixed upon a broad torus; in *Espadea* it is tubular, with four, five, or six short, erect teeth, with a valvate æstivation, the tube being partially adnate to a large pulvinate disk, above which it is free. The corolla in *Gœtzia* is somewhat hypocrateriform, narrow and hexagonal at its base, soon becoming gradually enlarged into a funnel shape, with a regular mouth, surmounted by a border of six equal, sublanceolate, suddenly reflected segments, valvate in æstivation; in *Espadea* it is much shorter, infundibuliform, curving outwardly, and swelling into an oblique mouth, with a border of four, five, or six short, erect, acute teeth, the posterior tooth being a trifle larger, their æstivation being also valvate. The stamens in *Gœtzia* are six in number, alternate with the lobes of the corolla; their long filaments are fixed near the base of the tube, equal in length, straight, erect, distinct, exerted as far as the extremity of the segments; in *Espadea* there are from four to six stamens, alternate with the segments, and fixed near the base of the tube, the filaments, somewhat unequal in length, all converge to, and press against, the posterior segment, thence curve over the centre, extending considerably beyond the segments. The hypogynous disk in *Gœtzia*, on which the ovary is seated, is flat, broadish, and hexagonal; in *Espadea* it is tall, broad, pulvinate, and fleshy, partially adnate to the calyx, free above, slightly hollow in its summit, with its raised margin swollen into five or six rounded fleshy lobes, which are sometimes expanded into as many nectariferous, long, acuminate, connivent appendages. The ovary in *Gœtzia* is a depressed cone, smaller than the disk on which it is seated, and thickly pilose; it is two-celled, each cell with one or two appended (?) ovules, according to Wydler: in *Espadea* it is similar in form, tomentose, much smaller than the disk, in which it is partially imbedded; it is two-celled, the cells being antical and postical, each containing two small globular collateral ovules fixed in the basal angle.



The fruit in *Gætzia* is a pear-shaped drupe, the size of a hazel-nut, 1-locular by abortion, containing a single oval seed, which Wydler describes as being suspended, and as having a laterally oblique embryo, half the length of the cartilaginous albumen in which it is enclosed; but he expressed a doubt of the correctness of these facts, having probably examined an imperfect fruit, or mistaken a rudimentary for a true embryo, and the actual fleshy cotyledons for albumen, under the appearance to which I will presently allude. In *Espadea* the fruit is a globular, fleshy drupe, about five-eighths of an inch in diameter, slightly depressed and compressed, two-celled, with a membranaceous endocarp and dissepiment, each cell by abortion having only one seed, fixed by a small hilum in the basal angle of the cell; on the dissepiment is a short axial columella, rising from the base to the hilar point of attachment of the seeds, where it ceases; the testa is crustaceous, formed of fibrous transverse cells, which expand into several narrow wings with fimbriated margins, imbricately adpressed in a right and left direction from the front towards a prominent black dorsal ridge, which is probably a raphe; the inner integument is somewhat membranaceous and opaque; the embryo, which fills the space of the latter, is without albumen. In one instance examined, this embryo consisted of two large, very fleshy cotyledons, united at their base by a short inferior radicle, and in the centre between the cotyledons, leaving a corresponding impression upon their inner faces, was found a small free fleshy body, consisting of a central nucleus and four indistinct lobes, seeming like a radicle and four rudimentary cotyledons without any integument. When the seed was placed in hot water, in order to extract this body, the latter became soft and almost mucilaginous, but it hardened again on drying. That its shape had not been changed during its removal, is proved by the form of the impression left on the cotyledons where it was imbedded, which is a central hollow with four radiating arms tapering to a point, leading to the supposition that it is an accessory rudimental abortive embryo. The second seed examined had within similar integuments, a perfect embryo, consisting of four thick fleshy cotyledons, three of which were similar in size and trigonoid, the fourth being wedge-shaped and an eighth of their thickness, all united at their base by a short inferior radicle; here, again, a similar rudimentary embryo was found in the centre of the axis: it may be inferred from this repetition that it is a common occurrence in the seminal structure of the genus; and if so, it may account for what Wydler thought he observed in his examination of an imperfect seed of *Gætzia*. A pluricotyledonary embryo is a somewhat rare occurrence in exogenous plants; and its incidence here, coupled with the curious fibrous testa, increases the difficulty of reconciling *Espadea* with any known natural order.

After this ample description of the relative structure of these genera, it is desirable to ascertain their position in the system; but I will preface the inquiry by noticing a memorandum which Prof. De Candolle read before the Botanical Society of France in June 1856, concerning them. He states that when M. Wydler was curator of his herbarium he pointed out, in the collection brought from Cuba by M. Ramon de la Sagra in 1835, a plant allied to his *Gætzia elegans*; it appears, however, that, because he could not then find in his herbarium a specimen of the latter species in the series of plants of Wydler's collection, M. De Candolle inferred that the materials which had served M. Wydler in his



description and drawing were, probably, incomplete. Recognizing the identity of Lemaire's *Armeniastrum* with the *Espadea* of Richard, he admitted that *Gætzia* must be distinct from *Espadea*, unless there be grave errors in Wydler's details; and thus M. De Candolle rather implies than expresses his doubts concerning *Gætzia*. It appears to me, however, that Wydler's description is so clearly told, and the drawings so precise, that they seem to have been taken from a living specimen, and that they furnish strong evidence of truthfulness and general accuracy, considering also that they were published many years before *Espadea* was known; the only uncertain points in these details are those of the seed, which was probably examined in an immature state; and as he expressly states that he placed little reliance on this head, we are bound to consider his descriptions in all other respects worthy of confidence.

As the *Gætzia* of Reichenbach (1828) is a synonym of *Rothia*, Pers., Wydler's genus of the same name (1830) is now valid.

*Gætzia* has been referred to several natural orders. By Wydler it was thought to be allied to *Ebenaceæ*; but it cannot belong to that order if we regard the structure of the flower or organization of the ovary, and especially that of the seed, which in the cognate genus *Espadea* has no albumen, a very different embryo, and an inferior radicle.

Richard placed his *Espadea* in *Verbenaceæ*; but it has little in common with that family, except a tubular calyx and corolla, and a drupaceous fruit; it differs in its alternate, closely veined leaves and the simple structure of its ovary, with two complete cells, having two collateral ovules in each cell, and offering no approach to the peculiar organization so conspicuous in the *Verbenaceæ*.

Endlicher arranged *Gætzia* in *Styraceæ*; but as he included the *Symplocaceæ* in that family, it is difficult to know which group he meant. With *Styraceæ* proper it accords in its general habit, its tomentose flowers, its tubular calyx, and a corolla with an æstivation approaching to valvate, in its ovary partly imbedded in a large superior fleshy disk, in its simple style, compressed and widened at its summit, terminated by a papillose stigma; it differs, however, in the corolla being quite gamopetalous, in having long, free, filiform, exserted filaments, bearing versatile anthers, in a totally different kind of placentation, in its fleshy fruit, not nucumentaceous, its exalbuminous seeds, with two or four fleshy cotyledons, and a minute inferior radicle. If, on the other hand, Endlicher meant to compare *Gætzia* with the *Symplocaceæ*, we find little to support such an affinity; it differs from them in its tubular calyx and corolla, its few stamens, the structure of the ovary, and its superior fruit, which is not nucumentaceous and has only two cells, in its seeds, which are deficient of albumen, in its large fleshy cotyledons, and its inferior radicle.

Lastly, Dr. Grisebach has united together *Gætzia* and *Espadea* under the former name\*, placing it in *Solanaceæ*, without offering any reasons; he has given a diagnosis of the genus which is incorrect in several particulars. The *Solanaceæ*, notwithstanding their varied organization, differ from his *Gætzia* in their habit and mode of inflorescence, in their ovary and disk, in their very frequent capsular fruit, with numerous seeds attached to a large placenta in the middle of the dissepiment, the seeds being small, heterotropous, or amphitropous, with a curved embryo imbedded in albumen, having a long terete radicle

\* Cat. Pl. Cub. 190.



generally remote from the hilum. Even where the fruit is baccate, or where it is more rarely drupaceous, as in *Brugmansia* proper\*, or in other cases, as in the *Cestrineæ*, *Metternicheæ*, and *Fabianeæ* †, where the seeds are fewer, the nearly straight embryo, generally heterotropous, is always imbedded in albumen, with a long terete radicle pointing to the basal extremity. Finally, *Espadea* is irreconcilably discordant with the *Solanaceæ*, in having the cells of its ovary antical and postical, not right and left of the axis of inflorescence.

Among other monopetalous families, the *Convolvulaceæ* present a few points of resemblance. *Wilsonia*, the only gamosepalous (and indeed a doubtful) genus of that family, agrees with *Espadea* in its tubular 5-toothed calyx, its tubular corolla, its bilocular ovary, with two erect ovules in each cell; but it differs in its very dissimilar habit, in the total absence of a disk, and in its deeply bifid style: the fruit of *Wilsonia* is unknown. *Espadea* coincides with the tribe *Argyrieæ* (especially with *Maripa*) in its bilocular ovary, with two collateral ovules in each cell, in its style and stigma, and its drupaceous fruit; but it differs in its more erect habit, in its solitary extraaxillary ebracteated flowers, its gamosepalous calyx, its fleshy gibbous corolla, with valvate æstivation, in its exalbuminous seeds, with large fleshy cotyledons, and a minute radicle. With the other tribes of the *Convolvulaceæ* there exists a much smaller degree of analogy. *Espadea* differs also from that family, in the same manner as from *Solanaceæ*, in the position of its carpels.

With the  *Icacinaceæ* these genera accord in their ovary partially imbedded in a large hypogynous disk, and in their collateral ovules; but these last are erect (not suspended); they differ, moreover, in the position of their carpels; in their calyx, corolla, fruit, and seeds, which are suberect, without any albumen, having large thick cotyledons and a minute inferior radicle.

If we look to the *Loganiaceæ*, we find that *Gærtnera* alone presents a few points of similar structure, especially in its bilocular drupaceous fruit, with a single erect seed in each cell; it differs, however, from the genera under consideration in its large vaginant stipules, its opposite leaves, its panicular or capitate inflorescence, its bracteolate calyx, its much shorter stamens, the want of a large hypogynous disk, its seeds having a much smaller embryo, with short cotyledons, imbedded in copious cartilaginous albumen.

*Tesserandra* in *Oleaceæ* agrees in having a bilocular ovary, partly imbedded in a fleshy torus, each cell having two collateral ovules; but it differs in its opposite leaves, its terminal panicular inflorescence, its corolla, its small extrorse stamens, its style, its nucumentaceous fruit, and its superior radicle.

In *Myoporaceæ* we find some genera which agree tolerably well with *Espadea* in habit, extraaxillary solitary flowers, a similarly shaped corolla, and a bilocular ovary with collateral ovules; but they differ in their deeply partite calyx, their didynamous stamens, their peculiar anthers, the absence of a large disk, a different organization of their ovary, in their suspended ovules, their monopyrenous fruit, with two or more cells, their suspended seeds, with an embryo having a long terete radicle enclosed in albumen.

There is some resemblance in the habit of these plants and in the peculiar venation

\* Ill. S. Am. pl. 56.

† *Ibid.* pls. 14, 15, 16, 17, 46-51, 59, 60.



of their leaves to some genera of the *Apocynaceæ*: but the latter differ in their branches yielding a lactescent juice, in their opposite leaves, in their subpaniculated inflorescence, in their sepals mostly glandular at base, having a quincuncially imbricated æstivation, in the contorsive imbrication of the segments of the corolla, in their nearly sessile peculiar anthers, in their numerous ovules, with a different placentation, in their annularly glandular stigma, coherent with the stamens, and in their seeds; in such as have a drupaceous fruit (*Hancornia*, for instance), the seeds are immersed in pulp, the embryo being imbedded in a corneous or fleshy albumen, with a terete radicle. *Ranwolfia*, however, has a 2-celled ovary, with two ovules in each cell, as in *Espadea*, but in all other respects the objections above stated remain in full force.

The alternate leaves of *Gætzia* and *Espadea* present such a remarkable resemblance to those of *Chrysophyllum*, that a first glance at the plants might suggest an alliance with *Sapotaceæ*; but in that family the stamens are opposite to the lobes of the corolla, the anthers are generally extrorse, the ovary is multilocular, with solitary ovules in each cell; the seeds appear nucumentaceous from the induration of the endocarp in which they are enclosed, and are marked by large lateral scars, they have foliaceous cotyledons imbedded in albumen, with a terete radicle. It may be urged that *Bumelia* and *Bassia* have exalbuminous seeds, with large fleshy cotyledons and a small inferior radicle; but there, as in all *Sapotaceæ*, the fertile stamens are opposite to the lobes of the corolla, and alternate with as many other sterile or fertile stamens, the anthers being extrorse, they have small bracteated flowers in clusters, a different calyx and corolla, no large hypogynous disk, a very different ovary, and a nucumentaceous fruit.

For equally obvious reasons we must reject the *Hydroleaceæ* and other monopetalous families, which it will be needless to mention.

After this search through various natural orders for some near indication of affinity, we arrive at the conclusion that there is not one of them in which *Gætzia* and *Espadea* can obtain a fitting place, so that we are driven to the necessity, either of making a distinct family for them (*Gætziceæ*), or of placing them as a peculiar tribe (*Gætzieæ*), to be attached to some known Order; but I cannot suggest one with which they can be satisfactorily associated. Having already stated all the facts relative to the structure of these plants, I will leave it to others to determine upon either of the above alternatives, confessing at the same time my inclination to advocate the former course. I am aware of the objection of some botanists to the establishment of an order upon a few genera; but in similar cases it has been a more frequent rule with most authors to create for them a distinct position in the system, rather than to destroy the uniformity of the general characters of a family—a course which appears more conformable to reason; and I might quote more than twenty instances where such families have accordingly been based upon only one or two genera\*.

Wherever it may be determined to place this small group, its leading characters will be:—hermaphrodite flowers; a tubular calyx and corolla, each with a valvate æstivation; exerted stamens, with versatile anthers, fixed near the base of the corolla, equal in

\* In the last volume of De Candolle's *Prodromus*, just published, embracing eight families, one half of these have only three or fewer genera, one of them being founded upon two, and two others upon only a single genus.



number to, and alternate with its lobes; a simple style and stigma; a superior 2-locular ovary, half imbedded in a large, partly free, fleshy, hypogynous disk having a lobed margin, the lobes sometimes enlarged into long, acute, mellifluous appendages; two collateral ovules in each cell of the ovary, fixed at the base of the dissepiment; a fleshy fruit, 2-celled, often by abortion 1-celled, with a single seed attached at the base of the ventral angle of each cell; seed with a testaceous testa, without albumen, containing an embryo, with two, or often four, large, fleshy cotyledons, united to a minute inferior radicle.

I will now proceed to describe the two genera more particularly:—

GÆTZIA, Wydl. (non Reichenb. nec Griesb.).

*Calyx* tubulosus, imo subglobosus, superne constrictus, ore 6-dentatus, dentibus lanceolatis, erectis, extus nervo prominulo notatis, margine ciliatis, intus reticulato-nervosis, persistens. *Corolla* infundibuliformi-tubulosa, tubo infra medium anguste cylindrico, 6-gono, superne sensim ampliata, fauce regulari, limbo 6-fido, laciniis subacutis, reflexis, æstivatione subvalvatis, crassiuscula, puberula. *Stamina* 6, laciniis corollæ alterna, æqualia, longe exserta; *filamenta* imo tubi inserta, libera, subulato-filiformia, erecta, glabra; *antheræ* oblongæ, 2-lobæ, imo sagittatæ, dorso versatiliter suspensæ, pilosiusculæ, utrinque rima longitudinali dehiscentes; *pollen* album, globosum. *Stylus* tenuiter filiformis, staminibus paulo brevior, glaber; *stigma* majusculum, clavato-2-lobum, utrinque sulcatum. *Discus* crassus, carnosus, superus, depressus, 6-gonus. *Ovarium* parvum, conicum, medio disci semiimmersum, pilosum, 2-loculare, loculis 1-2-ovulatis, *ovulis* ex apice pendulis? (sec. Wydl.). *Drupa* pyriformi-ovata, calyce persistente suffulta, carnosæ, disperma; *seminis* structura, immatura visa, hinc incerta, forsan ad eam *Espadææ* accedens.

Arbuscula *Antillana*, ramosissima: folia alterna, cuneatim oblonga, acuta vel emarginato-truncata, integra, supra nitentia, confertissime penninervia, subtus flavo-pubescentia, breviter petiolata; inflorescentia axillaris, racemosa, 3-4-flora; flores alterni, pedicellati; corolla drupaque aurantiacæ.

1. GÆTZIA ELEGANS, Wydl. Linn. v. 423, tab. 8: arborescens, ramulis sparsis; foliis oblongis, utrinque acute attenuatis, glaberrimis, supra nitentibus, crebre parallelim nervosis, nervis marginem versus anastomosantibus, subtus pallide ferrugineis, utrinque sparse pilosis, petiolo ferrugineo-pubescente, limbo 10-plo brevior; racemis axillaribus vel terminalibus, folio brevioribus, 3-5-floris; floribus pedicellatis, ebracteatis; calyce acute 6-dentato; corolla infundibuliformi, carnosæ, puberula, fauce ampliata, limbo regulari, 6-fido, laciniis acutis, revolutis: staminibus 6, imo tubi insertis, filamentis subulato-filiformibus; antheris lineari-oblongis, imo cordatis, dorso pilosulis, exsertis: ovario depresso conico-piloso, disco tenui glabro cincto: drupa pyriformi, pericarpio exsucco aurantiaco, abortu monosperma. In ins. Puerto Rico (*Wydl.*): non vidi.

The leaves are  $2\frac{1}{4}$ – $2\frac{3}{4}$  inches long,  $1\frac{1}{4}$ – $1\frac{5}{8}$  inch wide, on a petiole 3 lines long; the raceme is 1–2 inches long, the pedicels 2 lines long; the persistent calyx 4 lines long; the tube of the corolla 10 lines long; the lobes of the border 2 lines long; anthers exserted 2 lines beyond the mouth; the dependent drupe obovate, 6–8 lines long. No one appears to have seen this plant, except Dr. Wydl., from whose details the above description is made.



## ESPADEA, Rich.

*Armeniastrum*, Lem.

*Calyx* turbinato-tubulosus, crassiusculus, 4-5-dentatus, æstivatione valvata, persistens. *Corolla* tubulosa, crassiuscula, tubo subincurvo, a basi sensim ampliore, antice subventricosus, fauce subobliqua, limbo 4-, 5-, 6-fido, laciniis subacutis, erectis, æstivatione valvata. *Stamina* numero laciniarum et iis alterna, longe exserta; *filamenta* imo tubi inserta, subulato-filiformia, versus laciniam posteriorem declinatoconniventia, dein sensim incurvata, apice breviter uncata, glabra; *antheræ* sagittato-oblongæ, 2-lobæ, versatiles, dorso suspensæ, glabræ, utrinque rima longitudinali dehiscentes. *Stylus* tenuiter filiformis, staminibus æquilongus, apice incurvatus; *stigma* parvum, breviter 2-lamellatum. *Discus* semisuperus, imo ad calycem connatus, pro dimidia parte liber, apice concavus, margine lobis 5-6 crassis, interdum in appendices 5 longe subulatas mellifluas auctis munito. *Ovarium* conicum, valde depressum, medio disci semiimmersum, tomentosum, 2-loculare, loculis antice et postice positis, 2-ovulatis, ovulis minutis, subglobosis, medio ad dissepimentum pingue collateraliter affixis. *Drupa* subglobosa, calyce persistente suffulta, carnosâ, 2-locularis, endocarpio dissepimentoque membranaceis, loculis ovatis, monospermis; *semen* loculum implens, imo ventrali affixum; *testa* fusca, subplicata, crassiuscule celluloso-fibrosa; *integumentum internum* opacum, submembranaceum; *embryo* exalbuminosus, crassus, *cotyledonibus* sæpius 4, carnosis, *radicula* brevissima, infera.

Arbusculæ *Antillanæ*, ramosissimæ; folia alterna, cuneatim oblonga, apice emarginato-truncata vel rotundata, integra, supra nitentia, confertissime penninervia, subtus pubescentia, breviter petiolata: flores solitarii, extraaxillares, pedicellati, flavo-tomentosi; drupa aurantiaca.

1. ESPADEA AMÆNA, Rich. in *La Sagra*, Fl. Cub. ii. 147, tab. 65; *ibid.* introd. 58; A.DC. in *Bull. Soc. Bot. Fr.* iii. 348; Walp. *Ann.* v. 704; Bocq. *Adans.* iii. 262: *Goetzia amœna* in parte, Griseb. *Cat. Fl. Cub.* 191: fruticosa, ramis subvirgatis, punctato-rugosis, glauco-opacis, junioribus ferrugineo-tomentosis; foliis obovatis, apice rotundato-truncatis, brevissime subito mucronatis, imo sensim cuneatis, integris, marginibus undulatis, subrevolutis, coriaceis, supra nitentibus, glaberrimis, crebre et oblique penninerviis, nervis prominulis, alternatim arcuatim nexis, subtus pallidioribus, costa mediana rubella, prominente, pulverulenta, petiolo tenui, tomentello, limbo 7-10-plo brevior: floribus extraaxillaribus, solitariis, subbreviter pedicellatis; calyce turbinato-tubuloso, breviter 4-, 5-, 6-dentato, ferrugineo-tomentoso, crassiusculo; corollæ tubo subcurvato, a basi sursum infundibuliformi, superne anticeque subventricosus, fauce obliqua, crassiusculo, floride tomentoso, calyce 2-plo longiore, limbi lobis 4, 5 vel 6, crassis, acutis, erectis, æstivatione valvatis, tubo 5-plo brevioribus, 2 posticis paulo majoribus; staminibus 4, 5, 6, inæquilongis, ultra lobos exsertis, paulo curvatis, postice sursum conniventibus; ovario 2-loculari, in discum magnum 5-lobum semiimmerso, parvo, conico, puberulo, loculis collateraliter 2-ovulatis; drupa subglobosa, 2-loculari, aut abortu 1-loculari, loculis monospermis, embryone interdum 4-cotyledonari. In ins. Cuba (*La Sagra*): v. s. in hb. *nost.* (*Linden*, 1801); in hb. *Hook.*, in flore et fructu, Cuba (*Wright*, 3185).

A small tree with very numerous spreading branches; the axils are  $\frac{1}{2}$ - $\frac{3}{4}$  inch apart; the leaves are  $1\frac{1}{4}$ - $2\frac{1}{2}$  inches long, 7-15 lines broad, on a petiole 2-3 lines long; the pedicel is  $1\frac{1}{2}$ - $2\frac{1}{2}$  lines long, inserted on the contrary side to the axil somewhat laterally and sometimes  $2\frac{1}{2}$  lines above it: the calyx is 2 lines long; the tube of the corolla is  $3\frac{1}{2}$



6 lines long; the lobes of the border are  $\frac{3}{4}$  line long; the anthers extend 1 line above them: the superior ovary is a depressed cone seated in the hollow of a very broad raised fleshy disk, which has five rounded erect lobes alternate with the calycine teeth and stamens; the lower portion of the disk is adnate to the calyx. The fruit is covered with a dense yellowish ferruginous tomentum, is 7 lines in diameter, rounded at the summit; it is very fleshy, and is either 1- or 2-celled, the cells being lined with a membranaceous endocarp: the seeds are already described. There is a difference in the three plants above quoted: in La Sagra's plant, according to the drawing of Richard, the flowers are 4-merous and the leaves are only  $1\frac{1}{4}$ – $1\frac{1}{2}$  inch long: in Wright's plant the flowers are 6-merous, and the leaves are of the same size as those in Richard's drawing; but in Linden's specimen the flowers are all 5-merous and the leaves are double the size, being  $2\frac{1}{2}$ –3 inches long; as, however, the leaves are similar in shape and appearance in the three specimens, I have regarded them as one species.

2. ESPADEA APICULATA, nob. *Armeniastrum apiculatum*, Lem. Jard. Fleur. vol. iv. misc. p. 78, cum tab. in p. 77; A. DC. Bull. Soc. Bot. Fr. iii. 348: fruticosa, ramis ramulisque gracilibus, divaricatissimis, junioribus tenuiter ferrugineo-puberulis; foliis parvis, alternis, pyriformibus, apice rotundatis, minute mucronatis, imo acute cuneatis, coriaceis, crassiusculis, glaberrimis, crebre parallelim nervosis; petiolo tenui, ferrugineo-puberulo, limbo 4-plo brevior; floribus extraaxillaribus, solitariis, breviter pedicellatis, pedicello puberulo; calyce subgloboso, parce puberulo, minutissime et acute 5-dentato; corollæ tubo infundibuliformi, curvato, antice paulo ventricoso, fauce obliqua, limbo 5-lobo, lobis subacutis, reflexis; staminibus 5, gradatim inæqualibus, imo tubi insertis, exsertis, postremo longiore; antheris 2-lobis, lobis collateraliter adnatis, in sinu affixis; stylo stamina excedente, sursum curvato; stigmatibus rotunde 2-lobulato; disco magno, carnosio, calyci adnato, margine appendicibus 5 erectis subulatis ovarium circumstantibus mellifluis instructo; ovario conico, brevi, 2-loculari, loculis 1- (vel 2-?) ovulatis; drupa subglobosa, longe apiculata, læte aurantiaca, carnosia, eduli, abortione sæpius 1-sperma: embryone basilari, exalbuminoso, cotyledonibus carnosis, radiculam inferam brevissimam claudentibus. Ex insula Cubæ, in hort. Belgic. culta (*Lemaire*): non vidi.

A species very distinct from either of the preceding, remarkable for its much smaller leaves and flowers. The axils are 2–4 lines apart; the leaves are 5–8 lines long,  $3\frac{1}{2}$ – $4\frac{1}{2}$  lines broad, on a petiole 2 lines long; the calyx is  $1\frac{1}{2}$  line long and broad; the tube of the corolla 3 lines long, the lobes of the border 1 line long, the appendages 1 line long: the fruit is 6 lines in diameter, 9 lines long, including the apical point.



## DESCRIPTION OF PLATE XXXVIII.

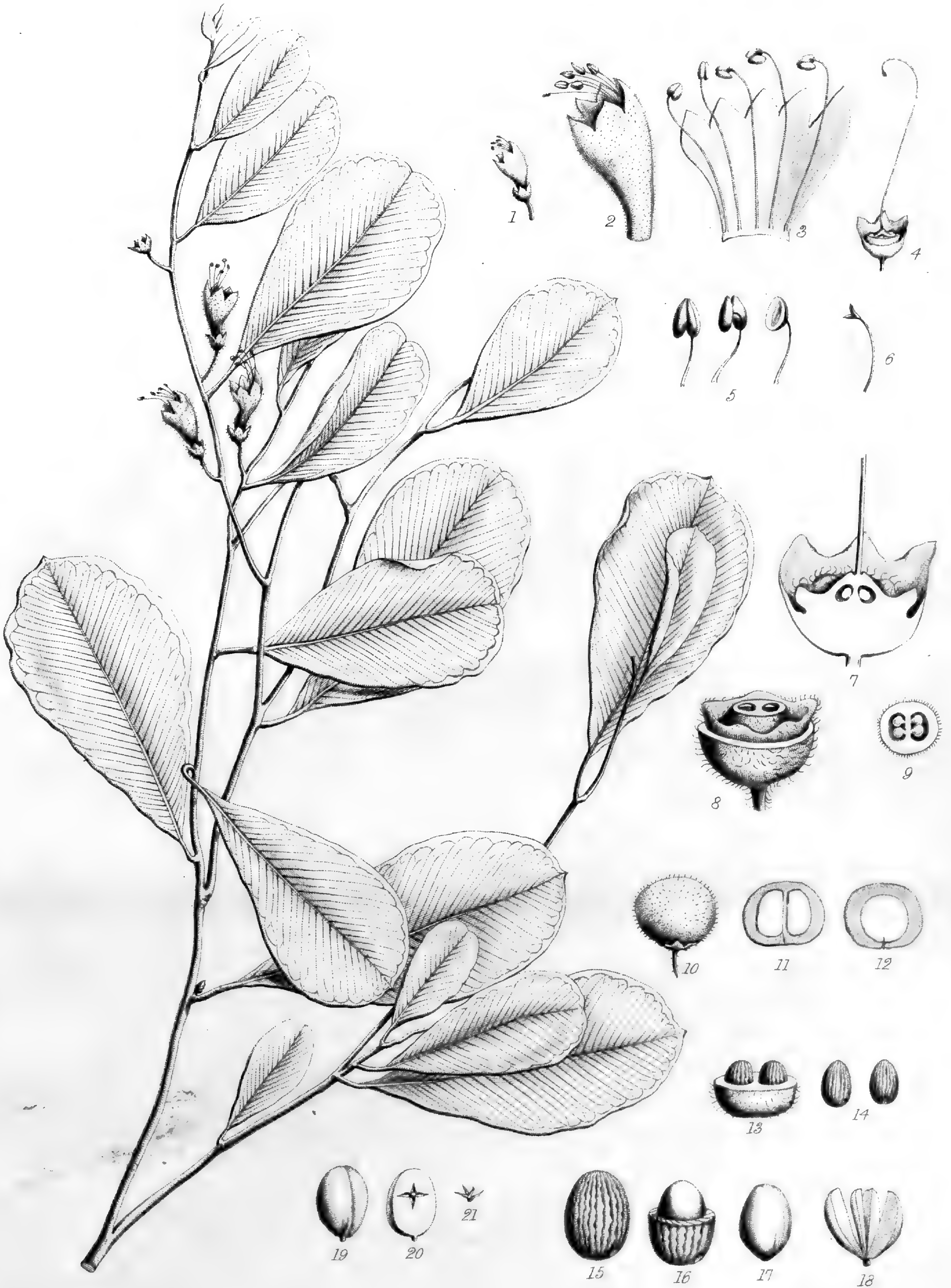
Showing a portion of *ESPADEA AMÆNA* : *nat. size.*

- Fig. 1. A flower, *nat. size.*  
Fig. 2. A corolla, *magnified.*  
Fig. 3. The same cut open, to show the position and insertion of the stamens.  
Fig. 4. The pistil, with half of the calyx cut away, exposing the fleshy torus and disk : *both magnified.*  
Fig. 5. An anther, seen in three different positions, *more magnified.*  
Fig. 6. The stigma and part of the style.  
Fig. 7. A longitudinal section of the ovary, disk, and calyx.  
Fig. 8. A transverse section of the ovary below the summit, the calyx being cut away to show the disk.  
Fig. 9. A transverse section of the ovary through the middle, showing its two cells, with two ovules in each cell : *all magnified.*  
Fig. 10. A fruit, *natural size.*  
Fig. 11. A longitudinal section of the same, with its two cells, having a membranaceous endocarp and dissepiment.  
Fig. 12. A longitudinal section in the contrary direction, showing the dissepiment, in the base of which is immersed the short columella.  
Fig. 13. A fruit, with half of its fleshy covering and endocarp removed, showing the two seeds.  
Fig. 14. The two seeds extracted, showing the hilar points of their attachment : *all nat. size.*  
Fig. 15. One of the seeds, *magnified.*  
Fig. 16. The same, with half of its thick testa removed, showing the embryo enclosed in its inner integument.  
Fig. 17. The integument and embryo removed.  
Fig. 18. An embryo, with four cotyledons united by a small inferior radicle.  
Fig. 19. Another embryo, with two cotyledons.  
Fig. 20. One of these cotyledons, seen on its inner face, with the hollow impression left by the small free nuclear body enclosed within the two cotyledons.  
Fig. 21. The nuclear body removed, showing its four radiating arms : *all magnified.*









*Espadea amena*, Miers.

J. Miers del.

G. Jarman sc.



X. *A Monograph of the Genus Polymorphina.* By HENRY B. BRADY, *F.L.S.*,  
W. K. PARKER, *F.R.S.*, and T. RUPERT JONES, *F.G.S.*

(Plates XXXIX.–XLII.)

Read June 3rd, 1869.

INTRODUCTORY.

PERHAPS no genus of the Foraminifera, embracing individuals so widely different in conspicuous characters, presents at the same time so unbroken a series in the differentiation of its successive links as the group brought together by D'Orbigny under the name *POLYMORPHINA*.

Whilst its interest is heightened rather than diminished by this fact, the difficulties in the way of satisfactory systematic arrangement and subdivision are considerably augmented; and as successive observers have pursued independent paths, with but little reference to what has gone before, the nomenclature of the genus has lapsed into almost inextricable confusion. This condition is obvious enough to any one who has attempted to name even a small collection of *Polymorphinæ*; but in recent investigations for our "Monograph of the Foraminifera of the Crag," it was found to be a cause of constant embarrassment. The extraordinary predominance of specimens belonging to the genus in the later Tertiary beds of our Eastern Counties, and their wide range of variation, rendered it desirable, under these circumstances, to make a critical examination of all the "species" previously described, before attempting to assign trivial names to the forms which presented themselves from this particular source. The exhaustive survey of the group thus commenced has been a more considerable undertaking than was at first anticipated; and its results appear to be of sufficient importance for embodiment in a separate memoir; and this it is that we now lay before the Society. An attempt has been made to arrange the various members of the genus in something like a natural sequence; whether it has been successful in any thing more than in the reduction of a disorderly mass of ill-defined and chiefly needless "species" into manageable compass by the adoption of larger subdivisions than those previously recognized, it is for others to judge.

The question of the importance to be attached to minute and very variable external characters is so much one of opinion, that the acceptance of any series of conclusions in respect to it cannot be urged on quite the same basis as that which may properly be claimed for results admitting of more direct proof. Observations on a very large number of specimens, drawn from a wide range of distribution both geographical and geological, and a comparison of their morphological characters with analogous variations in allied genera, form the groundwork of the views now advanced; and we may at least claim for them whatever consideration is due to careful study within these limits.

It may be well to state at the outset the principles which have been held in view



in resetting the nomenclature of the group, inasmuch as some previous endeavours in the direction of simplification have been misunderstood by Continental Rhizopodists, and conclusions which appear to us quite inconsequent have been adduced from them\*.

To most naturalists the question, whether, *if two specimens have the same zoological characters, they should be regarded as belonging to the same species, without reference to their age*, appears open to but one answer, namely that, unless proof of a positive nature be forthcoming of distinct and separate origin, specific determination must rest on zoological characters. Such proof is, in the very nature of things, impossible, and we are compelled to mould our views of the past on what we know of the present.

There are many well-marked species of Foraminifera now living in our seas, which are to be found in every marine microzoic deposit of Posttertiary and Tertiary date formed at corresponding depths. A published table of the distribution of living and fossil Foraminifera in the Mediterranean area† will afford us several illustrations of this fact. Many of the columns in the table referred to are by no means complete, having been compiled from limited supplies of material, and they represent sea-bottoms, present or past, widely differing in depth. Notwithstanding some discrepancies attributable to these causes, the twenty-five lists contained in the table, embracing the results of the examination of *eleven* Mediterranean soundings, and Tertiary deposits of various ages from *fourteen* localities in Italy (including Sicily), Spain, Malta, and the neighbourhood of Vienna, yield the following facts respecting some of the commoner species of Foraminifera.

<i>Globigerina bulloides</i> , D'Orb.,	occurs in 11 recent soundings and 10 Tertiary deposits.
<i>Discorbina globularis</i> , D'Orb. . . . .	6     "     "     5     "     "
— <i>rosacea</i> , D'Orb. . . . .	5     "     "     7     "     "
— <i>elegans</i> , D'Orb. . . . .	8     "     "     5     "     "
<i>Planorbulina Haidingerii</i> , D'Orb. . . . .	4     "     "     6     "     "
<i>Truncatulina lobatula</i> , W. & J. . . . .	8     "     "     11     "     "
<i>Rotalia Beccarii</i> , Linn. . . . .	3     "     "     11     "     "
— <i>orbicularis</i> , D'Orb. . . . .	7     "     "     5     "     "
<i>Polystomella crispa</i> , Linn. . . . .	8     "     "     11     "     "

\* This is scarcely the place to reply to a critique by our valued friend Dr. A. E. Reuss, of Vienna (see *Verhandlungen der k. k. geologischen Reichsanstalt*, No. 7, 1868), which, though based upon a short paper by one of us, is chiefly directed against the views held by British naturalists in respect to the subdivision of this group of Protozoa. We in no way undervalue the long and persevering labours of the learned German professor in the wide field of fossil Foraminifera; and though we cannot accept the principle which has led him to the use of a multitude of names for even the simplest types, we are equally far from expecting that he should now be inclined to adopt views which many others hold to be more consistent with natural laws, and more in accordance with the results of modern inquiry. It is unfortunately much easier to establish new "species" to accommodate each little set of specimens having trifling morphological peculiarities, or derived from a different geological horizon, than to trace their connexion with better-defined forms already described; and this is precisely true of the Liassic specimens on the descriptions of which he animadverts. Nor can we agree with him that a few "species" too many are less troublesome and mischievous than the bringing together of closely allied forms into one specific group which it may be found desirable subsequently for the convenience of classification to subdivide.

† See a paper "On the Rhizopodal Fauna of the Mediterranean, compared with that of the Italian and other Tertiary deposits, by T. Rupert Jones and W. K. Parker," *Quart. Journ. Geol. Soc.* vol. xvi. p. 292: 1860.



Considering that there is abundant evidence to show that the fossiliferous beds were generally deposited at a less considerable depth than that represented by the only series of Mediterranean soundings available for comparison, these figures require much stronger evidence than any that has yet been adduced against the theory of "continuity" to warrant the *specific separation* of recent and fossil specimens merely on the ground of age. The fauna of the Mediterranean area happens to be convenient for reference, because the data are already published; but the same conclusions are arrived at on a comparison of Recent and Tertiary Foraminifera, whatever the source. In the lapse of time, owing to causes partly well understood, partly only conjectured, some forms have died out or have gradually lost their importance, some have been replaced by others, and relative size and frequency have varied with altered climatal conditions; but with these exceptions the fossil Rhizopod fauna of the Tertiary and Quaternary epochs is the living Rhizopod fauna of similar depths of the present sea-bottom.

If these conclusions be accepted, the same must be held true of preceding geological times; for we find also in the microzoic rocks of the Secondary period a considerable proportion of the same "species" (*i. e.* forms having the same zoological characters); indeed, judging from recent researches on the deep-sea bed, it seems clear that we have at the present moment a Chalk area, with characteristic Rhizopoda, in process of formation in some parts of the North Atlantic.

In the comparison of the Mesozoic with the Recent, or even with the Tertiary fauna, a larger margin must be granted for different external conditions; and this allowance must be still further increased if the same question be discussed in respect to the animal life of the Palæozoic era. We may trace back even in the strata of those very early times, certain types of Foraminifera that are living at the present day in our seas. Thus, notably, the *Nodosariæ* and *Textulariæ* abound in certain parts of the Permian Limestone of Germany and England. A *Textularia*, undistinguishable from *T. sagittula*, is found in the Carboniferous Limestone; and a very similar form, possibly a variety of the type, is not rare in some parts of the same formation; and these occur together with the Planorbulina-like shell known as *Endothyra*, which is often seen in sections of compact Mountain limestone. Indications of a still higher Foraminifer, possibly *Nummulina*, have been noticed in both English and Russian limestone of Carboniferous age.

It is true that other forms are lost to us, so far as researches have yet extended; but even these tend rather to augment than diminish the cogency of our argument. Thus *Fusulina*, a genus which Dr. Carpenter has shown to be closely related to *Nummulina*, is a characteristic fossil of certain Palæozoic limestones of Russia and North America; and in the Devonian and Silurian rocks the massive *Stromatopora* appears with simple Foraminiferal structure. Other forms of Protozoa existed in these or even earlier ages, if we accept Professor Ehrenberg's conclusion that the green kernel-like grains occurring in the green Lower Silurian sand of St. Petersburg are casts of the chambers of Foraminifera. Lastly, structures essentially Foraminiferal (*Eozoon*) are traceable in the Lower Laurentian limestones, the lowest and oldest of the known geological series.

These few extinct types, the representatives probably of many, stand in the closest



relationship with surviving genera, and, so far from breaking the zoological continuity of the series, do but serve to fill up some of the links previously wanting to complete the chain.

It is quite true that, for some reasons, of which we know nothing, certain "genera" and "species" have become prominent at one period, and lapsed into insignificance at another; but the number of types which, so far as our present knowledge goes, are absolutely lost is comparatively trifling. Nor is this surprising; for it is seldom that we have evidence of sudden upheavals of the sea-bed extending over large areas; and even in such cases the displaced water would carry with it sufficient of its microzoa to stock a new area, should the fresh conditions be favourable to their development and increase; but in the far commoner process of gradual deposit the Rhizopoda would naturally follow, as it receded, the area of depth most favourable to their habits.

These considerations are merely brought forward to show that we have no evidence of want of "continuity" in respect to the forms of marine Microzoa recurring in successive strata, and that there is no valid reason for regarding morphological characters, wherever shown, in any other than a zoological light. It need not be assumed that there is absolute and direct descent in the trifling peculiarities which have been made the bases for so many "specific" subdivisions; indeed it is almost certain that the largest number of such modifications are brought about, gradually perhaps and within certain limits for each type, by external conditions.

The arguments employed to uphold the renaming of the same varietal form on its reappearance in successive beds would be as applicable, if well grounded, to geographical as to geological range, and must be held to be also true in case of the recurrence of the same variety in areas widely separated. It would be easy, for instance, to give a list of Foraminifera common on our own coast and equally at home at similar depths on the shores of North America; to trace direct relationship would be impossible; for we have the strongest negative evidence that the same varieties, or even the same types, do not occur in the abyssal depths that separate Europe from America; yet no naturalist would suggest the "specific" separation of specimens found in the eastern from those found in the western habitat, or would hesitate to accept zoological characters *alone* as sufficient basis for identification.

In one word, the following history of the genus is as purely zoological as we have been able to make it; and the subdivisions adopted are based solely on external physical characters. We can see no consistency in any other course; and the present aspect of the nomenclature of this little section of the animal kingdom shows sufficiently the practical contradictions which accrue from the admission of *time* as a primary element in systematic zoology.

We have no hesitation in saying that, read in the light of the older definitions, the whole of the widely differing shells referable to the Polymorphine type must be regarded as a single species. From end to end of the long series it embraces there is no single break; the successive modifications of the typical form, however well defined when judged by central and characteristic specimens, are seen, as the number of examples is multiplied,



to glide into each other by absolutely imperceptible gradations. This does not diminish the necessity for subdivision, but it alters the zoological significance of the constituent groups, which have no claim to rank as true species, although necessarily distinguished by trivial names. The headings under which the various modifications of the type have been arranged in the present memoir are based upon what we regard as the best representative specimens; and under one or other of these we have been able without much difficulty to place nearly all the forms described by the authors referred to. But when the most closely related individuals may differ in so many small particulars affecting their general appearance, and the successive links in the chain are so close, considerable latitude in minor points of variation may be properly allowed to each subgroup. Under such circumstances it is impossible entirely to avoid artificial distinctions; and the best that can be done is to accept only those that are really serviceable and do not interfere with natural sequence in general characters. Those who prefer an extended nomenclature based upon evervarying minute peculiarities, have ample field amongst the *Polymorphinæ* for the exercise of their ingenuity; indeed, if the subdivision be carried much further than the limits we have adopted, it can hardly stop short of naming every specimen. There would be no difficulty in splitting up each of the groups which, with us, stand in the place of "species" into half a dozen smaller sets; but if this were done, just as great necessity would appear again to subdivide, and so forth: and even such a process of multiplication of groups has found favour with some authors.

The plan which we have adopted in reducing the nomenclature has been to go carefully over the whole of the published descriptions and figures to which we have had access, taking them as nearly as possible in the order of precedence, selecting in the process the varieties which afforded the best-defined characters, and only introducing new subtypes for specimens not referable to previously described forms. Upwards of a hundred memoirs, dating from 1780 to the present time, have been worked over in this way; and no pains have been spared to place successive writers on a proper footing in respect to the forms they have described. In some instances scant justice may appear to have been done to the labours of an author in the non-adoption of trivial names founded on laboriously worked-out diagnoses. Such omissions, alluded to more at length at a subsequent page, do not result from any lack of disposition to accept already published material; and where names previously employed do not appear, it is due to the fact that we have failed to see any advantage likely to be gained by their retention.

In almost every case we have adopted the name *first* given to a variety as its proper designation, on the simple ground of priority, making no distinction whether its original application was to a recent or to a fossil specimen; but in one or two instances the description and figures appended to the first mention of a "species" are ill defined or obscure, or in some way do not fairly represent the subgroup to which it belongs, whilst a later name given to a better representative may have been in general use and be already well understood. In these rare cases we have chosen the better type, or have merged the question of priority in that of practical convenience.

The drawings of the different "species" have, as far as possible, been made from specimens; when copied, they have been carefully redrawn from the originally pub-



lished figures; and we wish to acknowledge the great attention and labour bestowed upon them by Mr. George West.

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### Genus POLYMORPHINA, D'Orbigny.

#### Synonyms:—

- Polymorphium*, Soldani, 1780.
- Serpula*, Walker and Jacob, 1784; Kanmacher, 1798.
- Vermiculum*, Montagu, 1803; Fleming, 1823; Macgillivray, 1843.
- Arethusa*, Montfort, 1808; Bowditch, 1822; Fleming, 1828; Thorpe, 1844.
- Misilus*, Montfort, 1808.
- Cantharus*, Montfort, 1808.
- Polymorphina*, D'Orbigny, 1826; Sander-Rang, 1829; Menke, 1830; Ehrenberg, 1838; Roemer, 1838; Macgillivray, 1843; Morris & Searles Wood, 1843; Philippi, 1844; Reuss, 1845; Strickland, 1846; Alth, 1850; Jones, 1852; Morris, 1854; Parker & Jones, 1857; Egger, 1857; Williamson, 1857; Terquem, 1858; Karrer, 1861; Carpenter, 1862; Gümbel, 1862; Brady, 1864; Stache, 1864; Dittmar, 1864; Sars, 1865; Schwager, 1866; Alcock, 1867; Bunzel, 1869; Von Schlicht, 1869.
- Globulina*, D'Orbigny, 1826; Sander-Rang, 1829; Roemer, 1838; Reuss, 1845; Alth, 1850; Morris & Jones, 1854; Bornemann, 1855; Egger, 1857; Karrer, 1861; Schwager, 1864; Von Schlicht, 1869.
- Guttulina*, D'Orbigny, 1826; Sander-Rang, 1829; Roemer, 1838; Reuss, 1845; Alth, 1850; Morris & Jones, 1854; Bornemann, 1855; Egger, 1857; Karrer, 1861; Stache, 1864; Von Schlicht, 1869.
- Pyrulina*, D'Orbigny, 1826; Sander-Rang, 1829; Reuss, 1845; Morris & Jones, 1854; Ehrenberg, 1854; Von Schlicht, 1869.
- Renoidea* (in part), Brown, 1827.
- Raphulina* (in part), Zborzewski, 1834.
- Apiopterina* (in part), Zborzewski, 1834.
- Proroporus* (in part), Ehrenberg, 1844; Reuss, 1845.
- Aulostomella*, Alth, 1850.
- Grammostomum* (in part), Ehrenberg, 1854.
- Strophoconus* (in part), Ehrenberg, 1854.
- Bigenerina* (in part), Ehrenberg, 1854.
- Vaginulina* (in part), Ehrenberg, 1854.
- Pleurites* (in part), Ehrenberg, 1854.
- Sagrina* (in part), Ehrenberg, 1854.
- Sphaeroidina* (in part), Ehrenberg, 1854.
- Rostrolina*, Von Schlicht, 1869.
- Atractolina* (in part), Von Schlicht, 1869.



*General Characters*.—Shell free, or (rarely) adherent; globular, ovate, oblong, cylindrical, compressed, or complanate. Visible segments variable in number—two or many. Segments even-margined or ventricose; arranged in an obscure spiral or (less frequently) in two opposed alternating series (as in *Textularia*), more or less embracing, and partially investing the previous segments. Shell inequilateral, from unequal overlapping of the segments. Septal lines often depressed, obscure in thick-shelled specimens, but in hyaline individuals marked by whitish milky lines. Pseudopodial orifice at the anterior extremity of the ultimate segment; nearly central, and generally situated in a mamilliform protuberance; circular, oval, slit-like, or porous, and (normally) surrounded by a coronal of strongly defined radiating grooves. In rare cases the direction of the aperture is reversed, as in the Entosolenian *Lagenæ*. Texture hyaline and delicate in young specimens, opaque and coarse in older ones; never arenaceous. Foramina conspicuous in hyaline shells, minute and tubular in those with thicker walls. Surface either smooth or presenting outgrowths in the form of setæ, spines, tubercles, granular lines, striæ, or riblets.

The natural position of the genus *Polymorphina* is in the suborder PERFORATA, Family LAGENIDA (Carpenter), between the genera *Nodosarina* and *Uvigerina*.

Whilst there is little difficulty in distinguishing well-grown specimens pertaining to this group in any of the numerous modifications of form they are liable to assume, it must be borne in mind that there is scarcely a genus in the whole family of *Lagenida* which has not its isomorph amongst the *Polymorphinæ*. The minute globular forms, either smooth, as in the smaller examples of *P. gibba*, or with ornamented shell like *P. myristiformis*, have a strong resemblance to corresponding varieties of *Lagena*, especially if the septation be obscured, as it often is by a thickened shell-wall; and in these cases the inequilateral contour of the shell supplies the best indication of zoological affinity. In *P. Soldanii* we find an acervuline packing of the chambers; and when this occurs in tolerably regular series a striking analogy to the smooth *Uvigerinæ* is the result. In the Dimorphine varieties, which are sufficiently distinct to be roughly separated into a subgenus, the mode of growth simulates *Nodosaria*, *Bigenerina*, or *Sagrina*; and in addition to these the genus presents isomorphs of at least two other types—namely, of *Textularia* in many of the biserial varieties, and of *Bulimina* in one or two irregular forms described by D'Orbigny. But the chief difficulty in diagnosis arises not out of well-developed specimens, however much they mimic collateral types, but in modifications arising, on the one hand, out of an exaggerated condition of otherwise normal characters, or, on the other, out of the want of distinctive character resulting from external influences unfavourable to vigorous growth. Better examples of this latter "starved" condition could not be found than in the assemblage of few-chambered, ill-grown, elongate varieties upon which M. Terquem has founded his "Fourth Memoir on the Foraminifera of the Lias." It is not necessary here to occupy space by criticism on a memoir so unsatisfactory; but we may in passing enter a protest against the establishment of a number of species on a set of poorly developed and sometimes even monstrous individuals. Some of M. Terquem's drawings do not represent *Polymorphinæ* at all, but specimens belonging to widely differing genera, as *Lituola*; others are just as likely to be weak and irregularly grown *Nodosarinæ*, whilst



the remainder would be sufficiently provided for by association with *Polymorphina Thouini*, *P. fusiformis*, and *P. compressa*.

Whilst speaking of the literature of the genus, we may advert to the difficulty of identifying the particular varieties figured by some of the earlier writers. The value of an otherwise excellent paper, like that by Herr Roemer on the North-German Tertiary Marine Sands, is much diminished, so far as the Foraminifera are concerned, by the minuteness and want of definition of the drawings; and the same fault appears in Prof. Reuss's earlier illustrations. The desire to express *relative* size, by observing a uniform scale for all the figures on a plate, has in the same way somewhat marred the usefulness of our own Monograph of the Crag Foraminifera; but in this case the deficiency is confined to the smaller species.

A treatise on any subject pertaining to fossil microzoa can hardly be regarded as complete without reference to the 'MIKROGEOLOGIE' of Prof. Ehrenberg, although so far as the "*Polythalamia*" are concerned, the value of its magnificent plates is very small in proportion to the labour bestowed upon them. Their defects are chiefly due to the system adopted throughout the work of drawing from specimens mounted in Canada Balsam and viewed by transmitted light. The result is that only one aspect of the test is given, and in transparent individuals the external characters are confused beyond recognition by the prominence of the septal lines in the interior. The figures, almost without exception, represent the longitudinal or horizontal section of the shell, from which, alone, the shape of its transverse section or its general external aspect cannot be determined. Under these conditions the compressed and complanate forms are undistinguishable from the subglobular and pyriform varieties, and the only characters left for diagnosis are the comparative length and breadth of the specimens and the contour of their margins. Whilst therefore we have thought it necessary to examine minutely all the figures in the 'Mikrogeologie' showing any apparent connexion with this genus, and have, to the best of our judgment, distributed the references to them amongst the synonyms appended to the species to which they seem to belong, the result is offered with much hesitation, and the determination must be accepted with a certain amount of reservation. The difficulty attending this re-setting of Prof. Ehrenberg's subdivisions is further enhanced by his non-acceptance of previously established and well known specific and even generic terms. We find undoubted *Polymorphinæ* under no less than ten generic headings, intermixed with Foraminifera belonging to several widely differing types; indeed the nomenclature of the 'Mikrogeologie' leaves us no terms of distinction between such genera as *Polymorphina*, *Textularia*, *Uvigerina*, and *Bulimina*, whilst the subgeneric names *Guttulina*, *Bigenerina*, and *Dimorphina* are applied to specimens that have no divisional characters in common with those for which they are employed by other writers.

It seems necessary to make a passing allusion to the last memoir on our bibliographic list,—Herr von Schlicht's work on the 'Foraminifera of the Septaria-clay of Pietzpuhl,' which came into our hands whilst engaged in revising the present paper. The institution of two new genera (*Atractolina* and *Rostrolina*) for sets of specimens very slightly, if at all, divergent from previously well understood forms is a course which will scarcely



commend itself to a second observer. The first name is used for a mixed lot consisting partly of compact fusiform *Polymorphinæ*, the remainder of doubtful *Nodosarinæ*. His genus *Rostrolina*, on the other hand, consists entirely of *Polymorphinæ*; and its diagnosis is based upon the characters of the last chamber, especially its produced extremity and arcuate or slit-like terminal orifice. We have not pretended to sort the whole of the figures of the *Polymorphinæ* contained in Herr von Schlicht's work, but have inserted references to the least doubtful of them in their proper places.

In the subdivision of this truly polymorphic genus we are dependent on certain constantly varying characters, and the specific (or rather varietal) names we have adopted are those which have been given to forms which represent the best-defined lines of departure from a central type. We are well aware that many Continental observers, with their inclination towards minute and nominal distinctions, may regard some of the groups associated under a single varietal name as embracing too wide a range in minor characters; and we can only offer in defence the fact that we have in no case ignored a published trivial name that we could make of the slightest service in defining any particular assemblage of forms; and regarding the arrangement we have adopted as sufficient to embrace every modification of the type that has come under our notice, we could not have carried the process of subdivision further without naming almost every specimen.

The characters most available for purposes of systematic description are those depending on the shape, number, arrangement, and "setting on" of the chambers, and the condition of the surface of the shell in respect to ornamentation. In M. D'Orbigny's first scheme of classification of the Foraminifera\*, whilst the type was still only known by its smooth varieties, the genus was divided into four subgenera, which are given with their characters as under:—

POLYMORPHINA (proper), having a large number of chambers visible, alternating upon two sides almost equally.

GUTTULINA, having but few of the chambers visible, alternating upon three faces; chambers embracing.

GLOBULINA, alternating on three faces, chambers embracing; three chambers only visible.

PYRULINA, alternation irregular, or somewhat obscurely spiral, formed of half-embracing chambers.

These subgeneric names have been accepted with more or less reservation by subsequent continental writers†. But when a subdivision of this sort has confessedly no natural basis, it is fair to judge it on the simple issue of convenience as an artificial arrangement; and it has been thought better to abandon the complication of terms it necessitates, as tending to confuse rather than to simplify a general scheme of the group.

\* "Tableau méthodique de la classe des Céphalopodes."—*Annales des Sciences Naturelles*, Tome 7<sup>ème</sup>, 1826

† Quite recently Herr Karrer has abandoned the subdivision into subgenera, as Prof. Reuss also appears in some measure to have done.



There is, however, one set of forms, misunderstood by D'Orbigny, and correspondingly misplaced, which seems better entitled to the position of a subgenus or subtype, viz. those constituting his genus *Dimorphina*. All the biserial genera of Foraminifera have amongst their modifications some which show a tendency to a uniserial arrangement of a portion of their segments. In *Textularia*, for instance, there are a number of varieties, separated under the subgeneric name *Bigenerina*, differing in many of their characters, but alike in this—namely, that after the first few chambers have been formed on the normal alternating plan, the shell is completed by a uniserial line of segments. In the same way rare specimens of the Polymorphine type are found, in which the early segments are triserial, or obscurely spiral, and the later ones assume a uniserial arrangement. Thus *Dimorphina*, the subgenus embracing these varieties, bears precisely the same relation to *Polymorphina* that *Bigenerina* does to *Textularia*. These peculiar forms are interesting as supplying one of many evidences of the near relationship of the genus to the *Nodosarinæ*. In a large proportion of the specimens the later chambers are as completely Nodosarian in character as the earlier ones are Polymorphine; indeed it is an open question regarding such forms as the *Dimorphina obliqua* of D'Orbigny, which of the two genera they are best assigned to.

The genus *Uvigerina*, which is normally triserial, supplies another such instance in its subgenus *Sagrina*; and the resemblance its uniserial specimens often bear to those of *Dimorphina* is so close that the produced phial-shaped neck and lip is almost the only character which determines their Uvigerine affinity. Herr Schwager, in his contribution to the geological part of the 'Novara-Reise,' figures a beautiful variety of this kind as *Dimorphina striata*, which we have reluctantly omitted, regarding it as a striate *Sagrina*, on the ground of its neatly formed Uvigerine neck.

Accepting the shell first figured by Walker and Boys\*, the smooth, hyaline, Globuline form named by them *Serpula lactea*, as the type of the genus, it is easy to divide the *Polymorphinæ* proper into two groups,—1st, those having smooth shells, and, 2ndly, those having tests more or less altered by outgrowths of shell-substance, constituting a sort of surface-ornamentation. But, broad and well defined as this division seems, it is by no means absolute; for perfectly smooth examples of *Polymorphina frondiformis* may frequently be met with, although it is necessarily placed amongst the "ornamented" forms on account of the subcostate surface of the majority of specimens.

1st. Of the smooth varieties little need be said in explanation of the order which has been adopted in the treatment of the species. Two somewhat anomalous forms, *P. concava*, Williamson, and *P. Humboldtii*, Bornemann, whose plano-convex shape appears to be due to a parasitic habit of growth†, are placed at the end of the series; and another interesting modification, *P. elegantissima*, Parker and Jones, is equally removed from the normal type by the reversed direction of its later segments. But beyond these excep-

\* 'Testacea minuta rariora,' &c., p. 2, pl. 1. fig. 5.

† For *P. Humboldtii* this character is assumed from analogy, and we lay no stress upon it, never having seen specimens exactly similar to those figured by Dr. Bornemann; but whether our supposition be correct or not, the place assigned to it is probably nearly its natural one.



tional cases the varietal distinctions are derived chiefly from such characters as the form of the chambers, their number, the degree in which they overlap, the amount of depression at the sutures, and the general contour of the shell, as determined by their fitting together.

2nd. Amongst the "ornamented" varieties may be found almost every description of surface-marking known in the simple Foraminifera. The normal hyaline condition of the young shell is seldom preserved in the adult, but by degrees the delicate test is thickened and rendered opaque from the continued deposit of calcareous matter. This process usually takes place with uniformity over the whole surface; and as the pseudopodial perforations continue open, their length is necessarily increased, and from being mere minute circular apertures they become tubes traversing the shell-wall. A portion of a thickened shell exhibiting this tubular structure is shown at Plate XL. fig. 12, *f*.

But in another, large class of cases, the calcareous matter deposited by the sarcode issuing through the perforations of the originally thin and smooth chamber-wall, produces, by uneven deposition, a series of very different results. The characters depending on exogenous growths so formed are sufficiently marked to yield varietal distinctions, and we have employed the trivial names which previous authors have given in regard to the more salient of them; but it must be understood that in whatever guise the shelly outgrowths appear—whether as mere rugosities, as bristles, spines, tubercles, granular lines, striæ, or ribs—they all, physiologically speaking, originate in the same way, and, as might be expected, pass into each other by insensible degrees.

In so variable a genus there is perhaps less to be learnt from chance monstrous specimens than in those whose normal range of modification is narrower; indeed it becomes difficult, with such a group, to say what constitutes a monstrosity. The only really anomalous specimens we recollect, setting aside the fistulous or cervicorn varieties, here treated of separately, are a few rare examples which are partially double and present two principal orifices instead of one. An individual of this sort is represented at Plate XXXIX. fig. 1, *c*. It is of no special interest, except from the analogy it bears to the double-growing *Lagenæ* and *Cristellariæ* that are occasionally met with.

*Distribution.*—The geographical area of the distribution of the genus *Polymorphina* is coextensive with a certain bathymetrical range throughout the world. Its "home" is in shallow seas, and it can scarcely be said to flourish at greater depth than 60 or 80 fathoms, though occasional specimens are still found at 90 fathoms, and under favourable conditions it may occur in still deeper water\*. In littoral sands, or those dredged in the Laminarian, the Coralline, or the Coral zone, whatever the latitude, some variety of the type is sure to be found if Foraminifera are present at all.

Arctic dredgings off Hunde Island and off the coasts of Greenland and Norway have yielded fine specimens. Proceeding southwards, the genus is of common occurrence in

\* At the time this paragraph was written we had not seen Dr. Sars's valuable paper, containing "Additional Observations on the Animal Life met with in the Depths of the Sea," which mentions the occurrence of three varieties of *Polymorphina*, viz. *P. lactea* (*typica*), *P. compressa*, and *P. tubulosa* (= *P. Orbignii* of the present memoir), in soundings from 300 fathoms; but as this fact does not affect the general accuracy of our statement, we have allowed it to remain as originally written.



the Shetland area, it is met with at every point on the shores of the British Islands, and again in the British Channel and the Bay of Biscay. Its occurrence in the Mediterranean strikingly follows the variations of depth: the table before alluded to, which embodies the results of a large series of observations\*, shows its entire absence at 170, 250, 306, 500, 1100, 1620, and 1700 fathoms, whilst at 90 fathoms (off Syra) the attenuated variety is noted as "rare;" and the common forms by degrees come in, in the shallower water of the Gulf of Spezzia, off Leghorn, and off Crete; and, again, specimens of the genus have been noticed by many observers in the lesser depths of the Levant.

*Polymorphinæ* are found in the Red Sea, on the coast of China, amongst the Australian coral-reefs, in the sea-harbours of Tasmania, on the eastern shores of the American continent, in the West-Indian archipelago, and amongst the Canary Islands.

In all dredgings taken from mid-ocean the absence of the genus is conspicuous; in the deep Atlantic, whether in the northern, tropical, or southern portions, it is unknown; and there is no record of its occurrence at great depths in the Indian Ocean.

The distribution of the genus in *time*, geologically speaking, is similarly extensive.

If we accept the aggregations of green sand-grains figured by Prof. Ehrenberg under the names *Polymorphina avia* and *P. abavia* as glauconite casts of the chambers of Foraminifera (and, notwithstanding some doubt that has been thrown upon their organic origin, we must admit the extreme resemblance his two figures bear to some specimens of *Polymorphina compressa*), the first appearance of the genus must be placed back as far as the Lower Silurian sands of the neighbourhood of St. Petersburg. It has not, however, been noted in rocks of Palæozoic age by any other author.

In the Secondary period, specimens of *Polymorphina*, usually of the few-chambered, weaker forms, become gradually more frequent. In the Upper Trias of Derbyshire (Jones and Parker), the Raibl beds of southern Germany (Gümbel), and in the various Liassic marls of England and continental Europe examples of the genus are found, though rarely. It again makes its appearance in the Oxford and Kimmeridge clays (Middle and Upper Jurassic respectively), in the Portland beds, in the Gault, and the Chalk; and during the Tertiary period it occurs in abundance wherever conditions of depth and sea-bottom have been favourable. Though apparently wanting in the London Clay, specimens of the genus are to be found in some of the Lower Eocene beds of England; but in the Lower Tertiaries of the Paris district, in the Miocene strata of Bordeaux, of the Vienna Basin, and of Lower Bavaria, it exists in wonderful variety. In the later Tertiary beds of the Mediterranean area there is a curious discrepancy to be observed: the Italian Pliocene marls contain a fair representation of the genus, whilst beds of corresponding age on the Spanish coast (Malaga) yield no *Polymorphinæ* whatever: and the same absence is to be observed in a peculiar marl-bed of Miocene or late Eocene age at Baljik, on the Black Sea. In the Southern Hemisphere, such of the Tertiary clays as have been examined, *e. g.* those of New Zealand and South Australia, show a large number of specimens pertaining to the type. In one particular bed of the "Crag" of our own Eastern Counties (at Sutton, near Colchester) the size and abundance of the

\* Quarterly Journal of the Geological Society, vol. xvi. p. 302.



*Polymorphinæ* constitute a remarkable and distinguishing feature, though elsewhere in that formation they are small and scattered. Lastly, in the Glacial beds of the west and north of Scotland, of Norway, and of Canada the type still abounds, and in the Posttertiary clays immediately underlying the peat in the fen districts of Lincolnshire and Northamptonshire numbers of minute specimens are found in a scarcely fossilized condition.

POLYMORPHINA LACTEA, Walker and Jacob, sp. (Pl. XXXIX. figs. 1, *a-c*.)

(Normal form; transverse section nearly circular.)

- Serpula tenuis ovalis lævis*, Walker and Jacob, 1784, Test. Min. p. 2, pl. 1. fig. 5.  
*S. lactea*, W. and J., *fide* Kanmacher, 1798, Adams's Essays, 2nd ed. p. 634, pl. 24. fig. 4.  
*Vermiculum lacteum*, Montagu, 1803, Test. Brit. p. 522.  
*Serpula lactea*, Maton and Rækett, 1807, Trans. Linn. Soc. vol. viii. p. 246; Pennant, 1812, Brit. Zool. vol. iv. p. 363; Turton, 1819, Conch. Dict. p. 156.  
*Vermiculum lacteum*, Fleming, 1822, Wern. Mem. vol. iv. p. 566, pl. 15. fig. 6.  
? *Polymorphina* (*Globulina*) *ovata*, D'Orbigny, 1826, Ann. Sc. Nat. vol. vii. p. 266; Soldani, Testaceographia, vol. ii. pl. 112. figs. *g, g'*.  
? *Arethusa lactea*, Fleming, 1828, Hist. Brit. Anim. p. 234.  
? *Globulina Caribæa*, D'Orbigny, 1836, Foram. Cuba, p. 130, pl. 2. figs. 7, 8.  
*Guttulina Plancii*, D'Orbigny, 1839, Voyage dans l'Amér. Mérid. p. 60, pl. 1. fig. 5.  
*Renoidea oblonga*, Brown, 1839, Conch. Illust. p. 3, pl. 56. figs. 16, 17.  
*Vermiculum lacteum*, Macgillivray, 1843, Moll. Aberd. p. 37.  
*Polymorphina lactea*, id. 1843, *ibid.* p. 320.  
*Arethusa lactea*, Thorpe, 1844, Brit. Mar. Conch. p. 233.  
*Globulina lachryma*, Reuss, 1845, Verstein. böhm. Kreid. pt. 1, pp. 40, 110, pl. 13. fig. 83; Alth, 1849, Haidinger's Abhandl. vol. iii. p. 263, pl. 13. fig. 16; Reuss, 1850, *ibid.* vol. iv. p. 43, pl. 5. fig. 9.  
*Polymorphina lactea*, Jones, 1854, in Morris's Cat. Br. Foss. 2nd edit. p. 40.  
*Pyrulina ovulum*, Ehrenberg, 1854, Mikrogeologie, pl. 31. figs. 35, 36.  
*Strophoconus ovum* (in part), id. *ibid.* pl. 20, § 2, fig. 3, and pl. 26. fig. 21.  
*S. spicula* (in part), id. *ibid.* pl. 26. fig. 20.  
*S. laxum*, id. *ibid.* pl. 25. fig. 15, and pl. 31. fig. 26.  
*Polymorphina Muensteri*, Reuss, 1855, Sitzungsab. Akad. Wissen. Wien, vol. xviii. p. 249, pl. 8. fig. 80.  
*P. ovulum*, id. *ibid.* p. 250, pl. 6. fig. 63.  
*P. Roemeri*, id. *ibid.* p. 245, pl. 6. fig. 64.  
*P. deformata*, id. *ibid.* p. 246, pl. 6. fig. 66.  
*P. turgida*, id. *ibid.* p. 246, pl. 6. fig. 67.  
*P. lactea (typica)*, in part, Williamson, 1858, Rec. For. Gt. Br. p. 71, pl. 6. fig. 147.  
*P. lactea*, var. *communis*, id. *ibid.* p. 72, pl. 6. figs. 153-155.  
*Guttulina diluta*, Bornemann, 1860, Zeitschr. deutsch. geol. Gesellsch. vol. xii. p. 160, pl. 6. fig. 11.  
*Polymorphina lactea*, Parker and Jones, 1859, Ann. N. H. Ser. 3, vol. iv. p. 336; 1860, Q. J. Geol. Soc. vol. xvi. p. 454, pl. 20. fig. 44; *ibid.* *ibid.* p. 302, table; *ibid.* 1862, in Carpenter's Introd. Appendix, p. 311; Brady, 1864 (in part), Trans. Linn. Soc. Lond. vol. xxiv. p. 473; Brady, 1865 (in part), Nat. Hist. Trans. Northumberland and Durham, vol. i. p. 99.  
*P. lactea (typica)*, Alcock, 1865, Proc. Lit. & Phil. Soc. Manchester, vol. iv. p. 206; Sars, 1865, Foss. Dyreleevn. fra Quartærperiod. pp. 55, 62, 65, 68, 85, 91; Jones, Parker, and Brady, 1866, Monogr. Crag For. pl. 1. fig. 48; Brady, 1868, Trans. Geol. Soc. Glasgow, vol. iii. p. 125, &c.; Sars, 1868, Vidensk.-Selsk. Forhandling for 1868, p. 248.



?*Rostrolina*, sp., Von Schlicht, 1869, *Foram. Septar.* Pietzpuhl, no. 416, pl. 25. figs. 17, 18.

*Guttulina*, sp., id. *ibid.* No. 491, pl. 32. fig. 21.

*Polymorphina lactea*, var. *amygdaloides*, Reuss.

(Compressed varieties, Wood-cuts *a, b, c, d.*)

*Polymorphina (Globulina) minuta*, Roemer, 1838, *Neues Jahrb. für Min.*, Jahrg. 1838, p. 386, pl. 3. fig. 35.

*P. (globulina) acuta*, id. *ibid.* p. 386, pl. 3. fig. 36.

*Globulina minuta*, Reuss, 1849, *Denkschrift. d. mathem.-natur. Cl. k. Akad. Wissensch.* vol. i. p. 377, pl. 48. fig. 8.

*G. inæqualis*, id. *ibid.* p. 377, pl. 48. fig. 9.

*G. guttula*, Reuss, 1851, *Zeitsch. deutsch. geol. Gesell.* vol. iii. p. 82, pl. 6. fig. 46.

*G. amygdaloides*, id. *ibid.* p. 82, pl. 6. fig. 47.

*G. guttula*, Bornemann, 1855, *ibid.* vol. vii. p. 344.

*G. amygdaloides*, id. *ibid.* p. 344.

*Polymorphina deplanata*, Reuss, 1855, *Sitzungsb. k. Akad. Wissensch. Wien*, vol. xviii. p. 246, pl. 6. fig. 67.

*P. amygdaloides*, id. *ibid.* p. 250, pl. fig. 84.

*P. subdilata*, Egger, 1857, *Neues Jahrb. für Min.*, Jahrg. 1857, p. 286, pl. 13. figs. 30–33.

*Guttulina elongata*, Karrer, 1861, *Sitzungsb. k. Akad. Wissensch.* vol. xlv. p. 24, pl. 2. fig. 3.

*Polymorphina (Guttulina) sororia*, Reuss, 1862, *Bulletin Acad. Roy. de Belgique*, 2<sup>me</sup> sér. vol. xv. p. 121, pl. 2. figs. 25–29.

*P. sororia*, Reuss, 1863, *Sitzungsb. k. Akad. Wissensch.* vol. xlv. p. 57, pl. 7. figs. 72–74; id. 1866, *Denkschr. d. mathem.-naturw. Cl. k. Akad. Wissensch.* vol. xxv. p. 152; id. 1867, *Sitzungsb. k. Akad. Wissensch.* vol. lv. p. 73.

*P. inæqualis*, id. *ibid.* p. 72.

*P. depauperata*, id. *ibid.* p. 73, pl. 3. fig. 9; Karrer, 1868, *ibid.* vol. lviii. p. 173.

*Globulina guttula*, Gümbel, 1868, *Abhandl. d. ii. Cl. k. Akad. Wissensch.* vol. x. p. 645.

?*G. subalpina*, id. *ibid.* p. 646, pl. 2. figs. 80, *a. b.*

*Characters.*—Shell (typical) ovate, gibbous, slightly unsymmetrical; anterior extremity acute; posterior obtuse, rounded. Chambers few, oblong, oblique, somewhat inflated. Sutures depressed. Surface smooth. Aperture simple, circular or oval, radiate. Length  $\frac{1}{50}$  to  $\frac{1}{20}$  inch.

The earliest figure of a specimen belonging to the genus *Polymorphina* happens to be a fair representation of the particular form that may be regarded as a type of the group. Walker's drawing, which we have reproduced on a somewhat larger scale than the original, Pl. XXXIX. fig. 1 *a*, though small and, in some respects, not very definite, has obviously been taken from a specimen very similar to that which has served as a basis for one of Prof. Williamson's figures, copied in fig. 1 *b*.

The shell of *P. lactea* has normally but four or five visible chambers, sufficiently ventricose to disturb the regularity of the general outline, the sutural lines being marked by depression or excavation. In its typical form the transverse section is nearly circular; but this is a character open to variation.

These peculiarities are matters of degree only; and a "species" founded on them represents an indefinite portion of a series of which the successive sections cannot be absolutely distinguished by the existence or non-existence of any single character. Such a



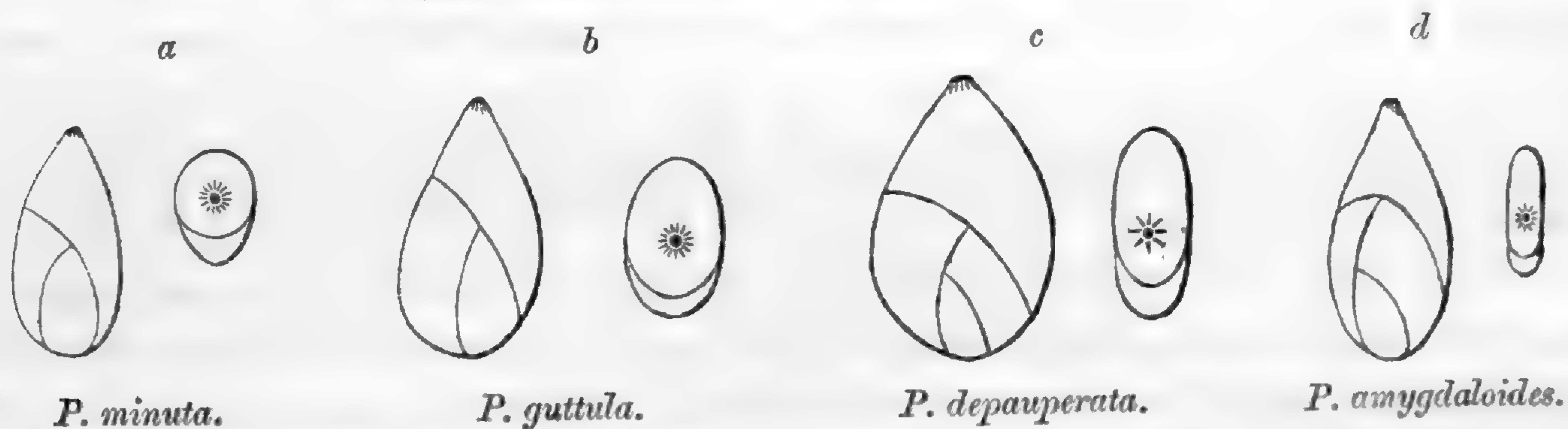
series may be said to commence with *P. gibba*, a subglobular shell, with three or four visible chambers, the sutures marked only by lines. By degrees these characters are modified in successive specimens, till in *P. lactea* the shell is rather longer proportionally, the external chambers number four or five, and the sutures are slightly excavated. Again, *P. communis*, with about the same number of chambers, has the sutures more deeply set, and the shell consequently somewhat irregular, but showing better evidence of its triserial arrangement. Lastly, in *P. problema* the number of chambers is increased to five, six, eight, or more, the convexity of each is heightened, and their order can sometimes scarcely be traced.

We have endeavoured to place the forms pertaining to this series, described by various writers, under one or other of these four subtypes, admitting the more or less compressed modifications of *P. lactea* and *P. gibba* to a sort of subvarietal distinction. Hence, under each, a considerable range of variation in minor and unimportant particulars is comprehended.

*Globulina Caribæa* of D'Orbigny has a slightly irregular shell, the lower portion of which is rugose: *P. Muensteri*, Reuss, is a porous or punctate variety; and *P. ovulum*, in the same memoir, is inequilateral; *P. Roemeri*, *P. deformata*, and *P. turgida* seem to represent heavier, less elegant forms, with the segments irregularly combined.

From the typical *Polymorphina lactea*, with its nearly circular transverse section, may be traced a series of modifications tending towards the complanate forms; and the references to the various authors who have alluded to these are placed together in the second division of the above synonymy. The subjoined outlines, taken from figures of four such subvarieties, about equidistant from each other in the chain of differentiation, will show how slight is the basis on which they have received distinctive names. Specimens intermediate again to these could, without difficulty, be found.

*Polymorphina lactea*, var. *amygdaloides*, Reuss.



*P. sororia* of Reuss is one of the most compact of the flattened varieties, elongate and almost pyruline in septation. *P. minuta* (a) scarcely differs from the type, except in its lateral compression. *P. guttula* (b) and *P. depauperata* (c) present the varietal peculiarity in increased degree. Lastly, in *P. amygdaloides* (d) we have a close approximation in contour to *P. oblonga* (Plate XXXIX. fig. 7); and it may even be a question whether this latter "species" might not with propriety have been brought into the same series.

*P. inæqualis* and *P. deplanata* are less regular and less symmetrical modifications of the type, the latter somewhat resembling *P. Burdigalensis*.

*Distribution*.—The range of *Polymorphina lactea* is very wide, whether regarded as a question of time or of geographical area. We have specimens from the Kimmeridge



Clay (Kimmeridge) and from the Upper Portland Limestone (Dorsetshire); and German observers figure the same form from the Cretaceous system of Bohemia. It is of frequent occurrence in the Lower and Middle Tertiaries of Northern and Central Germany and England, in the Subapennine Tertiaries (Pliocene) of Italy, in the Crag of our Eastern Counties and of Antwerp, and, lastly, in the Posttertiary (Glacial) clays of Scotland and Norway.

In the recent condition it is cosmopolitan, preferring shallow waters; indeed, except for the fact that it was one of the forms dredged by Prof. Sars in depths of 300 fathoms, it might have been set down as limited to an outside range of 80 or 90 fathoms. It is found on every portion of the shores of Great Britain, in the Arctic Sea, on the Norwegian coast, in the Mediterranean, in the West Indies, on the shores of Tasmania, and, indeed, in Foraminiferous sands from whatever latitude derived.

*POLYMORPHINA GIBBA*, D'Orbigny. (Plate XXXIX. figs. 2, *a-d*.)

(Typical form; subglobular, transverse section nearly circular, figs. 2, *a* and *b*.)

*Polymorphina (Globulina) gibba*, D'Orbigny, 1826, Ann. Sci. Nat. vol. vii. p. 266, no. 20; Modèle no. 63; Menke, 1830, Synopsis Molluscorum, p. 5; Roemer, 1838, Neues Jahrb. für Min., Jahrg. 1838, p. 386, pl. 3. fig. 32; Morris, 1843, Cat. Brit. Foss. p. 62.

*Globulina gibba*, Reuss, 1845, in Geinitz's Grundriss der Verstein. p. 669, pl. 24. fig. 84; D'Orbigny, 1846, For. Fos. Vienne, p. 227, pl. 13. figs. 13, 14.

*G. punctata*, D'Orbigny, *ibid.* p. 229, pl. 13. figs. 17, 18.

*G. gibba*, Reuss, 1851, Zeitschr. deutsch. geol. Gesell. vol. iii. p. 80.

*G. amplectens*, *id. ibid.* p. 81, pl. 6. fig. 45; Bornemann, 1855, *ibid.* vol. vii. p. 344.

*G. gibba*, Bornemann, *ibid.* p. 344.

*Polymorphina communis* (in part), Parker and Jones, 1857, Ann. & Mag. Nat. Hist. 2nd ser. vol. xix. p. 283, pl. 11. fig. 32.

*Polymorphina (Globulina) gibba*, Egger, 1857, Neues Jahrb. für Min., Jahrg. 1857:—var. *a*, *vera*, p. 288, pl. 13. figs. 1–4; var. *β*, *ovoidea*, p. 289, pl. 13. figs. 5–7; var. *γ*, *subgibba*, p. 289, pl. 13. figs. 8–10; var. *δ*, *pyrula*, p. 290, pl. 13. figs. 11, 12.

*Globulina amplectens*, Bornemann, 1860, Zeitschr. deutsch. geol. Gesellsch. vol. xii. p. 160, pl. 6. fig. 12.

*Polymorphina lactea*, Parker and Jones, 1864, Phil. Trans. vol. clv. p. 359, pl. 13. figs. 45, 46.

*P. gibba*, Jones, Parker, and Brady, 1866, Monogr. Crag Foram. pl. 1. figs. 49–51; Reuss, 1867, Sitz. Akad. Wissensch. vol. lv. p. 72. no. 1; Karrer, 1868, Sitzungs. Akad. Wissensch. vol. lviii. p. 172.

*P. gibba*, var. *orbicularis*, Karrer, *ibid.* p. 54, pl. 4. fig. 8.

*P. punctata*, *id. ibid.* p. 53.

*Globulina subgibba*, Gümbel, 1868, Abhandl. d. ii. Cl. k. Akad. Wissensch. vol. x. p. 645, pl. 2. fig. 79.

*Rostrolina*, sp., Von Schlicht, 1869, Foram. Septar. von Pietzpuhl, no. 415, pl. 26. figs. 25–27.

*Globulina*, sp., *id. ibid.* no. 425, pl. 26. figs. 31–34, no. 427, pl. 27. figs. 1–3, no. 428, pl. 27. figs. 4–6, no. 429, pl. 27. figs. 7–9, no. 431, pl. 27. figs. 10, 12.

*Polymorphina gibba*, var. *æqualis*, D'Orbigny.

(More or less compressed varieties, Plate XXXIX. figs. 2, *c* and *d*.)

*Polymorphina (Globulina) globosa*, von Münster, 1838 (*vide* Roemer), Neues Jahrb. für Min., Jahrg. 1838, p. 386, pl. 3. fig. 33.

*Globulina globosa*, Reuss, 1845, Verst. böhm. Kreid. 1<sup>te</sup> Abtheil. p. 40, pl. 3. fig. 82; Reuss, 1845, in Geinitz's Grundriss der Verstein. p. 669, pl. 24. fig. 85.



- Globulina æqualis*, D'Orbigny, 1846, For. Fos. Vien. p. 227, pl. 13. figs. 11, 12; Reuss, 1851, Zeitsch. deutsch. geol. Gesell. vol. iii. p. 81.  
*G. inflata*, Reuss, ibid. p. 81, pl. 6. fig. 45; Bornemann, 1855, ibid. vol. vii. p. 344.  
*G. æqualis*, Bornemann, ibid. p. 344.  
*G. globosa*, Reuss, 1861, Sitzungs. Akad. Wissensch. vol. xlv. p. 318, pl. 3. fig 3.  
*Polymorphina globosa*, Karrer, 1865, Sitzungs. Akad. Wissensch. vol. lii. p. 497, pl. 1. fig. 12.  
*P. æqualis*, Reuss, 1867, ibid. vol. lv. p. 72, no. 2; Karrer, 1868, ibid. vol. lviii. p. 172; Bunzel, 1869, Jahrb. k. k. geol. Reichsanstalt für 1859, p. 203.

*Characters*.—Shell (typical) subspherical or oval, somewhat produced at the apex, broad and rounded at the base. Chambers few, compact, and overlapping. Sutures marked by lines only, neither excavated nor depressed externally. Surface smooth. Long diameter about  $\frac{1}{50}$  inch.

*Polymorphina gibba* is, perhaps, as definite in its typical characters and as apt for technical description as any member of the group; still some latitude must be allowed in the terms employed for its diagnosis. D'Orbigny's "Modèle" represents a nearly globular shell, and may be taken as representing the normal form. Our first list of synonyms refers to specimens deviating in no striking particular from this standard.

Perhaps the commonest modification is to be found in the compressed varieties, of which the best-known and most generally recognized is the *Globulina æqualis* of the same author (Plate XXXIX. figs. 2, *c*, *d*); and the second portion of the above synonymy comprises (together with *Gl. æqualis*) a number of subvarieties differing from the type and from each other chiefly in the amount of lateral compression.

Dr. Karrer's *Polymorphina gibba*, var. *orbicularis*, on the other hand, instead of being compressed laterally, is shortened in the direction of its axis, and, whilst preserving a circular transverse section, is elliptical in its lateral aspect, the longer diameter being the horizontal one.

Specimens like Dr. Egger's subvarieties  $\beta$ ,  $\gamma$ , and  $\delta$  are often to be met with, and represent individuals in which the segments are unequally gibbous and not very regularly combined, rather than groups sufficiently stable in their characters for separation, even under varietal names, from the type.

*Globulina punctata*, D'Orb., we can regard only as representing a thin-walled condition in a shell of the common type. The extent to which the minute foramina in the chamber-walls are visible depends in great measure on the thickness and age of the shell. Old and opaque specimens seldom exhibit the perforations, which, notwithstanding, are still present, as may be seen under favourable circumstances, like the fractured edge shown at Plate XL. fig. 12 *f*. Just the same appearance may be observed in many other clear-shelled forms besides *P. gibba*.

The shape of the anterior portion of the shell differs a good deal in different individuals. In some it is acuminate, and the orifice is situate in a mamillate protuberance; in others it is truncate, and the general aperture is "flush" with the body of the shell. In rare examples the orifice is turned inwards, like that of an entosolenian *Lagena*.

Such trifling divergences from a normal type cannot be looked upon as safe ground



for the subdivision of an otherwise compact group. We are conscious that the principle we have adopted in endeavouring to simplify the nomenclature of the genus might be carried legitimately much further, and that the compromise arrived at has been in a measure influenced by motives of convenience; but the primary consideration of natural relationship has been steadily kept in view.

*Distribution.*—The range of *Polymorphina gibba*, geological and geographical, is very extended. It appears as a cretaceous fossil in Bohemia, and we have specimens from the Kimmeridge Clay of the South of England. It is found in the Septaria clays of Northern and Central Germany, in the Miocene of the Vienna Basin (Baden and Nussdorf beds) and Lower Bavaria, in Pliocene clays near Sienna (Coroncina), at Turin, and Palermo, in the Crag of our Eastern Counties, and in other Tertiary deposits.

It is equally common in the recent state. We have note of its occurrence off almost every portion of the shores of Europe, though never in very deep water.

POLYMORPHINA GUTTA, D'Orbigny. (Pl. XXXIX. figs. 3, *a*, *b*.)

*Polymorphium pyriformium*, Soldani, 1789, Testac. ac Zoophytograph. vol. ii. p. 117, pl. 122. fig. *gg*.

*Polymorphina (Pyrulina) gutta*, D'Orbigny, 1826, Ann. Sci. Nat. vol. vii. p. 267, no. 28, pl. 12. figs. 5, 6; Modèle no. 30.

? *P. (Globulina) clavata*, Roemer, 1838, Neues Jahrb. für Min., Jahrg. 1838, p. 386, pl. 3. fig. 38.

*Pyrulina obtusa*, Reuss, 1862, Sitzungsb. d. k. Akad. Wissensch. vol. xlvi. p. 79, pl. 9. fig. 9.

*Polymorphina gutta*, Jones, Parker, and Brady, 1866, Monogr. Crag Foram. pl. 1. figs. 46, 47.

*Rostrolina*, sp., Von Schlicht, 1869, Foram. Septar. Pietzpuhl, p. 72, nos. 408, 409, and 411, pl. 26. figs. 1–6, 10–12.

*Pyrulina*, sp., id. *ibid.* nos. 423, 424, pl. 25. figs. 55, 56, pl. 27. figs. 13–15.

*Characters.*—Shell ovate-elongate, symmetrical, pyriform; anterior portion tapering, acuminate; posterior obtuse, rounded; margin entire, septal lines not depressed. Chambers elongate, closely embracing, arranged triserially. Surface smooth. Length  $\frac{1}{50}$  inch.

As explained in the introduction (*vide ante*, p. 209), the earlier writers were accustomed to divide the *Polymorphinæ* into several genera or subgenera, and the present species was made the type of one of the groups, under the name of *Pyrulina gutta*. As this subdivision of the genus is being gradually abandoned, even by those who have been its upholders, it is unnecessary to make further allusion to it.

*P. gutta*, in good specimens, presents tolerably definite characters, its triserial arrangement, closely-embracing chambers, and circular transverse section being sufficient for ordinary diagnosis. Its long, tapering upper extremity and numerous chambers distinguish it from *P. gibba*, and the rounded base and compact spiral build from its nearly *P. acuminata*.

*Pyrulina obtusa*, Reuss, is more regularly elliptical than the generally accepted type, but may fairly be associated with it. The number of individuals that agree in every point with D'Orbigny's model is very limited, and we are obliged, as in every other group, to make some allowance for variation amongst the specimens associated under one specific name.



*Distribution.*—Although *Polymorphina gutta* has been noticed in the Hils Clay of Germany, a deposit of Neocomian age, it is best known as a Tertiary fossil. It is found in the various Tertiary clays of North Italy and Germany, in the Barton Beds (Isle of Wight), and is not uncommon in the Crag of Suffolk. We have no note of its occurrence except as a fossil.

POLYMORPHINA ACUMINATA, D'Orbigny, sp. (Plate XXXIX. figs. 4, *a*, *b*.)

*Pyrulina acuminata*, D'Orbigny, 1840, Mém. Soc. Géol. Fr. vol. iv. p. 43, pl. 4. figs. 18, 19; Reuss, 1845, in Geinitz's Grundriss der Verstein. p. 670, pl. 24, fig. 64; Jones, 1854, in Morris's Cat. Br. Fossils, 2nd ed. p. 40.

*Strophoconus stiliger*, Ehrenberg, 1854, Mikrogeologie, pl. 26. fig. 22.

*S. acanthopus*, id. ibid. pl. 26. fig. 23.

*Atractolina*, sp., Von Schlicht, 1869, Foram. Septar. Pietzpuhl, p. 70, no. 397, pl. 25. figs. 9, 10.

*Pyrulina*, sp., id. ibid. no. 422, pl. 25. fig. 53.

*Characters.*—Shell ovate-elongate, symmetrical, triserial; both anterior and posterior extremities acuminate; margin entire, septal lines not depressed, often indistinct. Earlier chambers small, and forming a short inverted cone; the two or three last-formed segments large, embracing, and erect. Surface smooth. Length  $\frac{1}{60}$  inch.

The claims of this pretty little form to specific distinction are of similar value to those of *P. gutta*. Both have compact triserial shells, with no constriction along the septal lines; both are circular in transverse section; and in both the upper portion of the shell tapers gently to a point: but whilst *P. gutta* has an obtuse, rounded base, the earlier chambers of *P. acuminata* are arranged in a short spire, resembling an inverted cone, the point of which forms the lower extremity of the shell.

In some of its characters *P. acuminata* bears a resemblance to *P. fusiformis*; but the latter has fewer chambers, they are more even in size and scarcely overlap; it is also a much larger shell, and not so compactly built.

We have already stated our views on Herr von Schlicht's genus *Atractolina*, two of the figures of which seem to pertain to the present species. His *Pyrulina*, numbered 422, is not quite pointed, but may, from its general accordance with the characters above laid down, be looked upon as belonging to *P. acuminata*.

*Distribution.*—D'Orbigny's specimens were obtained from the Chalk of Meudon, in France; and a few examples have been found in the Chalk-marl of Kent (Charing). The Tertiary clays of Northern Germany have also afforded specimens; still, although it is probable that *P. acuminata* might be found wherever *P. gutta* occurs, it is, so far as our present knowledge goes, a rare species, and, like its close ally, unknown in a recent condition.

POLYMORPHINA FUSIFORMIS, Roemer. (Plate XXXIX. figs. 5, *a*, *b*, *c*; and Woodcut *e*.)

*Polymorphina (Globulina) fusiformis*, Roemer, 1838, Neues Jahrb. für Min., Jahrg. 1838, p. 386, pl. 3. fig. 37.

*P. liassica*, Strickland, 1845, Quart. Journ. Geol. Soc. vol. ii. p. 30, fig. *b*.

*Globulina Leopolitana*, Reuss, 1850, Haidinger's Abhandl. vol. iv. p. 44, pl. 5. fig. 11.



- Polymorphina lanceolata*, Reuss, 1851, Zeitschr. deutsch. geol. Gesel. vol. iii. p. 83, pl. 6. fig. 50.  
*Grammostomum turio*, Ehrenberg, 1854, Mikrogeologie, pl. 26. fig. 19.  
*Globulina minima*, Bornemann, 1855, Zeitschr. deutsch. geol. Gesel. vol. vii. p. 344, pl. 17. fig. 3.  
*Guttulina ovalis*, id. ibid. p. 345, pl. 17. fig. 7.  
*G. vitrea*, id. ibid. p. 346, pl. 17. fig. 8.  
*G. cylindrica*, id. ibid. p. 347, pl. 18. figs. 4-6.  
*Polymorphina lanceolata*, id. ibid. p. 347.  
*Globulina acuta*, Reuss, 1855, Sitzungsab. k. Akad. Wissensch. vol. xviii. p. 51, pl. 6. fig. 62.  
*Polymorphina (Globulina) angusta*, Egger, 1857, Neues Jahrb. für Min. 1857, p. 290, pl. 13. figs. 13-15.  
? *Polymorphina praelonga*, id. ibid. p. 287, pl. 13. figs. 25-27.  
*Globulina porrecta*, Reuss, 1859, Sitzungsab. k. Akad. Wissensch. vol. xl. p. 86, pl. 12. fig. 4.  
*Polymorphina subteres*, Reuss, 1861, ibid. vol. xlii. p. 361, pl. 2. fig. 14; id. 1861, Bulletins de l'Acad. Roy. Belg. 2nd ser. vol. xv. p. 122, no. 41.  
*P. proteiformis* (in part), id. ibid. p. 121, pl. 2. figs. 30-36; pl. 3. figs. 37-40.  
*Guttulina jurassica*, Gümbel, 1861, Württemb. naturwiss. Jahreshefte, Jahrg. xviii. p. 228, pl. 4. figs. 15, a, b.  
*Polymorphina rudis*, Reuss, 1861, Sitzungsab. k. Akad. Wissensch. vol. xlv. p. 319, pl. 3. figs. 5-8.  
*Globulina prisca*, Reuss, 1862, ibid. vol. xlvi. p. 79, pl. 9. fig. 8.  
*Polymorphina (Guttulina) lanceolata*, Reuss, 1863, ibid. vol. xlviii. p. 58, pl. 7. figs. 75-84.  
*P. cylindrica*, id. ibid. p. 58.  
*Globulina nuda*, Schwager, 1864, in Dittmar's "Contorta-Zone," p. 201, pl. 3. fig. 14.  
*Polymorphina bilocularis* (in part), Terquem, 1864, 4<sup>me</sup> Mém. For. Lias, p. 293, pl. 11. figs. 10, 11, 12, &c.  
*P. ovula* (in part), id. ibid. p. 294, pl. 11. fig. 33, &c.  
*P. Breoni* (in part) id. ibid. p. 295, pl. 12. fig. 4, &c.  
*P. triloba* (in part), id. ibid. p. 300, pl. 13. fig. 19, &c.  
? *P. avena* (in part), id. ibid. p. 304, pl. 13. fig. 45, &c.  
? *P. metensis* (in part), id. ibid. p. 301, pl. 13. fig. 38, &c.  
*P. lactea*, Brady, 1867, Proc. Somersetshire Archæol. Soc. vol. viii. p. 114, pl. 3. fig. 49.  
*Guttulina*, sp., Von Schlicht, 1869, For. Septar. Pietzpuhl. no. 485, pl. 32. figs. 13-16, no. 487, pl. 32. figs. 5-8.

*Characters*.—Shell elongate, subcylindrical, tapering at both extremities. Chambers few (often only three), oblique, somewhat convex. Septal lines but little depressed. Surface smooth. Length  $\frac{1}{30}$  to  $\frac{1}{15}$  inch.

Roemer's name appears to be the earliest for the feeble, few-chambered, fusiform members of the genus, forming a long series downwards (if we may be allowed the expression) from *P. lactea (typica)*. The shell originally figured as *Globulina fusiformis* differs from *Polymorphina lactea* only in being slightly narrower and having its base somewhat drawn out to a point; and from this form we are led by imperceptible gradations to specimens with the elongate fusiform contour of *Globulina porrecta*, Reuss, or, it may be, to some of even slenderer proportions.

Roemer's figure, as nearly as can be made out, coincides in general features with *P. liassica*, Strickland (Woodcut e), *Globulina minima*, *Guttulina ovalis*, and *G. vitrea*, Bornemann, *Gl. prisca*, Reuss, and *Gl. nuda*, Schwager,—an interesting series, as it comprehends some of the earliest examples of the genus, geologically speaking.



*Polymorphina liassica*,  
Strickland.



In his figures of *Gutt. lanceolata* Prof. Reuss gives a series of forms extending not only from the longer to the shorter extremes above described, but embracing a number of irregular specimens which connect the series with such varieties as *Gl. Leopolitana* and *P. rudis*.

*Polymorphina lanceolata* and *P. subteres* have tests more compactly built, and tend towards Bornemann's *Gutt. cylindrica* (vide Plate XXXIX. fig. 5, *b*). Two of Dr. Egger's "species," *Globulina angusta* and *Polymorphina prælonga*, seem to be transition-forms between the present group and *P. compressa*: both of them are proportionally very long; but they are rounded at the ends, and otherwise depart somewhat from the characters set down to *P. fusiformis*. Dr. Gümbel's *Guttulina jurassica* is possibly an immature shell: the figure given is small and too indefinite for positive diagnosis; but we should for many reasons be inclined to place it in company with the kindred early forms of Strickland and Schwager, above named. M. Terquem's figures and our references to them must be taken for what they are worth.

Plate XXXIX. fig. 5, *a*, represents the elongate few-chambered form of *P. fusiformis*, copied from Prof. Reuss's figure of *Gl. porrecta*; figs. 5, *b* and *c*, show the more compact and regular variety copied from the best of Dr. Bornemann's many figures of *Guttulina cylindrica*; the woodcut *e* represents the stouter section of the group, and is reproduced from the late Mr. Strickland's drawing of *P. liassica*.

In one of his recent papers, Dr. Reuss has placed *Gutt. cylindrica* as a synonym of *G. rotundata*; and there is much to be said for such an arrangement; but a review of the entire series of figures given by Dr. Bornemann leads to the conviction that they find their closest allies amongst the feebler specimens constituting the present group, and the figures show much the same sort of range of variation in general form as that just alluded to.

*Distribution*.—The references already made indicate what is known of the geological distribution of *Polymorphina fusiformis*. It is found in the Lower Lias of England, France, and Germany; in the Chalk; in the Hils Clay of Hanover; in the Septaria-clay of Hermsdorf, Offenbach, Pietzpuhl, &c., and in various other Tertiary beds of Germany. It has also been recognized among the Tertiary Foraminifera of New Zealand. It does not appear to exist as a living species; at any rate we find no figures of recent specimens that conform precisely to the characters laid down.

POLYMORPHINA CYLINDROIDES, Roemer. (Plate XXXIX. figs. 6, *a*, *b*, *c*.)

*Polymorphina cylindroides*, Roemer 1838, Neues Jahrb. für Min., Jahrg. 1838, p. 385, pl. 3. fig. 26;

Philippi, 1844, Beiträge zur Kenntniss d. Tertiärverst. d. nord-west. Deutsch. p. 41.

*Proroporus cylindroides*, Reuss, 1845, in Geinitz's Grundriss d. Verstein. p. 678, pl. 24. fig. 80.

*Polymorphina cylindroides*, Karsten, 1849, Verzeichn. d. Rostock. Verst. a. d. Sternberger Gestein, p. 8;

Reuss, 1855, Sitzungsb. k. Akad. Wissensch. vol. xviii. p. 249, pl. 8. fig. 78.

*Polymorphina lactea*, var. *acuminata*, Williamson, 1858, Rec. For. Gt. Br. p. 71, pl. 6. fig. 148.

*P. compressa* (in part), Parker & Jones, 1864, Phil. Trans. vol. clv. p. 361, pl. 13. figs. 48 *a*, *b*.

*Guttulina*, sp., Von Schlicht, 1869, Foram. Septar. Pietzpuhl, no. 471, pl. 31. figs. 5, 6.

*Characters*.—Shell elongate, fusiform, more or less compressed. Anterior extremity



acuminate, posterior acuminate or slightly rounded. Chambers elongate, arranged in two parallel series. Margins entire, scarcely depressed at the sutures. Aperture large, radiate. Surface smooth. Length  $\frac{1}{30}$  to  $\frac{1}{15}$  inch.

As we have elsewhere observed, the figures given with Herr Roemer's paper on the North-German Tertiary Sands are often obscure, owing to their small size and poor execution. We have endeavoured (Plate XXXIX. figs. 6, *a*, *b*) to reproduce his drawing of *P. cylindroides* on a larger scale, as it seems to represent a useful subtype and is referred to constantly by German authors. Professor Williamson's *P. lactea*, var. *acuminata* (Plate XXXIX. fig. 6, *c*) manifestly belongs to the same species. Reference to the two figures, placed side by side, will show that in all main features they are identical, the acuminate lower extremity of the latter being the only appreciable difference. Prof. Reuss, in his paper on the Tertiary Foraminifera of Northern and Central Germany, figures the shell with *both* ends somewhat rounded and a nearly circular transverse section, but other authorities agree in the more or less compressed contour indicated in Plate XXXIX. fig. 6, *b*. Dr. Gümbel describes, under the name of *Guttulina strumosa*, a shell somewhat akin to this species from the Streitberger sponge-bed (Jahreshefte des Vereins für vaterländische Naturkunde in Württemberg, p. 227, pl. iv. figs. 13 *a*–14 *b*), but too ill-defined for absolute diagnosis. Its age (Jurassic) would, in the absence of distinctive characters, suggest relationship with the poorly grown Liassic forms, of which *P. fusiformis* is the best example.

*Distribution*.—Fossil, in the North-German Tertiary sands and Septaria-clay. Recent, in Mr. Barlee's dredgings from Skye and some other more northern localities.

POLYMORPHINA OBLONGA, Williamson. (Plate XXXIX. figs. 7, *a*, *b*.)

*Polymorphina lactea*, var. *oblonga*, Williamson, 1858, Rec. For. Gr. Br. p. 71, pl. 6. figs. 149, 149 *a* ; Alcock, 1865, Proc. Lit. & Phil. Soc. Manchester, vol. iv. p. 206.

*Characters*.—Shell oblong, ovate, symmetrical, tapering but little, rounded at both extremities, compressed; consisting of numerous, erect, narrow, oblong segments extending nearly to the upper extremity of the shell, and scarcely overlapping at all laterally, so that the earlier segments are left partly uncovered. Septal plane narrow, oblong, convex. Septal lines scarcely depressed, but distinct. Orifice surrounded by a conspicuous corona of radiating grooves. Surface smooth. Length  $\frac{1}{35}$  inch.

The present species must not be confounded with the *Polymorphina oblonga* of D'Orbigny ('Vienna Basin,' pl. xii. figs. 29–31), which is an elongate many-chambered Uvigerine form, closely related to, if not identical with, *P. Soldanii*. Again, the *Polymorphina* (*Globulina*) *oblonga* of Roemer (Neues Jahrbuch, 1838, pl. iii. fig. 34) belongs rather to the well-known *P. communis*. Neither of these varieties has been recognized as a leading form by subsequent rhizopodists; hence there will be no inconvenience in retaining Prof. Williamson's name for the well-marked variety to which it was applied by him.

We have little to add to the description above given, which is quoted, in the main, from Professor Williamson's notes. It represents one of the most symmetrical varieties of the genus; and its long erect chambers, strongly marked terminal orifice, and generally very translucent shell are sufficiently distinctive characters for its recognition.



*Distribution.*—The geographical range of *P. oblonga* seems to be limited; it is most abundant on the Devonshire and Cornwall coast, and may be found sparingly distributed at intervals all round the British Islands. We are not aware of its occurrence in the seas of warmer latitudes or in a fossil condition.

POLYMORPHINA ANCEPS, Philippi. (Plate XXXIX. figs. 8, *a-c.*)

*Polymorphina anceps*, Philippi, 1844, Beiträge zur Kenntniss d. Tertiärverstein. d. nordwest. Deutsch. pp. 41, 70, pl. 1. fig. 34.

*P. compressa*, id. ibid. p. 69, pl. 1. fig. 35.

*Guttulina dilatata*, Reuss, 1849, Denkschr. mathem.-natur. Cl. k. Akad. Wissensch. vol. i. p. 378, pl. 48. fig. 11.

*Polymorphina dilatata*, Reuss, 1851, Zeitschr. deutsch. geol. Gesell. vol. iii. p. 83, pl. 6. figs. 49, *a, b.*

? *Strophoconus Hemprichii*, Ehrenberg, 1854, Mikrogeologie, pl. 24. fig. 32.

*Polymorphina dilatata*, Bornemann, 1855, Zeitschr. deutsch. geol. Gesell. vol. vii. p. 347.

*P. anceps*, Reuss, 1855, Sitzungs. k. Akad. Wissensch. vol. xviii. p. 246, pl. 6. fig. 68, pl. 7. fig. 69; id. 1864, ibid. vol. l. p. 38, pl. 4. figs. 2, 3; id. 1866, Denkschr. math.-natur. Cl. Akad. Wiss. vol. xxv. p. 155, pl. 4. figs. 9–11.

*P. pernaeformis*, Stache, 1865, Novara-Reise, vol. i. 2<sup>te</sup> Abtheil. Paläont. von Neu-Seeland, p. 256, pl. 24. fig. 2.

? *P. cognata*, id. ibid. p. 257, pl. 24. fig. 3.

? *P. contorta*, id. ibid. p. 257, pl. 24. fig. 4.

*Characters.*—Shell oblong, ovate, compressed, symmetrical, broad and rounded at the base, tapering towards the apex; periphery usually sharp-edged, sometimes slightly rounded. Chambers long, oblique, regular, springing from the base of the shell or near it. Septa marked externally by lines, or by slight depressions over the sutures. Surface smooth. Length  $\frac{1}{10}$  inch.

The large biconvex or sometimes complanate *Polymorphinae*, with broad, rounded base and oblique or nearly erect segments, constitute an assemblage which arrange themselves conveniently around the *P. anceps* of Philippi. As even the limited number of subdivisions which we have recognized for the purposes of nomenclature have no claim to be regarded in the light of true species, in the older acceptation of the word, the fact that such a series inosculates with kindred groups is of little consequence. It has therefore been thought preferable to retain both *P. anceps* and *P. regularis* as types of subdivisions, although they have recently been stated by Prof. Reuss to represent only extreme examples of the same species.

*Polymorphina dilatata*, Reuss, represents an outspread variety with inflated chambers, rather than the regular biconvex form; and Ehrenberg's *Strophoconus Hemprichii* shows similar divergence from the type. Dr. Stache's three species (*P. pernaeformis*, *P. cognata*, and *P. contorta*) are intermediates that tend to establish the connexion alluded to between *P. anceps* and *P. regularis*.

*Distribution.*—This is an essentially Tertiary Foraminifer; and, except Dr. Stache's somewhat doubtful forms, which were derived from the New-Zealand beds, notices of its occurrence are almost entirely confined to the Tertiaries of Germany.



POLYMORPHINA BURDIGALENSIS, D'Orbigny. (Plate XXXIX. figs. 9, *a*, *b*.)

*Polymorphina Burdigalensis*, D'Orbigny, 1826, Ann. Sci. Nat. vol. vii. p. 265, no. 2; Modèle no. 29.

*Characters*.—Shell oblong, unsymmetrical; flattened, or even slightly concave on one side, irregularly convex on the other; anterior extremity acute, posterior rounded. Septal lines slightly excavated. Aperture excentric, situate near the flattened side of the terminal segment. Surface smooth.

The mere name of a species in a synopsis, with reference to a plaster model, is far from being a satisfactory basis on which to lay down its normal peculiarities; yet this is all we have as authority for *Polymorphina Burdigalensis*. D'Orbigny's "Modèle," which we assume to be a fair representation (Ann. N. H. 1865, ser. 3, vol. xvi. p. 181, pl. 2. fig. 48), exhibits a compact shell, somewhat resembling *P. Humboldtii* in its septation, flattened on one side and having rounded edges. The chambers are numerous and obscurely tri-serial in their arrangement, and the septa are marked by lines rather than depressions.

We may just remark that the *Guttulina semiplana* of Reuss (Zeitschr. deutsch. geol. Gesell. vol. iii. p. 82, pl. vi. figs. 48, *a-c*) resembles *P. Burdigalensis* in the contour of its transverse section; but as its general characters are much more those of *P. communis*, we have preferred to associate it with the latter.

*Distribution*.—The only habitat appended to the species in the 'Tableau Méthodique' is, "Fossil, near Bordeaux," from which we suppose it to be a Middle-Tertiary form.

POLYMORPHINA COMMUNIS, D'Orbigny. (Plate XXXIX. figs. 10, *a*, *b*.)

*Polymorphina (Guttulina) communis*, D'Orbigny, 1826, Ann. Sc. Nat. vol. vii. p. 226, no. 15, pl. 12. figs. 1-4; Modèle no. 62.

? *Guttulina vitrea*, D'Orbigny, 1836, Foram. Cuba, p. 128, pl. 2. figs. 1-3.

*Polymorphina (Guttulina) communis*, Roemer, 1838, Neues Jahrb. für Min., Jahrg. 1838, p. 385, pl. 3. fig. 29.

*P. (Globulina) oblonga*, id. ibid. p. 386, pl. 3. fig. 34.

? *P. glomerata*, Roemer, 1841, Verstein. nordeutsch. Kreid. pt. 2, p. 19, pl. 15. fig. 19.

*P. communis*, Morris, 1843, Cat. Br. Foss. 1st ed. p. 62.

? *P. glomerata*, Reuss, 1845, Verstein. böhm. Kreid. pt. 1, p. 40, pl. 12. fig. 32; Reuss, 1845, in Geinitz's Grundriss der Verstein. p. 668, pl. 25. fig. 19.

*Guttulina communis*, Reuss, ibid. p. 669, pl. 24. fig. 82; D'Orbigny, 1846, For. Foss. Vien., p. 224, pl. 13. figs. 6-8.

*G. irregularis*, D'Orb. ibid. p. 226, pl. 10. figs. 9, 10.

*Globulina discreta*, Reuss, 1849, Denkschr. mathem.-natur. Cl. k. Akad. Wissensch. vol. i. p. 378, pl. 48. fig. 10.

*Guttulina cretacea*, Alth, 1849, Haidinger's Abhandl. vol. iii. p. 262, pl. 13. fig. 14; Reuss, 1850, ib. vol. iv. p. 44, pl. 5. fig. 10.

*G. semiplana*, Reuss, 1851, Zeitschr. deutsch. geol. Gesell. vol. iii. p. 82, pl. 6. fig. 48.

*Polymorphina communis*, Jones, 1854, in Morris's Cat. Br. Foss. 2nd ed. p. 40.

*Sphaeroidina Parisiensis*, Ehrenberg, 1854, pl. 27. figs. 23, 24.

*Guttulina robusta*, Reuss, 1855, Sitzungsber. k. Akad. Wissensch. vol. xviii. p. 246, pl. 6. fig. 65.

*G. semiplana*, Bornemann, 1855, Zeitschr. deutsch. geol. Gesellsch. vol. vii. p. 344.

*Polymorphina (Guttulina) communis*, Egger, 1857, Neues Jahrb. für Min., Jahrg. 1857, p. 288, pl. 13. figs. 16-18.



*Polymorphina (Guttulina) lata*, Egger, *ibid.* p. 288, pl. 13. figs. 22–24.

*P. communis*, Morris & Quekett, 1860, *Cat. Hunt. Mus. Coll. Surg. Eng.* p. 88, A 5.

? *Globulina bulloides*, Reuss, 1861, *Sitzungsb. k. Akad. Wissensch.* vol. xlv. p. 318, pl. 3. fig. 4.

*Guttulina communis*, Karrer, 1863, *Sitzungsb. k. Akad. Wissensch.* vol. xlviii. (Table).

*G. fissurata*, Stache, 1865, *Novara-Reise*, vol. i. 2<sup>te</sup> Abtheil. Paläont. Neu-Seeland, p. 263, pl. 24. fig. 10.

*G. obliquata*, *id. ibid.* p. 264, pl. 24. fig. 11.

*Polymorphina problema*, var. *deltoidea*, Reuss, 1866, *Denkschr. d. mathem.-natur. Classe d. k. Akad. Wissen.* vol. xxv. p. 154, pl. 4. fig. 8.

*P. communis*, Brady, 1868, in Crosskey and Robertson, *Trans. Geol. Soc. Glasgow*, vol. iii. p. 118.

*P. irregularis*, Karrer, 1868, *Sitzungsb. k. Akad. Wissensch.* vol. lviii. p. 172.

*Guttulina*, sp., Von Schlicht, 1869, *Foram. Septar. Pietzpuhl*, no. 435, pl. 27. figs. 22–25.

*Polymorphina*, sp., *id. ibid.* no. 493, pl. 32. figs. 17–20.

*Characters*.—Shell ovate, gibbous, more or less compressed at three sides; anterior extremity acute; posterior obtuse and rounded. Chambers few, oblique, inflated. Sutures depressed. Surface smooth. Aperture circular, coronate. Length  $\frac{1}{30}$  to  $\frac{1}{15}$  inch.

In the section referring to *Polymorphina lactea* (page 215) the relations of *P. communis* with that species on the one hand and *P. problema* on the other are described; and but little need be added to what is there stated. A glance at the figures of the three forms (Plate XXXIX. figs. 1, 10, & 11) will explain better than words whatever may have been left obscure. Prof. Reuss, in his memoir on the Fossil Fauna of Wieliczka, has placed *P. communis* and *P. Austriaca* in the same group as *P. problema*,—a course to which we only object on the ground of convenience, as may be gathered from our previous remarks.

Some difficulty has been experienced in determining the place of *P. glomerata* of Roemer and Reuss. The figures given by both authors are too small to be of much service; but they appear to represent a short, wide, few-chambered variety, such as would find its nearest allies amongst specimens of *P. communis*; and possibly *Gl. bulloides* may also be included in the group for similar reasons. D'Orbigny's *Gutt. irregularis* is a thinner, outspread form, partaking of the same characters; and Egger's *Gutt. lata* is almost circular in its lateral aspect, notwithstanding a somewhat irregular septation. *Gutt. semiplana* has a plano-convex transverse section, and may be a transition variety between the present species and *P. Burdigalensis*. The remaining references in our list answer to the characters of the subtype as laid down above.

*Distribution*.—In distribution *P. communis* has much the same range as *P. lactea*. It appears in the Chalk of Northern Germany and Bohemia and in the Lower Tertiaries of Central Europe, in the Miocene of the Vienna Basin and Lower Bavaria, and in the Crag of Suffolk. The New-Zealand Tertiary formations also yield specimens referable to this species. It occurs too in the Glacial (Posttertiary) clays of Scotland and Norway.

Recent specimens are found in sea-sands from the littoral, laminarian, coralline, and coral zones in every latitude.

POLYMORPHINA PROBLEMA, D'Orbigny. (Plate XXXIX. figs. 11. *a*, *b*.)

*Polymorphina (Guttulina) problema*, d'Orbigny, 1826, *Ann. Sc. Nat.* vol. vii. p. 266, No. 14; *Modèle* no. 61.



- Polymorphina (Guttulina) crassatina*, Von Münster, 1838 (*Fide* Roemer), Neues Jahrb. für Min., Jahrg. 1838, p. 385, pl. 3. fig. 30.
- P. (G.) spicaformis*, Roemer, 1838, *ibid.* p. 386, pl. 3. fig. 31.
- Guttulina problema*, Reuss, 1845. In Geinitz's Grundriss der Verstein. p. 669, pl. 24. fig. 83.
- G. austriaca*, D'Orbigny, 1846, For. Foss. Vien. p. 223, pl. 12. figs. 23-25.
- G. problema*, *id. ibid.* p. 224, pl. 12. figs. 26-28.
- Polymorphina uvula*, Ehrenberg, 1854, Mikrogeologie, pl. 26. fig. 28.
- Strophoconus polymorphus* (in part), *id. ibid.* pl. 27. figs. 23-28.
- S. auricula*, *id. ibid.* pl. 20. § 2. fig. 2.
- S. africanus*, *id. ibid.* pl. 21. fig. 88.
- Polymorphina problema*, Egger, 1857, Neues Jahrb. für Min., Jahrg. 1857, p. 287, pl. 10. figs. 23-25.
- P. uvula*, *id. ibid.* p. 293, pl. 10. figs. 26-29.
- Guttulina rotundata*, Reuss, 1864, Sitzungsb. Akad. Wissensch. vol. 1. p. 469, pl. 3. fig. 4.
- G. problema*, *id. ibid.* p. 470, pl. 5. fig. 4.
- G. pusilla*, Stache, 1865, Novara-Reise, vol. i. 2<sup>te</sup> Abtheil., Paläont. von Neu-Seeland, p. 265, pl. 24. fig. 12.
- Polymorphina problema*, Parker, Jones, & Brady, 1865, Ann. Nat. Hist. Ser. 3, vol. xvi. p. 187, pl. 2. fig. 50; *id.* 1866, Monogr. Crag Foram. pl. 1. fig. 64; Reuss, 1867, Sitzungsb. Akad. Wissensch. vol. lv. p. 73; Karrer, 1868, Sitzungsb. Akad. Wissensch. vol. lviii. p. 172.

*Characters*.—Shell oblong, ovate, irregular. Chambers numerous, much inflated, and separated by deep sutures; sometimes arranged triserially, but more frequently crowded together irregularly; orifice round, radiate; surface smooth. Length  $\frac{1}{75}$  to  $\frac{1}{10}$  inch.

D'Orbigny's Model, represented in fig. 11, *a*, is a convenient subtype embracing a large group of *Polymorphinæ* having in common a somewhat acervuline mode of growth and but little adhesion or overlap amongst the segments. His later figures of the same species are by no means so characteristic, and are scarcely separable from *P. communis*. This circumstance has led Prof. Reuss in a recent memoir to place together *P. problema*, *P. communis*, and *P. Austriaca*—a conclusion in which we should entirely agree were the figures in the "Vienna Basin" monograph our only guide. That the typical *P. lactea* inosculates with *P. communis*, and this again with *P. problema*, does not admit of doubt; but they none the less represent types round which a large number and variety of individuals may be conveniently arranged; and this is all that can be said for any single "species" of the genus. We have therefore preferred to accept the Modèles no. 61 and no. 62 as a basis of subdivision; and our synonymy has been arranged accordingly.

The specimen described by Egger under the name *P. uvula* may be regarded as an irregularly grown example of this species; and Prof. Reuss's *Guttulina rotundata*, figured in his memoir "Zur Fauna des deutschen Oberoligocäns," appears to be more nearly related to *P. problema* than to Bornemann's form.

*Guttulina Austriaca* is somewhat longer proportionally than the type; and in *Polymorphina oblonga*, D'Orb., and *P. uvæformis*, Reuss, we have varieties apparently intermediate to *P. problema* and *P. Soldanii* (more nearly approaching the latter)—that is to say, somewhat Uvigerine in their general contour.

*Distribution*.—It is as a Tertiary fossil that *Polymorphina problema* is best known; indeed our notes of its occurrence in a living condition are not sufficient to enable us to



lay down its geographical range. In the earlier Tertiaries of North Germany, in the Miocene of the Vienna Basin, of Lower Bavaria, and of Kostej in the Banat, in the Pliocene clays of Northern Italy, and the Crag formation of the east of England it is constantly found; and the presence of a similar, if not identical, variety in the Tertiaries of New Zealand is recorded by Herr Stache.

POLYMORPHINA COMPRESSA, D'Orbigny. (Plate XL. figs. 12, *a-f*.)

*Polymorphina tuberosa*, D'Orbigny, 1826, Ann. Sci. Nat. vol. vii. p. 265; *Polymorphium*, Soldani, Testaceographia, vol. ii. p. 99, pl. 107. fig. *kk*.

*Guttulina elliptica*, Reuss, 1845, Verst. norddeutsch. Kreid. 2<sup>te</sup> Abtheil. p. 110, pl. 24. fig. 55; Alth, 1850, Haidinger's Abhand. vol. iii. p. 75, pl. 13. fig. 15.

*Polymorphina compressa*, D'Orbigny, 1846, For. Foss. Vien. p. 243, pl. 12. figs. 32-34.

*P. acuta*, D'Orbigny, 1846, For. Foss. Vien. p. 244, pl. 14. figs. 5-7, and pl. 13. figs. 4, 5.

*P. ovata*, id. ibid. p. 233, pl. 13. figs. 1-3.

*P. acanthophora*, Ehrenberg, 1854, Mikrogeologie, pl. 31. fig. 30.

*P. obtusa*, id. ibid. pl. 31. fig. 31.

? *P. Gizensis*, id. ibid. pl. 23. fig. 26.

*P. prisca*, id. ibid. pl. 24. fig. 34.

*Grammostomum lingua*, id. ibid. pl. 27. fig. 15.

*G. myoglossum*, id. ibid. pl. 27. fig. 18.

*G. gracile*, id. ibid. pl. 27. fig. 25.

*G. polytrema*, id. ibid. pl. 28. figs. 15, 16.

*G. thebaicum*, id. ibid. pl. 23. fig. 19, & pl. 31. fig. 25.

? *G. attenuatum*, id. ibid. pl. 23. fig. 20.

*Strophoconus leptoderma*, id. ibid. pl. 24. figs. 28, 30.

*S. ovum*, id. ibid. (in part), pl. 22. fig. 81, pl. 24. fig. 29, & pl. 27. fig. 27.

*S. spicula*, id. ibid. (in part), pl. 24. fig. 31, pl. 27. fig. 24.

*S. gibbus*, id. ibid. pl. 20. § ii. fig. 4.

*S. teretiusculus*, id. ibid. pl. 23. fig. 24.

*S. efflorescens*, id. ibid. pl. 26. fig. 24.

*Bigenerina apiculata*, id. ibid. pl. 28. fig. 23.

*B. libnotica*, id. ibid. pl. 25. figs. 25, 26, pl. 26. fig. 25.

*Pleurites calciparus*, id. ibid. pl. 30. fig. 19.

*Pl. turgens*, id. ibid. pl. 31. fig. 37.

*Pl. obtusus*, id. ibid. pl. 32. fig. 24.

*Pl. americanus*, id. ibid. pl. 33. fig. 20.

*Polymorphina insignis*, Reuss, 1855, Sitzungs. b. k. Akad. Wissensch. vol. xviii. p. 248, pl. 7. figs. 74, 75.

*P. communis*, Parker & Jones (in part), 1857, Ann. & Mag. Nat. Hist. 2nd ser. vol. xix. p. 283, pl. 11. fig. 32.

*P. incerta*, Egger, 1857, Neues Jahrb. für Min., Jahrg. 1857, p. 286, pl. 13. figs. 19-21.

*P. media*, id. p. 287, pl. 13. figs. 28, 29.

*P. lactea*, Williamson (in part), 1858, Rec. For. Gt. Br. p. 70, pl. 6. fig. 145.

? *P. abavia*, Ehrenberg, 1858, Monatsb. d. Akad. Wissensch. June, 1858, p. 337, pl. 1. fig. 4.

? *P. avia*, id. ibid. pl. 1. fig. 5.

*Globulina discreta*, Reuss, 1864, Sitzungs. b. k. Akad. Wissensch. vol. 1. p. 468, pl. 3. fig. 3.

*Guttulina robusta*, id. ibid. p. 470, pl. 3. figs. 5-7.

*Polymorphina lactea*, var. *compressa*, Parker & Jones, 1862, in Carpenter's Introd., Appendix., p. 311; id. (in part), 1864, Phil. Trans. vol. clv. p. 361, pl. 13. figs. 47, 49, 57.



- ? *Polymorphina ovula*, Terquem (in part), 1864, 4<sup>m</sup>e Mém. Foram. Lias, p. 294, pl. 11. figs. 35 &c.  
*P. angustata*, id. ibid. p. 296, pl. 12. figs. 33, 34.  
*P. sinuata*, id. ibid. p. 298, pl. 12. fig. 48.  
*P. compressa*, Brady, 1864, Trans. Linn. Soc. Lond. vol. xxiv. p. 473; Brady, 1865, Nat. Hist. Trans. Northumberland & Durham, vol. i. p. 99.  
*P. sacculus*, Stache, 1865, Novara-Reise, vol. i. 2<sup>te</sup> Abtheil., Paläont. Neu-Seeland, p. 259, pl. 24. fig. 6.  
*P. incavata*, id. ibid. p. 260, pl. 24. fig. 7.  
*P. compressa*, Jones, Parker, and Brady, 1866, Monog. Crag Foram. pl. 1. figs. 54, 65, 77-80.  
*P. Zeuchneri*, Reuss, 1867, Sitzungsb. k. Akad. Wissensch. vol. lv. p. 74, pl. 4. fig. 1.  
*P. ovata*, id. ibid. p. 75.  
*P. compressa*, Brady, 1867, Proc. Somerset. Arch. Soc. vol. viii. p. 114, pl. 3. fig. 50; Sars, 1868, Vidensk.-Selsk. Forhandlinger for 1868, p. 248; Karrer, 1868, Sitzungsb. k. Akad. Wissensch. vol. lviii. p. 174.  
*P. acuta*, Karrer. ibid. p. 174.  
*P. compressa*, Brady, 1868, in Crosskey & Robertson's Memoir, Trans. Geol. Soc. Glasgow, vol. iii. p. 118.  
*Polymorphina*, sp., Von Schlicht, 1869, Foram. Septar. Pietzpuhl, nos. 495 & 496, pl. 32. figs. 29-32 & 35-38.

*Characters*.—Shell oblong, inequilateral, compressed, more or less fusiform. Chambers numerous, arranged in two unequal series, somewhat inflated. Septal lines depressed. Surface smooth. Aperture variable, usually simple, circular, and coronate, sometimes labyrinthic or porous. Length  $\frac{1}{20}$  to  $\frac{1}{10}$  inch.

The three figures of the exterior aspect of *Polymorphina compressa* (Plate XL. figs. 12, *a*, *b*, *c*), although they indicate a considerable range of variation, from the wide outspread examples like those found in the Crag to the tapering specimens separated by D'Orbigny under the name *P. acuta*, fall far within what may fairly be regarded as the limits of the present group; for, on the one hand, its modifications may be said to lose themselves amongst the less regular examples of *P. complanata*, whilst, on the other, they are scarcely separable from the feebler forms typified by *P. fusiformis* and *P. cylindroides*.

A somewhat indefinite biserial arrangement, in which the segments appear irregularly opposed to each other rather than in alternation, together with the rounded margins and constricted septa, are characters sufficient for general diagnosis. The difficulty in distinguishing attenuated specimens from those of *P. cylindroides* is confessedly great; but the less compressed contour of the latter, its few chambers, and their erect position will usually serve the purposes of the systematist.

So far as it is in our power to determine, from the information supplied by the respective authors, the representatives of all the reputed species comprised in the foregoing extended synonymy answer to the characters assigned to this subtype. We reserve our judgment in respect to those taken from the works of Prof. Ehrenberg and M. Terquem, for reasons already given.

*Distribution*.—In *Polymorphina compressa* we have one of the commonest and one of the most widely spread members of the genus. Setting aside the Silurian casts figured by Prof. Ehrenberg as somewhat doubtfully pertaining to this subtypical form, we may regard as the earliest specimens those of the Lower and Middle Lias of the north-east of France and of the Middle and Upper Lias of Somersetshire. It appears



again in the Lower Oolite of Somerset, in the Upper Oxford Clay (Oxford), in the Kimmeridge Clay (Kimmeridge), and in the Cretaceous system of North Germany. Since the Secondary period it has been even more generally distributed, being common in the Septaria-clays and Miocene deposits of Central Europe, and occurring in the Tertiary beds of New Zealand. It is present in the Lower Crag of Suffolk, in the Upper Crag of Norfolk, and in the Postpliocene (Glacial) clays of Norway and the west of Scotland.

In the living state it is cosmopolitan, especially common in the seas of temperate latitudes, but extending even into the Arctic regions. Although affecting shallow water, it is one of the three species of *Polymorphina* dredged by Prof. Sars in 300 fathoms; but this depth must be regarded as an exceptional range.

*POLYMORPHINA REGULARIS*, von Münster. (Plate XL. figs. 13, *a-c*.)

*Polymorphina regularis*, von Münster, 1838, *vide* Roemer, Neues Jahrb. für Min., Jahrg. 1838, p. 385, pl. 3. fig. 21; Philippi, 1844, Beiträge zur Kenntniss d. Tertiärverst. nord-west. Deutsch. pp. 41, 70; Karsten, 1849, Verzeichn. d. Rostock. Verst. a. d. Sternberger Gestein, p. 8; Reuss, 1855, Sitzungsber. k. Akad. Wissensch. vol. xviii. p. 247, pl. 7. figs. 70–73; id. *ibid.* vol. I. p. 38, pl. 3. figs. 11, 12, pl. 4. fig. 1.

*P. regularis*, var. *Nysti*, Reuss, 1863, Bullet. de l'Acad. roy. de Belgique, vol. xv. p. 162, pl. 3. fig. 42.

*P. lingulata*, Stache, 1865, Novara-Reise, vol. i. 2<sup>te</sup> Abtheil., Paläont. von Neu-Seeland, p. 255, pl. 24. fig. 1.

? *P. marsupium*, id. *ibid.* p. 258, pl. 24. fig. 5.

*P. dispar*, id. *ibid.* p. 261, pl. 24. fig. 8.

*P. gigantea*, id. *ibid.* p. 262, pl. 24. fig. 9.

*Characters*.—Shell oblong, irregularly biconvex, broadest in the upper half, tapering towards both base and apex; periphery thin and produced but not carinate. Septal lines marked by slight constriction. Chambers numerous, long, oblique. Surface smooth. Length  $\frac{1}{10}$  inch.

Notwithstanding certain differences that at first sight appear formidable, there can be little doubt that *Polymorphina regularis* is very closely allied to *P. anceps*. Prof. Reuss, in his later papers, has placed the two under the same heading, giving *P. anceps* precedence, and describing them as the extreme modifications of the same series. The relationship is not very manifest; but the careful study of such a set of figures as that given by Dr. Stache (*op. cit.* pl. xxiv. figs. 1–5, 8, 9) is sufficient to show that there is no real boundary-line between the two, and, further, that, on the side of *P. regularis*, there are still more aberrant specimens, like *P. marsupium*, Stache, which must be taken into the same group. It is, however, consistent with the plan adopted in the present paper, and it is certainly more convenient, to recognize *both* as subtypes for separate congeries of specimens having average characters very distinct from each other. The same reasons that have led Prof. Reuss to merge these two varieties must, if uniformly pursued, result in the entire disuse of subdivisions in most of [the generic or typical groups of Foraminifera. In the case of the genus *Polymorphina* there is, as we have already stated, no single reputed "species" that does not inosculate with one or more other groups of similar zoological value; but whilst this fact must be borne in mind, it does not affect the necessity for recognizing the more important and characteristic modi-



fications as they occur. Many of them may be associated with external conditions, such as climate, depth of water, and the like; and some of the peculiar forms, the result of gradual alteration, afford evidence of a certain value in respect to geological age.

*Distribution.*—The range of *Polymorphina regularis* is nearly identical with that of *P. anceps*. The Middle and Lower Tertiaries of Germany, and the Crag of Antwerp, are the only localities in which its occurrence is noted.

POLYMORPHINA COMPLANATA, D'Orbigny. (Plate XL. figs. 14, *a*, *b*; Woodcuts *f*–*j*.)

? *Polymorphina lingua*, Roemer, 1838, Neues Jahrb. für Min., Jahrg. 1838, p. 385, pl. 3. fig. 25.

? *P. obscura*, id. ibid. p. 385, pl. 3. fig. 23.

? *P. campanulata*, id. ibid. p. 385, pl. 3. fig. 22.

? *P. teretiuscula*, id. ibid. p. 385, pl. 3. fig. 24.

*P. lingua*, Philippi, 1844, Beiträge zur Kenntniss d. Tertiärverstein. nord-west. Deutsch. pp. 41, 69; Reuss, 1855, Sitzungsber. k. Akad. Wissensch. vol. xviii. p. 248, pl. 7. fig. 77.

*P. complanata*, D'Orbigny, 1846, For. Foss. Vien. p. 234, pl. 13. figs. 25–30.

*P. Philippii*, Reuss, Sitzs. Ak. Wissen. vol. xviii. p. 248, pl. 7. fig. 76.

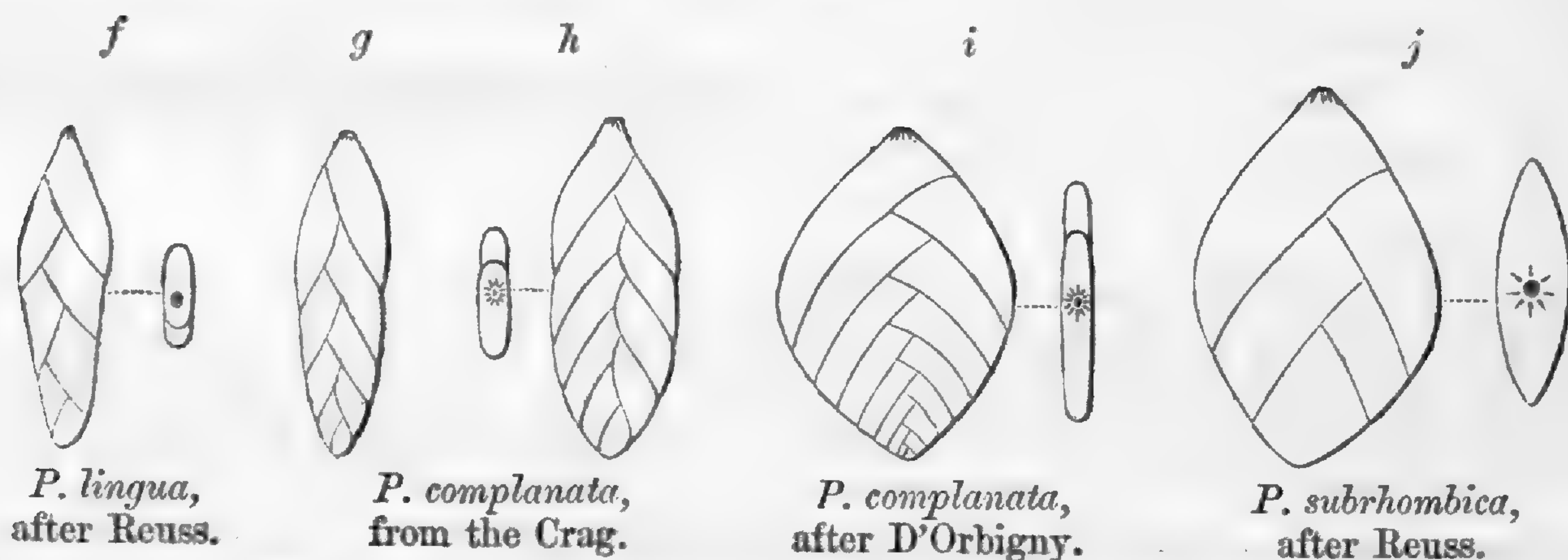
*P. subrhombica*, Reuss, 1861, ibid. vol. xlv. p. 239, pl. 7. fig. 3.

*P. obscura*, Reuss, 1864, ibid. vol. l. p. 471, pl. 7. figs. 8–10.

*P. complanata*, Karrer, 1864, Sitzungsber. k. Akad. Wissensch. vol. l. p. 716 (table); Jones, Parker, and Brady, 1866, Monogr. Crag Foram. pl. 1. figs. 52, 53, 60.

*Characters.*—Shell much compressed, elongate or subrhomboidal. Chambers elongate, oblique, arranged in two regularly alternating series. Septal lines but slightly excavated. Surface smooth. Aperture radiate. Length  $\frac{1}{50}$  inch or more.

The figures given by M. D'Orbigny in the "Vienna-Basin" monograph, to represent his *Polymorphina complanata*, indicate very wide and thin specimens, with an almost angular or rhomboidal lateral aspect. Such specimens may be regarded as the extreme examples of a considerable series which have as a common character the regular alternating or Textularian arrangement of their chambers. They vary amongst themselves in certain particulars—to a certain extent in the degree of compression of the shell, but far more in its relative length and width. The following outlines are copied from some of the figures included in the list of synonyms.



We see no reason why the *Proroporus Schultzei* of Prof. Reuss should not be regarded as the extreme form of the series, at the opposite end to the short outspread variety which originally received the name now adopted for the whole. Its shell is thin and flat, and the arrangement of its segments distinctly Textularian; its anomalous length alone dis-



tinguishes it from the commoner modifications. Setting this aside, we have in the *Polymorphina lingua* (Woodcut *f*) and *P. obscura* of Roemer\* two of the lanceolate varieties, having a transverse diameter equal to about one-third of the length, and showing the characteristic arrangement of the chambers. Our own specimens from the Crag yield many intermediates, two of which are represented in Woodcuts *g* and *h*, whilst D'Orbigny's figure (*i*) exhibits the extreme form. *P. subrhombica* (*j*) appears to be only a few-chambered and somewhat stouter modification, possessing otherwise the same general features.

*Polymorphina complanata* is very closely connected with *P. compressa* and *P. regularis*; but the thickened centre and obscure septation of the one, and the unequal and irregular disposition of the segments of the other, and its depressed sutures, will in general prevent their being confused with the more regularly built specimens of the form under consideration.

*Distribution.*—Well-marked Textularian *Polymorphinæ* seem only to be known as Tertiary fossils. The Miocene beds of the Vienna Basin were the source of D'Orbigny's specimens; and the various Tertiary formations of North and North-western Germany, and the Crag of the east of England, have supplied those of later observers.

POLYMORPHINA ELEGANTISSIMA, Parker and Jones. (Plate XL. figs. 15, *a-c*.)

*Polymorphina elegantissima*, Parker and Jones, 1864, Phil. Trans. vol. clv. Table x. p. 438.

*Characters.*—Shell oblong or oval, thin, complanate, composed of a number of long, arcuate, erect chambers, arranged in two unequal series. The final segment of each series large, and embracing those previously formed, the arrangement being reversed on the two sides of the shell. Chambers but slightly convex, occasionally having an ill-defined border or blunt carina. Surface smooth. Length  $\frac{1}{20}$  inch.

This beautiful variety received bare mention in the Appendix to the Memoir on North-Atlantic and Arctic Foraminifera above referred to, and is now first described and figured.

It differs from other modifications of the type in the peculiar obliquity of its segments, which are arranged in two alternating series, but in such a way that on each face of the shell one of the series is completely invested by the overlap of its large terminal chamber. The series of segments which is exposed on one face of the shell is covered on the other, and *vice versâ*. Thus from whichever side it is viewed, it presents four or five arcuate or semicircular chambers, with their ends embraced by the outspread terminal segment of the opposite series.

*Distribution.*—We have specimens of *Polymorphina elegantissima* from shell-sand collected near Melbourne, Australia, and from soundings in Storm Bay, Tasmania, the latter forwarded to us by the late Dr. Greville, of Edinburgh. Though it has not been met with

\* Herr Roemer's drawings are, unfortunately, too small and indistinct to be of much service—a circumstance the more to be regretted as they were amongst the earliest illustrations of Tertiary Foraminifera. In many cases the want of definite character in the figures has precluded the adoption of names that might otherwise have taken precedence of those in use. Prof. Reuss, in subsequent papers relating to geological formations of similar age, has reproduced some of the drawings on a larger scale, thereby restoring their value. Our remarks on *P. lingua* and *P. obscura* are founded on the later figures rather than on those of the original plate.



in any other locality, we can scarcely suppose that its distribution is confined to the Australasian seas.

POLYMORPHINA TRIGONULA, Reuss, sp. (Plate XL. figs. 16, *a*, *b*.)

*Guttulina trigonula*, Reuss, 1845, Verstein. böhm. Kreid. 1<sup>te</sup> Abtheil. pp. 40, 110, pl. 13. fig. 84.

*Characters*.—Shell oblong transversely, truncate at the base. Anterior extremity obtuse, pointed. Chambers numerous, turgid. Orifice radiate. Surface smooth. Long diameter (at the base)  $\frac{1}{40}$  inch.

Professor Reuss, in his work on the Cretaceous System of Bohemia, describes and figures a curious and somewhat anomalous *Polymorphina* under the name *Guttulina trigonula*. We are unable to associate any specimens, recent or fossil, that have come under our notice with his description of the species, and are therefore content to copy his figure on a somewhat larger scale than the original, and adapt our description to it. It appears to represent a variety allied to *P. communis*, and differing chiefly in its truncate, somewhat three-sided base. Were a good specimen of this latter species cut across in its widest part, we should have a near approach to the characters indicated in the drawing. Another squat variety mentioned in the same work, *P. glomerata*, may possibly pertain to the same subtypical division; but the insufficiency of the figures has left us in so much doubt, that we have preferred to place it provisionally under *P. communis*, p. 224.

*Distribution*.—The geological stage and locality given by Reuss are the Plänermergel of Luschitz in Bohemia.

POLYMORPHINA THOUINI, D'Orbigny. (Plate XL. fig. 17.)

*Polymorphina Thouini*, D'Orbigny, 1826, Ann. Sc. Nat. vol. vii. p. 265, no. 8; Modèle no. 23.

*P. asparagus*, Ehrenberg, 1854, Mikrogeologie, pl. 27. fig. 14.

*P. turio*, id. ibid. pl. 28. fig. 27.

*Bigenerina Cretæ*, id. ibid. pl. 28. fig. 21.

*B. acanthopora*, id. ibid. pl. 28. fig. 22.

*Proroporus Cretæ*, id. ibid. pl. 27. fig. 29, and pl. 28. fig. 20.

*P. Siculus*, id. ibid. pl. 26. fig. 18.

*Sagrina longirostris*, id. ibid. pl. 32. fig. 23.

*Vaginulina obscura*, id. ibid. pl. 26. fig. 27.

*Polymorphina Thouini*, Parker and Jones, 1860, Quart. Journ. Geol. Soc. vol. xvi. p. 302 (Table).

*P. pupiformis* (in part), Terquem, 1864, 4<sup>me</sup> Mém. sur les Foram. du Lias, p. 524, pl. 13. figs. 23, 26, 29, &c.

*P. Thouini*, Parker, Jones, and Brady, 1865, Ann. & Mag. Nat. Hist. 3rd Ser. vol. xvi. p. 22, pl. 2. fig. 49; Jones, Parker, and Brady, 1866, Monogr. Crag Foram. pl. 1. fig. 59.

*Guttulina*, sp., von Schlicht, 1869, Foram. Septar. Pietzpuhl, p. 467, pl. 25. figs. 14, 15.

*Characters*.—Shell attenuate, subcylindrical, slightly constricted at the septal lines. Anterior extremity acute; posterior rounded. Chambers elongate, oblique, erect, slightly ventricose. Orifice round, central. Surface smooth. Length  $\frac{1}{50}$  to  $\frac{1}{12}$  inch.

Of the very long, many-chambered *Polymorphinæ*, perhaps *P. Thouini* is the best-defined variety; yet it does not appear to have been generally adopted. It represents a



longer, more cylindrical subtype than *P. fusiformis*, with a larger number of chambers and less oblique setting on; indeed it resembles more a much outdrawn specimen of *P. problema* than any other variety.

We have given references to a number of Ehrenberg's figures, which may, we think, properly be placed under this species. *Proroporus Cretæ* and *Pr. Siculus* are somewhat shorter than our figure; and *Bigenerina acanthopora* is armed with a terminal mucro; but we cannot regard these as variations of sufficient importance to merit specific separation. Some of M. Terquem's Liassic *Polymorphinæ* seem also to belong to *P. Thouini*. His *P. pupiformis* represents a very mixed set of specimens, mostly ranging between *P. Thouini* and *P. nodosaria*, with some others that we should hesitate to place in the same genus.

*Distribution*.—Accepting M. Terquem's figures representing Liassic specimens as belonging, in part at least, to this species, it is one of the earliest in its appearance. We have notes of its occurrence in the Eocene beds of the Paris Basin, in various Pliocene clays of North Italy, and in the Crag of our Eastern Counties.

In the living state it is a rare shell. A sample of Levant dredgings, obtained by Capt. Spratt at a depth of 90 fathoms, off Syra, contained a few specimens, the only recent ones on record.

POLYMORPHINA NODOSARIA, Reuss. (Plate XL. figs. 18, *a*, *b*.)

? *Vaginulina paradoxa*, Ehrenberg, 1854, Mikrogeologie, pl. 26. fig. 26.

*Polymorphina subnodosa*, Reuss, 1860, Sitzungs. Akad. Wissensch. vol. xlii. p. 362, pl. 2. fig. 15.

*P. nodosaria*, Reuss, 1863, Sitzungs. Akad. Wissensch. vol. xlvi. p. 58, pl. 7. fig. 85.

*P. quadrata* (in part), Terquem, 1864, 4<sup>me</sup> Mém. Foram. Lias, p. 296, pl. 12. figs. 27 &c.

*Dimorphina nodosaria*, Jones, Parker, and Brady, 1866, Monogr. Crag Foram. pl. 1. figs. 55–58.

*Polymorphina nodosaria*, Reuss, 1866, Denkschr. mathem.-natur. Cl. k. Akad. Wissensch. vol. xxv. p. 155.

*Characters*.—Shell elongate, cylindrical, somewhat tapering, irregular, composed of from 4 to 8 chambers. Chambers oblique, inflated, alternating. Sutures constricted. Orifice central, radiate. Surface smooth. Length  $\frac{1}{30}$  to  $\frac{1}{15}$  inch.

It may be questioned whether the uniserial *Polymorphinæ* typified by *P. nodosaria* belong more properly to the principal division of the group or to the subgenus *Dimorphina*. On the whole, it seems most convenient to confine the term *Dimorphina* to those varieties which begin growth on a biserial or triserial plan, and, after a certain number of segments have been formed, lapse into a single rank. In the present species, the mode of growth is uniserial from the commencement, or very nearly so; and its chief departure from the characters of the simpler type it otherwise resembles is in the alternating obliquity of the septal lines. Thus, while the genus *Nodosaria* has horizontal sutures connecting the chambers, and *Dentalina* has oblique septa, all slanting in one direction, *Polymorphina nodosaria* has oblique septa the direction of which is reversed with each succeeding segment. The general outline of the shell is somewhat irregular, from the different convexity of the segments; but its central axis is straight.

The *Polymorphina subnodosa* of Prof. Reuss does not represent so good a type as that more recently described under the name which we have adopted; and Ehrenberg's figure is unreliable, for reasons already explained.



Dr. Karrer, in his paper on the Miocene Foraminifera of Kostež, figures an anomalous shell as *Cristellaria pleurostomelloides*. There is, doubtless, some good reason for placing it under the genus *Cristellaria*; but, judging from the figures, we should have inclined to regard it as much more closely related to the group under consideration.

*Distribution*.—Setting aside the references to Ehrenberg and Terquem as unsatisfactory in the highest degree, we have no record of *Polymorphina nodosaria* except as a Tertiary fossil. The Middle Tertiaries of Central Germany, the Crag of Antwerp, and the Crag of the East of England are the only localities for the species, so far as our present knowledge extends.

POLYMORPHINA ROTUNDATA, Bornemann, sp. (Plate XL. figs. 19, *a-e*. Woodcuts *k, l, m*.)

? *Polymorphina Rochefortiana*, D'Orbigny, 1840, Foram. Cuba, p. 131, pl. 2. figs. 9-11.

? *Polymorphina nucleus*, Ehrenberg, 1854, Mikrogeologie, pl. 30. fig. 18.

*Guttulina rotundata*, Bornemann, 1855, Zeitschr. deutsch. geol. Gesell. vol. vii. p. 346, pl. 18. fig. 3.

*G. incurva*, id. ibid. p. 345, pl. 17. fig. 6.

*G. fracta*, id. ibid. p. 344, pl. 17. fig. 4.

*G. dimorpha*, id. ibid. p. 345, pl. 17. fig. 5.

*G. globosa*, id. ibid. p. 346, pl. 18. fig. 1.

*G. obtusa*, id. ibid. p. 346, pl. 18. fig. 2.

*P. rotundata*, Reuss, 1866, Denkschr. mathem.-naturw. Cl. k. Akad. Wissensch. vol. xxv. p. 153.

*P. obtusa*, id. ibid. p. 153.

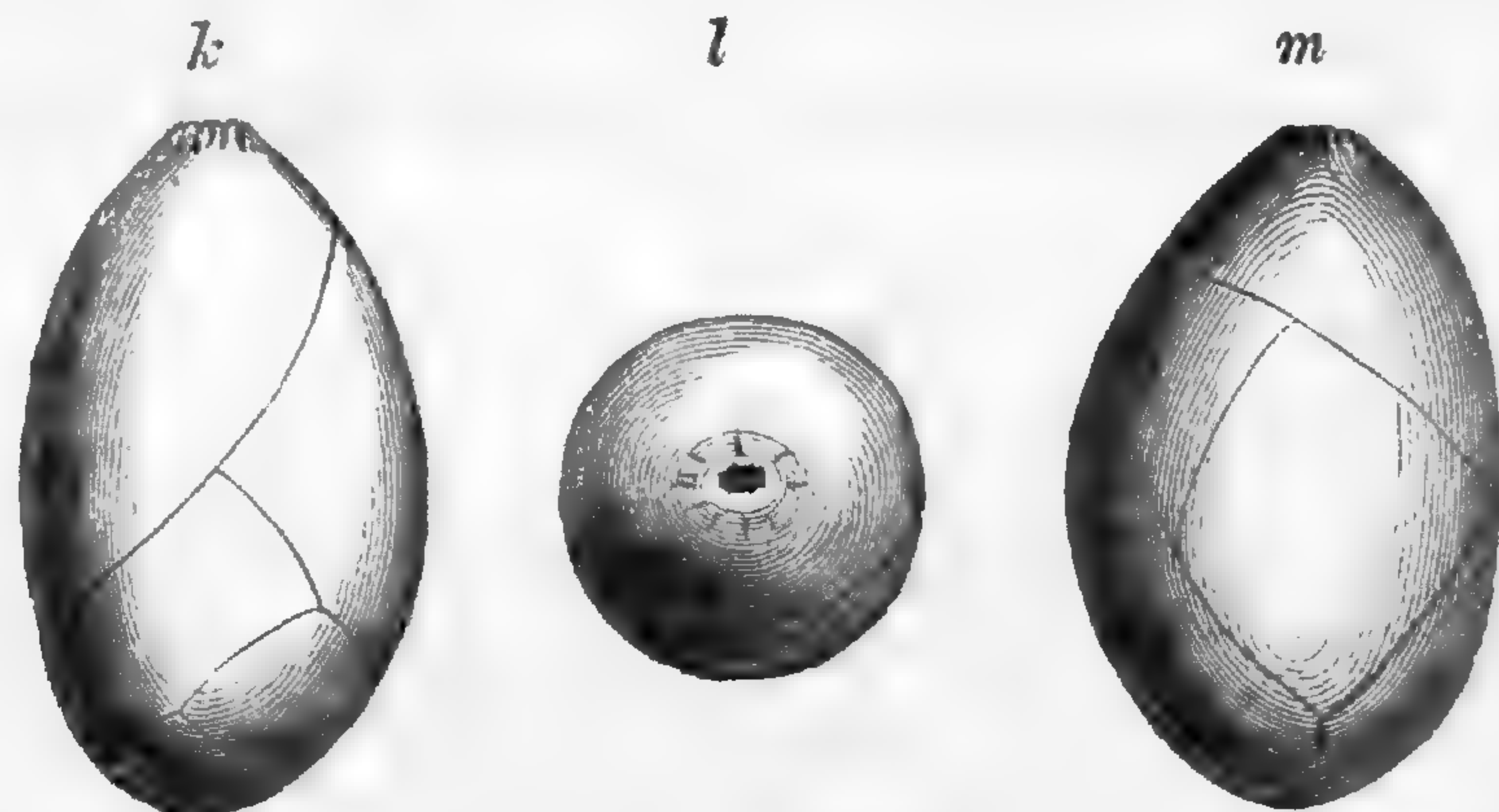
*P. tenera*, Karrer, 1868, Sitzungsber. Akad. Wissensch. vol. lviii. p. 174, pl. 4. fig. 9.

*Rostrolina*, sp., Von Schlicht, 1869, Foram. Septar. Pietzpuhl, no. 412, pl. 26. figs. 13-15.

*Guttulina*, sp., id. ibid. no. 442, pl. 28. figs. 6-25.

*Characters*.—Shell oblong, ovoid, subcylindrical, gibbous, rounded at the base, more or less produced at the apex. Chambers numerous, broad. Septa marked by lines only, neither constricted nor excavated. Orifice simple, round, oval, or radiate. Surface smooth. Length  $\frac{1}{30}$  to  $\frac{1}{20}$  inch.

Out of a large number of figures of compact, oval, Guttuline *Polymorphinæ* accompanying Dr. Bornemann's paper on the Microzoa of the Septaria-clay of Hermsdorf, those of *Guttulina rotundata*, from which the subjoined Woodcuts are copied, appear to represent



*Guttulina rotundata*, after Bornemann.

the best-developed specimens; and as the range of variation in the whole series is not more than is often found within the limits of a single variety, we have placed a number of them together under this head.



*Guttulina incurva* (Plate XL. figs. 19, *a*, *b*) has the same general characters, but is somewhat longer in proportion and less symmetrical, one side being straight or even slightly concave, the other convex. In *G. fracta* (Pl. XL. figs. 19, *c*, *d*, *e*) this peculiarity is present to an exaggerated extent, whilst in *G. globosa* and *G. obtusa* the whole setting-on of the segments is anomalous and irregular. *Guttulina dimorpha*, but for its obvious connexion with the others of the group, might have been placed amongst the *Dimorphinæ*; but it is probably only a feeble example of *P. rotundata*, with two of its chambers uniserial. Karrer's *Polymorphina tenera* closely resembles the figures of the "incurved" varieties. The curious recent specimen figured in D'Orbigny's "Cuba" monograph, under the name *P. Rochefortiana*, is possibly as nearly related to the present group as any; but no form exactly similar to it has been observed by subsequent writers. Of Herr von Schlicht's *Rostrolinæ* we have already spoken.

*Distribution*.—We are dependent on the German authors above quoted for our knowledge of the distribution of *Polymorphina rotundata*. It appears to be a predominant form in the Septaria-clays both of Hermsdorf, near Berlin, and Pietzpuhl, near Magdeburg. The locality of Herr Karrer's specimens alluded to is the Miocene clay of Kostej in the Banat.

POLYMORPHINA SOLDANII, D'Orbigny. (Plate XL. fig. 20.)

? *Arethusa corymbosa*, De Montfort, 1808, Conchyl. Systém. vol. i. p. 302, 76<sup>e</sup> genre.

*Polymorphina Soldanii*, D'Orbigny, 1826, Ann. Sci. Nat. vol. vii. p. 265. no. 12; Soldani, 1789, Testaceographia, vol. ii. p. 99, pl. 107. fig. *nm*.

*Polymorphina oblonga*, D'Orbigny, 1846, For. Foss. Vien. p. 233, pl. 12. figs. 29–31.

*P. uvæformis*, Reuss, 1855, Zeitschr. deutsch. geol. Gesell. vol. vii. p. 289, pl. 11. fig. 5.

*Characters*.—Shell elongate, subcylindrical. Chambers numerous, convex, arranged in a compact indefinite spire, the visible portions of the external segments somewhat triangular. Orifice circular, or radiate. Surface smooth. Length  $\frac{1}{20}$  inch or more.

The drawing in the 'Testaceographia,' to which D'Orbigny gave the name *Polymorphina Soldanii*, seems to represent a tolerably distinct varietal form—a compact, subcylindrical, spirally arranged shell, which might be mistaken for one of the smooth *Uvigerinæ*. De Montfort's figure is so rough and ill-drawn that it is recognized with difficulty as belonging to the same, notwithstanding evidence of its having been copied from Soldani's plate.

*Polymorphina oblonga*, D'Orbigny, and *P. uvæformis*, Reuss, are almost identical in general characters with *P. Soldanii*; but both of them are figured with a central, erect aperture, whilst that of the original drawing is somewhat eccentric and oblique—a difference of slight importance; both have also slightly longer and more fusiform chambers.

*Distribution*.—The Chalk of Mecklenburg and the Nussdorf beds of the Vienna Basin (Miocene) are the localities given by Reuss and D'Orbigny respectively for the specimens above alluded to. Soldani's figure is from a recent specimen found in the rich shore-sand of the Adriatic, near Rimini.



POLYMORPHINA HUMBOLDTII, Bornemann. (Plate XL. figs. 21, *a*, *b*.)

*Polymorphina Humboldtii*, Bornemann, 1855, Zeitschr. deutsch. geol. Gesell. vol. vii. p. 347, pl. 18. figs. 7, 8; Reuss, 1866, Denkschr. d. math.-natur. Cl. k. Akad. Wissensch. vol. xxv. p. 155; Gümbel, 1868, Abhandl. d. ii. Cl. k. Akad. Wissensch. vol. x. p. 647.

*Characters*.—Shell oval or oblong, inequilateral, compressed; one side flat, or sometimes slightly concave, the other surface convex. Anterior extremity acute; posterior rounded. Margins thin, often spreading into an obtuse carina. Chambers long, narrow, oblique, curved, slightly inflated; arranged with some regularity in two unequal series. Orifice pouting, radiate. Surface smooth. Length  $\frac{1}{40}$  to  $\frac{1}{16}$  inch.

In the absence of specimens from which to form an independent judgment, we are quite ready to accept *Polymorphina Humboldtii*, represented in Dr. Bornemann's figures, as a good subtype. The drawings indicate a compressed, carinate, Textulariform test, bearing near relationship in the arrangement of its chambers to *P. complanata*, but rounder and more elegant in its lines and unequal in its two sides.

*Distribution*.—*P. Humboldtii* was first described from specimens obtained in the Saptaria-clay (Lower Tertiary) of Hermsdorf, near Berlin; and though this formation has been thoroughly examined in many localities widely separated, it has not been noticed at any other portion of it. Dr. Gümbel's note refers to specimens of somewhat earlier age, the Eocene of the Northern Alps.

POLYMORPHINA CONCAVA, Williamson. (Plate XL. figs. 22, *a*, *b*.)

*Polymorphina lactea*, var. *concaua*, Williamson, 1858, Rec. For. Gt. Br. p. 72, pl. 6. figs. 151, 152.

*Characters*.—Shell irregular, oval or oblong, concavo-convex; at some period of its growth parasitic. Central portion consisting of a small hyaline shell of the typical form, round which the last segment is extended as a thin, arched, marginal expansion. On the under or concave surface the earlier segments are scarcely visible. Margin very thin, rounded, sinuous. Surface smooth.

Professor Williamson's figures, from which our own are copied, are the only previous record we find of unmistakably parasitic *Polymorphinæ*, and they agree with specimens which have come under our own notice. In the present memoir we describe a second attached variety (see p. 246), in which cervicorn shelly growths serve to root the animal to a foreign body. We propose, notwithstanding certain points of similarity between the two, to limit Prof. Williamson's name to the more regularly formed variety which he describes.

It is not easy to read the physiological significance of the outspread ultimate segment which characterizes *Polymorphina concaua*. It has no visible orifice, and is, in fact, only a wide inequilateral ring round the long periphery of the shell; and in well-preserved specimens the orifice of the penultimate chamber remains large and conspicuous. It may be that the supplementary closed-in segment bears a direct analogy to the closed tubular expansions often observable in *P. Orbignii*.

*Distribution*.—*P. concaua* is extremely rare, and probably has not been noticed except



on our own coast. Prof. Williamson gives Brixham as the locality whence his specimens were obtained.

POLYMORPHINA RUGOSA, D'Orbigny. (Plate XL. figs. 23, *a-d*.)

? *Polymorphina rugosa*, D'Orbigny, 1840, *Foram. Cuba*, p. 132, pl. 2. figs. 14, 15.

*Globulina rugosa*, id. *ibid.* 1846, *For. Foss. Vien.* p. 229, pl. 13. figs. 23, 24.

*P. leprosa*, Reuss, 1867, *Sitzungsb. Akad. Wissensch.* vol. lv. p. 73, pl. 4. fig. 3.

*P. foveolata*, id. *ibid.* p. 74, pl. 4. fig. 2.

*P. leprosa*, Karrer, 1868, *ibid.* vol. lviii. p. 173.

*P. foveolata*, id. *ibid.* p. 173.

*Globulina asperula*, Gümbel, 1868, *Abhandl. d. ii. Cl. k. Akad. Wissensch.* vol. x. p. 646, pl. 2. fig. 81, *a, b*.

*Characters*.—Shell subglobular, oval, or oblong. Chambers few, variously combined. Surface rough, either from minute granular outgrowths, or slight elongate pitted depressions, or both. Length  $\frac{1}{50}$  inch.

As has been stated in the Introduction, almost every variety of "surface" within certain limits may be found amongst the *Polymorphinæ*. When fully developed exostoses (like spines, bristles, or tubercles) occur, they are easily understood, and it only remains to the observer to determine the amount of importance to be assigned to them; but when the altered condition of the shell amounts to little more than mere rugosity of the exterior, the questions arising from it are more difficult to answer.

D'Orbigny's *Globulina rugosa* owes its roughness chiefly to minute elongate pitted depressions, whilst his *Polymorphina rugosa* has in addition granular outgrowths of shell-substance. *P. foveolata*, Reuss, appears to resemble the former, and *P. leprosa*, Reuss, follows the latter variety in these particulars. Such modifications of the typically smooth shell commence in *Globulina punctata*, D'Orb., which shows a somewhat irregular surface from abnormally developed foramina. In *P. rugosa* specimens are to be found porous or pitted or granular, sometimes both pitted and granular; and it is scarcely needful to attempt to separate into two or three subspecies so interwoven a series.

The figure given in the "Vienna Basin," copied in Plate XL. fig. 23, *a, b*, is excellently supplemented by those of Prof. Reuss above referred to. D'Orbigny's Cuban specimen (Plate XL. fig. 23, *c, d*) represents an altogether anomalous shell, with an irregular, embracing, terminal chamber, monstrously developed, which almost obscures its Polymorphine characters. He admits that such specimens are very rare; and much importance can hardly be assigned to an exceptional example of this sort.

*Distribution*.—Fossil in various Tertiary deposits. Recent in littoral sand from Cuba and Martinique.

POLYMORPHINA VARIATA, Jones, Parker, and Brady. (Plate XL. fig. 24.)

*Polymorphina variata*, Jones, Parker, and Brady, *Monogr. Crag Foram.*, App. I. & II. (foot-notes), pl. 1. figs. 67, 68.

*Characters*.—Shell oblong, compressed, unsymmetrical, few-chambered. Margin rounded, somewhat constricted over the septal lines. Chambers slightly inflated. Surface uneven, studded with irregular angular depressions imparting a mottled appearance to the whole exterior. Orifice variable, simple or labyrinthic. Length  $\frac{1}{2}$  inch.



Some of the fine large *Polymorphinæ* from the Crag show a peculiar form of surface-ornamentation that has not hitherto been described; nor have we observed any thing precisely similar in specimens from other localities. It consists of unequal and irregular depressions of angular shape, sometimes bordered by a slightly raised line. In these specimens the shell-wall is coarse and thick, and the terminal orifice sometimes differs from the normal circular aperture and becomes labyrinthic, or even divided into two or three distinct perforations.

*Distribution.*—We have only found *P. variata* in Mr. Searles Wood's gatherings from the Crag of Sutton, near Colchester; and even in these it is by no means of common occurrence.

POLYMORPHINA DIGITALIS, D'Orbigny. (Plate XLI. figs. 25, *a*, *b*.)

*Polymorphina digitalis*, D'Orbigny, 1846, For. Foss. Vien. p. 235, pl. 14. figs. 1-4.

*Grammostomum costulatum*, Ehrenberg, 1854, Mikrogeologie, pl. 25. fig. 21.

*Polymorphina digitalis*, Karrer, 1868, Sitzungs. Akad. Wissen. Wien, vol. lviii. p. 174; Bunzel, 1869, Jahrb. k. k. geol. Reichsanstalt, vol. for 1869, p. 203.

*Characters.*—Shell elongate, subequilateral, compressed, composed of many segments. Chambers oblique, narrow, convex. Aperture oval. Surface rugose, the rugosities distributed in longitudinal lines. Length  $\frac{1}{50}$  inch.

The shell figured by M. D'Orbigny, *loc. cit.* is a good representative of a section of the *Polymorphinæ* which, in the arrangement of their chambers, simulate the *Textulariæ*; indeed, in this particular instance, the general resemblance is so strong that the true affinity of the species is only betrayed by the central terminal orifice and its radiate corona. Closely allied in form to the elongate modifications of *P. complanata*, it differs from them in its peculiar surface-ornamentation, consisting of granular lines.

*Distribution.*—We have never met with specimens corresponding exactly with the figures given by D'Orbigny, and can add nothing in respect to distribution to the localities noted by the observers quoted above, viz. the Nussdorf beds of the Vienna Basin, and a Tertiary deposit at Kostej in the Banat, both of Miocene age.

POLYMORPHINA GRANULOSA, Egger. (Plate XLI. figs. 26, *a*, *b*.)

*Polymorphina (Globulina) granulosa*, Egger, 1857, Neues Jahrb. für Min., Jahrg. 1857, p. 290, pl. 14. figs. 1, 2.

*Characters.*—Shell oblong or oval, regular, subcompressed, rounded at the anterior and posterior extremities. Surface marked by closely set, delicate, parallel, longitudinal striæ. Septal lines scarcely perceptible. Length  $\frac{1}{35}$  inch.

It would probably be impossible to draw a rigid line between the varieties of *Polymorphina granulosa* and those of some other striate or substriate forms, such as for example *P. myristiformis*, but for the compact ellipsoidal contour of the shell and the granular texture of the striæ; these are distinctive characters, and cannot readily be mistaken in fully grown or average specimens.

*Distribution.*—Found by Dr. Egger in the Miocene beds of Stansbach, Bavaria.



POLYMORPHINA AUSTRALIS, D'Orbigny, sp. (Plate XLI. figs. 27, *a*, *b*.)

*Globulina australis*, D'Orbigny, 1839, Voyage dans l'Amér. Mérid. p. 60, pl. 1. figs. 1-4.

*Characters*.—Shell ovate, inequilateral, somewhat compressed, slightly constricted at the septal lines. Anterior portion acuminate, smooth; posterior rounded, striate longitudinally. Orifice circular, radiate. Length  $\frac{1}{75}$  inch.

Judging from D'Orbigny's description and drawings, the minute, feebly developed, partially striate shell to which he has given the name *Polymorphina australis* may without inconsistency be admitted under a distinct name. The surface-ornamentation is similar to that of *P. pulchella* and *P. irregularis*, but is confined to the earlier chambers. In the form and arrangement of the segments it differs considerably from either of the last-named varieties.

*Distribution*.—We have never met with *P. australis*, and can only note the locality appended to the original description, viz. "littoral sand from the Bay of San Blas, Patagonia."

POLYMORPHINA PULCHELLA, D'Orbigny, sp. (Pl. XLI. figs. 28, *a*, *b*.)

*Guttulina pulchella*, D'Orbigny, 1840, Foram. Cuba, p. 129, pl. 2. figs. 4-6.

*Characters*.—Shell elongate, fusiform, somewhat compressed. Anterior end acute; posterior obtuse. Margin even; septal lines slightly excavated. Surface having an ornamentation of numerous, regular, well defined, longitudinal striæ. Chambers few, much elongated, erect, thin, and overlapping. Length  $\frac{1}{75}$  inch.

D'Orbigny's figures, from which our own are copied, represent a modification of the Polymorphine type exceedingly interesting in connexion with the morphology of the group. In general form *Polymorphina pulchella* most resembles *P. Thouini*; that is to say, it has long chambers, combined so as to form a narrow, fusiform, subcylindrical test, but possesses a distinctive mark in the parallel longitudinal striæ which cover the shell. Both this species and the next in order, *P. irregularis*, owing to the peculiar setting-on of the chambers have a strong resemblance at first sight to some forms of the genus *Bulimina*.

*Distribution*.—The specimens described by D'Orbigny were found in shore-sand from the islands of Cuba and Martinique. As we have never met with the species, we can add nothing in respect to its distribution.

POLYMORPHINA IRREGULARIS, D'Orbigny. (Plate XLI. figs. 29 *a*, *b*.)

*Polymorphina irregularis*, D'Orbigny, 1840, Foram. Cuba, p. 131, pl. 2. figs. 12, 13.

*Characters*.—Shell oblong, inequilateral, compressed, excavated at the septal lines. Anterior portion subacuminate; posterior obtuse and rounded. Surface traversed longitudinally by well marked parallel furrows. Chambers unequal, irregular, inflated. Aperture round, pouting. Length  $\frac{1}{30}$  inch.

The irregular, almost uniserial, setting-on of the chambers, and the sulcate surface of



the whole test, may be regarded as the principal distinctive characters of this pretty West-Indian species.

Such specimens as those figured remind us of the close affinity of the *Polymorphinæ* to the *Nodosariæ*. A very slight inequality in the development of the chambers of *Nodosaria scalaris*, for instance, might produce a shell undistinguishable from these, especially in the absence of a radiate aperture. Nevertheless they probably find their right place amongst the *Polymorphinæ*, and they sort well with some other anomalous varieties, like *P. australis* and *P. pulchella*.

*Distribution.*—Our knowledge of the distribution of the variety is confined to the information supplied by M. D'Orbigny, who gives "the shores of Cuba, Jamaica, and Martinique" as the localities whence his specimens were derived,—in each case from littoral sand.

POLYMORPHINA MYRISTIFORMIS, Williamson. (Plate XLI. figs. 30, *a-c*.)

*Polymorphina myristiformis*, Williamson, 1858, Rec. For. Gt. Br. p. 73, pl. 6. figs. 156, 157; Brady, 1864, Trans. Linn. Soc. vol. xxiv. p. 473; Alcock, 1865, Proc. Lit. & Phil. Soc. Manchester, vol. iv. p. 206.

*Characters.*—Shell subspherical, consisting of few (two to four) visible segments. Septal lines obscure, scarcely depressed. Surface marked by numerous longitudinal, interrupted, translucent costæ. Orifice surrounded by a corona of raised ridges. Shell finely foraminated. Length  $\frac{1}{40}$  inch.

*Polymorphina myristiformis* is a well-known recent species, being found at all points on our own coast where the water is deep enough. It is very rare in shallow water, but in forty fathoms or upwards becomes comparatively common. It is a pretty, bright little shell, not to be mistaken for any of its natural allies, but liable, at first sight, to be confused with the fine large specimens of *Lagena sulcata* found at similar depths. When the septation is obscured, as it often is by the thickening of the shell, the best diagnosis is afforded by the slightly gibbous and unsymmetrical contour of the test, and the radiate orifice. Our figure (Plate XLI, fig. 30, *a*), copied from Prof. Williamson's, fairly represents the species as usually found. Mr. Robertson, of Glasgow, has forwarded to us specimens, from deep water off Eddystone, in which the costæ are much more strongly developed (figs. 30, *b, c*), but not otherwise differing from the normal form. Although the costæ are usually interrupted, as shown in the figures, examples are occasionally met with in which they are nearly continuous and regular.

*Distribution.*—*P. myristiformis* has probably a very wide distribution as a recent Foraminifer. It is much more limited in its range as a fossil; our only fossil specimens are from the Barton beds (Lower Tertiary), Isle of Wight.

POLYMORPHINA COSTATA, Egger. (Plate XLI. figs. 31, *a, b*.)

*Polymorphina (Globulina) costata*, Egger, 1857, Neues Jahrb. für Min., Jahrg. 1857, p. 291, pl. 14. figs. 5, 6.

*P. (Globulina) striata*, Id. ibid. p. 292, pl. 14. figs. 3, 4.

*P. costata*, Karrer, 1868, Sitzungs. Akad. Wissen. Wien, vol. lviii. p. 173; Bunzel, 1869, Jahrb. k. k. geol. Reichsanstalt, vol. for 1869, p. 203.



*Characters.*—Shell ovate, globuline, more or less unsymmetrical. Septa obscure. Surface-ornamentation consisting of parallel longitudinal costæ, often irregular and varying in thickness, but always strong and conspicuous. Orifice circular, coronate, sometimes stellate and jagged. Length  $\frac{1}{50}$  to  $\frac{1}{30}$  inch.

We have placed under one name the two costate varieties of *Polymorphina* figured by Dr. Egger, as we do not see how any distinction sufficient for separate definition can be drawn between them. We can only speak from analogy based on the information supplied in Dr. Egger's memoir; but, judging from the habit of allied forms, we cannot think that it would be difficult, if a sufficient number of specimens were obtained, to find examples in every degree intermediate to the two which he has figured, in such variable characters as the contour of the shell and the thickness of the ribs.

*Distribution.*—*Polymorphina costata* is only known as a Miocene fossil. In the memoir referred to, the localities given are Mairhof, Buchleiten, Hausbach, and Habühl, all in Lower Bavaria. Herr Karrer more recently has noted its occurrence in beds of similar age at Kostej, in the Banat (Austria).

POLYMORPHINA REGINA, spec. nov. (Plate XLI. figs. 32, *a*, *b*.)

*Characters.*—Shell ovate, irregular, obscurely triserial. Anterior extremity acuminate, posterior obtuse and rounded. Chambers erect, distinct, inflated, separated by deep depressions at the sutures. Orifice circular, pouting. Surface marked by equidistant, longitudinal costæ. Length  $\frac{1}{30}$  inch.

There is but little danger of confounding *Polymorphina regina* with any other member of the genus. It may be regarded morphologically as *P. problema* with an ornamentation of longitudinal ribs. It differs from *P. costata* chiefly in general contour, the latter having its smooth-shelled analogue in *P. gibba*, but also to some extent in its more regular and definite external markings.

*Distribution.*—We have but three or four specimens of this striking and beautiful form. They were picked out of soundings from Storm Bay, Tasmania, forwarded to us by the late Dr. Greville, of Edinburgh.

POLYMORPHINA FRONDIFORMIS, Searles Wood. (Plate XLI. figs. 33, *a*–*c*.)

*Polymorphina frondiformis*, Searles Wood, 1843, in Morris's Catalogue of British Fossils, p. 62; Jones, Parker, and Brady, 1866, Monogr. Crag Foram., App. I. & II. (foot-notes), pl. 1. figs. 62, 63, & 69; pl. 4. figs. 11–14.

*Characters.*—Shell elongate, compressed or complanate, unsymmetrical. Chambers long, fusiform, irregular. Surface depressed over portions of the septal lines; sometimes smooth, but more frequently marked by exogenous shelly growths, either in the form of circular beads or short, interrupted costæ. Length  $\frac{1}{20}$  to  $\frac{1}{6}$  inch.

*Polymorphina frondiformis* has perhaps the largest dimensions of any variety of the genus hitherto described. It was discovered by Mr. Searles Wood in the Polyzoan débris of some of the Suffolk Crag-beds; and a detailed account of it, with figures of several



of the more striking specimens will be found in our 'Monograph of the Crag Foraminifera.'

Both the form and arrangement of the chambers are very variable; and from this circumstance it is difficult to assign characters to the species with any amount of precision. The shell is sometimes flat and Textularian; and then the chambers are regular and biserial, as in Plate XLI. fig. 33, *a*. A chance specimen of this sort, without surface-markings, could scarcely be distinguished from *P. complanata*, except on the ground of difference in size. But more frequently the chambers are irregular both in form and combination, and the lines of septation are only marked by slight unequal depressions on the surface of the test. Examples in this condition often resemble *P. compressa*; but the superficial ornament, usually present to a greater or less extent, will generally serve as a means of diagnosis.

*Distribution*.—Mr. Searles Wood's gatherings from the Crag at Sutton, near Colchester, represent all we know of either the geological or geographical range of the species.

POLYMORPHINA ORNATA, Karrer. (Plate XLI. figs. 34, *a*, *b*.)

*Polymorphina ornata*, Karrer, 1868, Sitzungsber. k. Akad. Wissensch. vol. lvii. p. 175, pl. 4. fig. 10.

*Characters*.—Shell oval or subspherical, having about five visible chambers; septal lines slightly depressed. Surface having an ornamentation consisting of slightly raised warts or tubercles in more or less regular lines parallel to the long axis of the shell. Orifice stellate. Length  $\frac{1}{34}$  inch.

We adopt this pretty little variety from our friend Herr Karrer's recently published memoir on the "Miocene Foraminifera of Kostej in the Banat." The nature of the ornamentation (elongated clear beads of exogenous shell-substance) is obviously similar to that of some of our specimens of *P. frondiformis*, though more regular in point of arrangement. The shell, too, is much smaller than our Crag form and is Globuline in its general contour. It bears also many points of resemblance to the fine subcostate specimens of *P. myristiformis* obtained by Mr. Robertson on the Devonshire coast, as will be seen by a comparison of the figures. The "beads" in the one case might be regarded as costæ broken up at regular intervals, whilst in the other the interruption is irregular and less frequent.

*Distribution*.—The author gives no particulars as to its distribution; we infer, however, that it occurs in the Miocene beds of Kostej, in the Banat, Austria.

POLYMORPHINA TUBERCULATA, D'Orbigny, sp. (Plate XLI. fig. 35, *a-d*.)

*Globulina tuberculata*, D'Orbigny, 1846, For. Foss. Vien. p. 230, pl. 13, figs. 21, 22.

*Polymorphina (Globulina) tuberculata*, Egger, 1857, Neues Jahrb. für Min., Jahrg. 1857, p. 292, pl. xiv. figs. 7, 8.

*Globulina tuberculata*, Reuss, 1862, Sitz. Akad. Wiss. Wien, vol. xlvi. p. 79.

*Polymorphina tuberculata*, Karrer, 1868, *ibid.* vol. lviii, p. 173.

*Characters*.—Shell ovate or subspherical. Anterior extremity more or less acute, posterior rounded. Surface beset with tubercles of unequal size and irregularly placed. Septation obscure. Aperture radiate. Length  $\frac{1}{80}$  to  $\frac{1}{90}$  inch.



Notwithstanding the great difference that appears at first sight between Dr. Egger's specimens of *Polymorphina tuberculata* and those originally figured by D'Orbigny under the same name, there need be little difficulty in accepting them as representing the same species. A slight doubt may exist as to whether the former may not be as nearly related to *P. spinosa*; but the two varieties probably inosculate in their extreme specimens, so that this is a circumstance of minor importance. In Pl. XLI. figs. 35, *a-d*, we have copied the drawings of both authors: *a* and *b* are from D'Orbigny; *c* and *d* are after Egger. We have remarked that in some other *Polymorphinæ* the Bavarian specimens are larger and more stoutly grown, as a rule, than those of similar geological age from the Vienna Basin; and in the case of the "ornamented" forms (*e.g.* *P. spinosa*) the former show a stronger development of the distinctive markings. The term "*tuberculata*" would scarcely suggest itself as applicable to the external condition of figs. *c* and *d*, viewed by itself; but if we suppose the exostoses to originate in tubercular shelly growths, increased in size until their margins have become merged into irregular ridges, it no longer conveys an anomaly. Intermediate specimens would probably demonstrate the correctness of this view; but we are altogether dependent on the authors above quoted for our knowledge of the species.

*Distribution*.—Baden beds, Vienna Basin (D'Orbigny); Mairhof and Hausbach, Ortenburg, Lower Bavaria (Egger), and Kostej in the Banat (Karrer), all these being of Miocene age. Dr. Reuss notes its occurrence in the "Minimus-Thon" (Gault) of North Germany and in the Crag of Antwerp.

POLYMORPHINA SPINOSA, D'Orbigny, sp. (Plate XLII. figs. 36, *a, b*.)

*Globulina spinosa*, D'Orbigny, 1846, For. Foss. Vien. p. 203, pl. 13. figs. 23, 24.

*Polymorphina (Globulina) spinosa*, Egger, 1857, Neues Jahrb. für Min., Jahrg. 1857, p. 292, pl. 14. figs. 9, 10.

*P. spinosa*, Karrer, 1868, Sitz. Akad. Wissensch. vol. lviii. p. 173.

*Characters*.—Shell oblong, ovate, or subspherical. Anterior extremity acute or rounded; posterior obtuse. Surface studded with more or less closely set, stout, pointed spines. Aperture radiate. Length  $\frac{1}{50}$  to  $\frac{1}{25}$  inch.

The Bavarian specimens of this species, figured by Dr. Egger, although of nearly the same geological age, are larger than those originally described by D'Orbigny, and have the characteristic superficial spiny processes developed to a much more striking extent. Our figures are copied from Dr. Egger's illustrations of Bavarian Foraminifera.

*Polymorphina spinosa* may be easily distinguished from allied forms, except in the rare cases in which the spines simulate the shorter outgrowths of *P. tuberculata*.

*Distribution*.—It is only known as a Miocene fossil—D'Orbigny's locality being the Nussdorf beds of the Vienna Basin; Egger's, Hausbach in Lower Bavaria; and Karrer's, Kostej in the Banat.

POLYMORPHINA HIRSUTA, spec. nov. (Plate XLII. fig. 37.)

*Characters*.—Shell subspherical, gibbous, oval, or slightly compressed. Septa obscure. Surface beset with short, stout bristles. Length  $\frac{1}{40}$  inch.

Amongst the simpler Foraminifera, the tendency to form superficial outgrowths of shell-



substance shows itself under many different phases; and in several genera it is not uncommon to meet with varieties having the test beset with needle-shaped points instead of the stouter exostoses such as the tubercles and spines more frequently seen. Thus there are aculeate varieties of *Lagena*, *Nodosaria*, and *Dentalina*; and even in *Uvigerina* and *Bulimina* a disposition is manifested to assume the prickly condition, though in the latter genera it affects only certain portions of the test. From the close connexion of these types with *Polymorphina*, it is a matter of some surprise that no specimens of the genus (in a normal form) have hitherto been described with this peculiarity of surface, a circumstance probably due in part to the delicacy and perishable nature of the aculei and their liability to be worn down or otherwise obscured.

Herr E. von Schlicht, in his work on the Foraminifera of the Septaria-clay of Pietzpuhl (pl. xxxiv. figs. 1-3), has figured a single specimen of this acerose variety, but it is in the cervicorn or tubulose condition.

*Distribution*.—The figure last alluded to seems to warrant the assumption that *Polymorphina hirsuta* dates as far back as the early Tertiary period. Our fossil specimens were obtained from the Crag of Sutton, near Colchester; and we have a single recent example, which was found adhering to a clam-shell from the West Indies.

POLYMORPHINA ORBIGNII, Zborzewski, sp. (Plate XLII. figs. 38, a-o.)

*Polymorpha corcula spinosa*, Soldani, 1791, Testaceographia ac Zoophytographia, vol. i. part 2, pls. 109-111.

? *Misilus aquatifer*, de Montfort, 1808, Conchyl. Systématique, vol. i. p. 294, 74<sup>e</sup> genre.

*Raphinulina Humboldtii*, Zborzewski, 1834, Nouv. Mém. Soc. Imp. Nat. Moscou, vol. iii. p. 311, pl. 28. fig. 1, a.

*Apiopterina D'Orbigni*, id. ibid. p. 311, pl. 28. fig. 2, b.

*Guttulina damæcornis*, Reuss, 1845, Verst. böhm. Kreid. 1<sup>te</sup> Abtheil. p. 40, pl. 13. fig. 85.

*Globulina horrida*, Reuss, 1846, ibid. 2<sup>te</sup> Abtheil. p. 110, pl. 43. fig. 14.

*Gl. tubulosa*, D'Orbigny, 1846, For. Foss. Vien. p. 228, pl. 13. figs. 15, 16.

*Aulostomella pediculus*, Alth, 1849, Haidinger's Naturw. Abhandl. vol. iii. p. 264, pl. 13. fig. 17.

*A. horrida*, id. ibid. p. 264.

*Globulina horrida*, Reuss, 1850, Haidinger's Naturw. Abhandl. vol. iv. p. 43, pl. iv. fig. 8.

*Polymorphina communis* (in part), Parker and Jones, 1857, Ann. & Mag. Nat. Hist. 2 ser. vol. xix. p. 283, pl. 11. fig. 34.

*P. fistulosa*, Williamson, 1858, Rec. For. Gt. Br. p. 72, pl. 6. fig. 150.

? *Globulina tubulifera*, Bornemann, 1860, Zeitschr. deutsch. geol. Gesellsch. vol. xii. p. 16, pl. 6. fig. 10.

*Polymorphina lactea*, var. *tubulosa*, Parker and Jones, 1860, Q. J. Geol. Soc. vol. xvi. p. 302 (table); Parker and Jones, 1862, in Carpenter's Introd., Appendix, p. 311.

*P. tubulosa*, Brady, 1864, Trans. Linn. Soc. Lond. vol. xxiv. p. 473; Brady, 1865, Nat. Hist. Trans. Northumberland and Durham, vol. i. p. 99.

*P. lactea*, var. *tubulosa*, Parker and Jones, 1865, Phil. Trans. Roy. Soc. vol. clv. p. 362, pl. 13. fig. 52, a-d; M. Sars, 1865, Forekommende fossile Dyreleminger, Quartærperioden, p. 62.

*P. tubulosa*, Alcock, 1867, Proc. Manchester Phil. Soc. vol. vi. p. 85; M. Sars, 1868, Vidensk.-Selsk. Forhandler for 1868, p. 248; Jones, Parker, and Brady, 1866, Monogr. Crag Foram. pl. I. figs. 70-76.

*Characters*.—Shell free or adherent. General form variable; oval, oblong, or com-



pressed. Terminal segments developing numerous irregular expansions and tubular outgrowths.

No variety of *Polymorphina* has been made the subject of so much discussion as that comprising the fistulose modifications of the type; and to none pertains the same amount of zoological interest. As early as 1791 cervicorn specimens had attracted the attention of the Abbé Soldani, and three entire folio plates of the "Testaceographia" are devoted to their elucidation. De Montfort, in 1808, gave what we suppose to be a rough copy of one of Soldani's figures; but if it be so, it must have been drawn in entire ignorance of the characters of the genus to which it belonged, and therefore much importance cannot be attached to either his figure or description. The first figures we find serviceable for purposes of nomenclature are those appended to Zborzewski's "*Observations Microscopiques sur quelques fossiles rares de Podolie et de Volhynie*," drawn from two specimens found in the Tertiary beds of the districts indicated. Although the author has so far misunderstood the nature of their peculiarities as to constitute two new genera for them, there seems no reason why one of his specific names should not take the precedence which, in point of time, is due to it. Of the two we prefer "*D'Orbigni*"\*—the other, "*Humboldtii*," having been since used for a distinct variety of *Polymorphina*.

Somewhat later other modifications were discovered by Professor Reuss in the Chalk formation of Bohemia; and M. D'Orbigny followed with specimens from the Miocene of the Vienna Basin, representing the simplest type of the genus (*Polymorphina gibba*), with four or five radiating tubular projections at the anterior extremity of the shell, surrounding or overgrowing the orifice. Shortly afterwards Dr. Alois Alth †, continuing Prof. Reuss's observations on specimens from the same geological habitat, came to the conclusion that the physiological differences indicated by the irregular shelly outgrowths were of generic importance; and he accordingly separated the tubulose forms from the rest of the *Polymorphinæ*, under the new generic term *Aulostomella*. No subsequent writer has participated in this view; and more recent investigation has shown clearly that the wild-growing forms possess no character sufficiently uniform or constant to render even specific definition desirable, except on the plea of convenience.

It is quite open to question whether, after all, the association of examples, having as their only common character the production of a terminal chamber of a certain sort, is the best method of recognizing a physiological peculiarity. Every separate variety of the genus has, or may have, its "fistulose" condition, and Continental Rhizopodists have been satisfied to give a new name to each of these as it was discovered,—a system open to great objection. One alternative is to place them together under a single head; another, to distribute them as subvarieties under the names of the symmetrical types in which they have their origin ‡. The former of these two courses has certain advantages for

\* "*Orbignii*" is manifestly more correct, and we have taken this amount of liberty with the original spelling in adopting the specific term; we do not say "*Von Humboldtii*."

† Haidinger's Naturw. Abhandl. vol. iii. p. 263.

‡ Prof. Reuss appears recently to have adopted the latter of these alternatives. In his "*Wieliczka*" memoir, p. 72, he places *Globulina tubulosa*, D'Orb., under *Polymorphina gibba*, with the note "*Monströse Aulostomellenform*," a diagnosis which agrees with the table at page 246.



purposes of description ; and, in conformity with the views already expressed as to the scope and limitation of subdivision in a group constituted like the genus *Polymorphina*, there need be no hesitation in its adoption. It is also more in conformity with our treatment of the varieties in which surface-ornamentation is accepted as a ground for binomial distinction.

A few examples from the list of synonyms will show the relationship between the simple and their corresponding fistulose forms. Thus, the typical

<i>Polymorphina lactea</i>	becomes in its cervicorn condition	<i>P. horrida</i> , Reuss, sp.
<i>P. gibba</i>	” ” ”	<i>P. tubulosa</i> , D'Orb., sp.
<i>P. trigonula</i>	” ” ”	<i>P. damæcornis</i> , Reuss, sp.
<i>P. compressa</i>	” ” ”	<i>P. fistulosa</i> , Williamson.
<i>P. regina</i>	” ” ”	like the Crag variety figured Pl. XLII. fig. 38, <i>m</i> .
<i>P. fusiformis</i>	” ” ”	the long tubulose variety found in the Chalk.
<i>P. hirsuta</i>	” ” ”	the prickly fistulose form fi- gured by Herr von Schlicht, <i>op. cit.</i> , pl. xxiv. figs. 1-3.

and so forth. Reference to the plates will confirm and extend this analogy.

The lobed and tubular extensions of the shell, which constitute the common character of the series, are never alike in two specimens, but vary in extent and shape, from minute excrescences resembling papillæ on the terminal chamber, to irregular expansions completely investing the test. The condition most commonly found in free-growing recent specimens is that of tubular passages commencing at the orifice and running in the direction of the base of the shell. These passages are at intervals prolonged outwards, and form smaller tubes, which again branch and constitute what have been described as “stag's-horn processes” or “cauliflower excrescences.” The ends of the smaller tubuli are usually found open ; and it is likely that they take the place, in part at least, of the normal terminal orifice, which is often overgrown to such an extent as to preclude the passage of pseudopodia. We can scarcely coincide with Dr. Carpenter's view, that “such wild-growing specimens are probably always parasitic.” In our experience, adherent examples are very rare ; almost the only instances we recollect are those represented in the two figures, Pl. XLII. figs. 38 *i, j*, one recent, the other from the Crag. On the other hand, the most abundant gathering of fistulose specimens we have met with was from sand recently dredged in Berwick Bay, from which hundreds of examples might have been selected, not one of which bore any trace of attachment to a foreign body ; indeed the soft, granular nature of the material in which they lived, would of itself indicate no ground for this supposition. Again, those found in the Chalk appear to have been quite independent in their manner of growth. At the same time the specimens cited are sufficient evidence that the animal has the power, under favourable circumstances, of fixing or rooting itself by the tubular prolongations of the shell-wall.

The ends of the tubuli are by no means invariably open, but are often found sealed in



by the continuation of the shelly investment; and the question has been raised, whether this may not be their normal condition. Further observations on living specimens are much needed; without them it can scarcely be admitted that the open ends are due to the breakage or erosion of the calcareous investment. It is not uncommon to meet with *Polymorphinæ* having irregular perforations of considerable size in the shell-wall. The same peculiarity may be and is observed from time to time in other genera; but in none does it exist to the same extent as a habit of growth, and in the particular varieties at present under notice it is a distinguishing feature. Soldani, as early as 1791, makes those frequent, large, irregular or rounded orifices very prominent in some of his figures, and appears to have suspected that they were indications of importance; and they have not been passed over by subsequent writers. Dr. Alcock, however, in some interesting observations on *Polymorphina tubulosa*\*, draws from them an ingenious argument in favour of the view that Foraminifera have the power of absorbing and re-precipitating portions of the carbonate of lime of which the shell-wall is formed, and supports the theory by collateral evidence. Thus, in specimens having the supplementary fistulose chamber, we find that the primary shell has the thickened homogeneous wall usual amongst fully grown Foraminifera of the same class, whilst the wild-growing portion of the test is of much more delicate texture. Individuals in which the irregular growths have been broken away (Pl. XLII. figs. 38, *g*, *k*, *l*) commonly exhibit a number of the perforations alluded to, in the region of the primary shell which formed the floor of the fistulose chamber. It might be supposed that the irregular segment was the result of the covering in of a lobe of sarcode issuing from those large perforations—in other words, that the perforations were the cause rather than the effect of the aberrant chamber; but this supposition is inconsistent with the well-observed fact, that the shell-wall is uniformly diminished in thickness over those portions which are so covered in. In old and worn specimens in which the fistulose chamber, from the tenuity of its wall, has been quite lost, its exact extent may commonly be traced by observing the outline of the area on the primary shell so thinned away. It would scarcely be necessary to insist on this, were it not that the Protozoa are seldom accredited with the power of performing any but the most simple vital processes. In some of the Mollusca the habit of thinning the interior portions of the calcareous spire as its growth advances is well ascertained; and a section of one of these shells presents some curious resemblances to our drawing, Pl. XL. fig. 12, *e*, taken from an accidentally broken specimen of a common thick-walled variety. It has been noticed, also, that, not unfrequently, the stolon-passages between the older chambers of large individuals are very free and patulous, whilst the terminal orifice of the last segment consists only of constricted radiate slits. It is fair to assume that this difference is due to resorption of calcareous material.

The shelly investment of the cervicorn chamber differs much in appearance and texture

\* Proc. Lit. and Phil. Soc. Manchester, vol. vi. p. 85. See also note on *Polymorphina lactea* in a memoir by W. K. Parker and T. R. Jones, on "Some Foraminifera from the North Atlantic and Arctic Oceans," Phil. Trans. vol. clv. p. 361, in which the opening of foraminal communication by absorption had previously been suggested as a possible explanation of the rows of orifices sometimes met with on the side of the antepenultimate, and even of the earlier chambers in these free-growing varieties.



from that of the earlier and regular segments. The latter are usually smooth, solid, and almost structureless; the former are delicately thin, and beset with minute, pointed rugosities, which have a glassy, subcrystalline appearance under a high magnifying-power. The difference is probably due to increased or diminished rapidity of deposition under the altered relations of the terminal sarcode lobe.

The nature of the irregular chambers is best explained by its analogy to conditions occasionally presented by other types. In luxuriant specimens of many genera, *Textularia* for instance, it is not uncommon to find a chamber abnormally large and unsegmented completing the shell—that is to say, sarcode enough for two or three segments of the normal size closed in, in bulk as it were, without subdivision. This is no evidence of enfeebled vital power as has been suggested\*, probably the contrary; for in the localities where the tubulose varieties most abound, the *Polymorphinæ*, in common with other Foraminifera, are remarkable for their fine proportions and apparently vigorous growth.

*Distribution.*—*Polymorphina Orbignii* is widely distributed both geologically and geographically. In one or other of its various modifications it has been noticed in the Chalk of Bohemia and the South of England, and the Chalk-marl of Kent and Central Europe, in the Tertiaries of the South-west of Russia, the Septaria-clays of Northern and Central Germany, the Miocene deposits of the Vienna Basin, the Pliocene clays of North Italy, and the Crag of our Eastern Counties. In the living state it is found wherever other members of the genus are abundant. We have record of its occurrence in the English Channel (55–60 fathoms), in the Mediterranean, on the shores of Norway, in the Arctic Sea, and at almost every part of our own coast. It is one of the three *Polymorphinæ* which were obtained by Dr. Sars from a depth of 300 fathoms in the North Atlantic.

#### Subgenus DIMORPHINA, D'Orbigny.

*Orthoceratium* (in part), Soldani, 1780.

*Dimorphina*, D'Orbigny, 1826; Sander-Rang, 1829; Menke, 1830; Reuss, 1845; Parker, Jones, and Brady, 1865; Schwager, 1866; Karrer, 1868; Von Schlicht, 1869.

*General Characters.*—Shell free, inequilateral; commencing growth in alternating (obscurely triserial) segments, as in the typical *Polymorphinæ*, but becoming uniserial after a certain number of chambers are formed. Orifice, at the summit of the terminal chamber.

In the subgenus *Dimorphina* have been included those few members of the group which commence growth regularly on the *Polymorphine* plan, but subsequently take on a *Nodosarian* arrangement of the chambers. As previously set forth, their separation cannot be regarded as absolute or very well-defined, but still sufficiently so to serve a practically useful purpose. We have, however, retained in the typical division of the group those specimens (like *Polymorphina nodosaria*, Reuss) whose chambers are oblique and alternating, and whose uniserial condition depends on an attenuated habit of growth, diminishing or entirely precluding the usual overlap of the segments. These we regard

\* Dr. Alcock, *op. cit.*



as extreme examples of the normal arrangement, inasmuch as they do not exhibit any real difference of plan between the earlier- and later-formed portions of the shell.

The phenomenon of change in the typical plan of growth is by no means uncommon amongst the Foraminifera. A triserial genus may have biserial varieties; for instance, *Bulimina*, which in all its more perfect forms has three or more segments to each turn of its spire, presents in the feebler varieties which constitute the subgenus *Bolivina*, an alternation of but two sets of chambers, and in this condition is scarcely distinguishable from *Textularia*; whilst *Textularia* itself, though typically biserial, has a uniserial group (*Bigenerina*) precisely analogous to the Polymorphine subgenus *Dimorphina*. The closely allied genus *Uvigerina* has also a uniserial section, described by D'Orbigny under the generic name *Sagrina*; and it would be very difficult to assign any characters that would serve in every case to distinguish it from *Dimorphina*. The Uvigerine parentage generally, however, betrays itself either in a long phial-shaped neck or by an ornamentation of raised lines and minute spines at some portion of the surface of the test.

*Distribution*.—It is to its morphological peculiarities, and to the assistance they yield in elucidating the relationship of several parallel genera, that *Dimorphina* owes its interest and importance; for in point of distribution the subgenus yields little ground for comment. It is very rare both in a recent and fossil state, too rare to be of service in the estimation of any external physical conditions. Its occurrence seems to be limited to a few particular deposits of the Tertiary epoch and to occasional living specimens from the seas of warm latitudes.

**DIMORPHINA TUBEROSA, D'Orbigny\*.** (Plate XLII. figs. 39, *a*, *b*.)

*Orthoceratium tuberosum*, Soldani, 1780, Testac. ac Zooph. vol. ii. p. 99, pl. 106. fig. *gg*.

*Dimorphina tuberosa*, D'Orbigny, 1826, Ann. Sci. Nat. vol. vii. p. 264, No. 1; "Modèle," No. 60.

*D. nodosaria*, D'Orbigny, 1846, For. Fos. Vien. p. 221, pl. 12. figs. 21, 22.

*D. tuberosa*, Parker, Jones, & Brady, 1865, Ann. & Mag. Nat. Hist. 3 ser. vol. xvi. p. 14, pl. 2. fig. 53.

*D. nodosaria* (in part), *Iid.* 1866, Monogr. Crag Foram., App. I. & II. pl. 1. fig. 61; Karrer, 1868, Sitzungs. k. Akad. Wissenschaft, vol. lviii. p. 177.

*Characters*.—Shell elongate, subcylindrical, straight, or nearly so. Anterior portion acuminate; posterior obtuse, and rounded. Early (alternating) chambers varying greatly in their proportion to the whole shell. Later (uniserial) chambers two to six in number, more or less inflated. Surface smooth. Length  $\frac{1}{50}$  to  $\frac{1}{25}$  inch.

The differences indicated by M. D'Orbigny between *Dimorphina tuberosa* and *D. nodosaria* are such as will scarcely bear examination; and we are compelled to regard them as the same variety, reserving the latter trivial name for a distinct form, belonging to the *Polymorphinæ* proper, described by Professor Reuss. M. D'Orbigny's figures of the

\* It is the custom to ignore the names given by pre-Linnæan observers, and those who wrote before the Linnæan method of nomenclature was generally adopted, in quoting the authority for specific or generic terms; else to Soldani, rather than D'Orbigny, should the present species be attributed; the latter only adopted the designation previously given by the indefatigable Tuscan naturalist.



two forms he separates specifically, correspond very nearly; but *D. tuberosa* is said to be recent, and to have its alternating segments more largely developed than *D. nodosaria*, which he regarded as essentially a fossil species. The relative development of the two portions of the shell, in point of fact, varies with each individual specimen; and the mere question of time, we repeat, cannot rightly be admitted as an element affecting zoological characters.

*Distribution.*—*Dimorphina tuberosa* is rare. It occurs as a fossil in the Tertiary deposits of Italy and Spain, of the Vienna Basin, and the East of England. Mediterranean soundings from depths not exceeding one hundred fathoms occasionally bring to light living specimens.

*DIMORPHINA OBLIQUA*, D'Orbigny. (Plate XLII. figs. 40, *a-c*.)

*Dimorphina obliqua*, D'Orbigny, 1846, For. Foss. Vien. p. 220, pl. 12. figs. 18–20.

*Characters.*—Shell elongate, arcuate. Anterior and posterior extremities acuminate. Chambers oblique, convex. Aperture excentric. Surface smooth. Length  $\frac{1}{25}$  inch.

The uniserial chambers of *D. obliqua*, as described by D'Orbigny, are in a curved line, and oblique in their setting-on, simulating the characters of *Dentalina* rather than those of the straight *Nodosarinæ*. The primary alternating segments are few, small, and inconspicuous. We have never met with specimens having precisely the aspect shown in the "Vienna" plates, the nearest approach being the elongate *Polymorphinæ* with two, or sometimes even three, oblique chambers, succeeding each other in one line, occasionally to be met with in shallow-water dredgings; and in these examples the uniserial segments are not developed with the regularity which marks M. D'Orbigny's figures. Judging from analogy, the existence of such a form might be anticipated; and if the biserial (or spiral) chambers are habitually as small and inconspicuous as they are represented in the drawing, it is not surprising that they have been overlooked by other observers. It is more than possible that two specimens figured by M. Terquem as *Bigenerina dentaliniformis* (Sixième Mémoire sur les Foraminifères du Lias, pl. 22. figs. 29, 30) are *Dimorphinæ*; and if so, they differ from *D. obliqua* chiefly in their extreme length and tenuity; but the drawing is too obscure to permit exact diagnosis.

Our figures are copied from the original ones (For. Foss. Vien. pl. xii.), and somewhat enlarged for the sake of greater distinctness.

*Distribution.*—The sole habitat given by D'Orbigny is "Baden (near Vienna), not common," his specimens being, of course, Miocene fossils.

*DIMORPHINA COMPACTA*, spec. nov. (Plate XLII. fig. 41.)

*Dimorphina tuberosa* (in part), Jones, Parker, & Brady, 1866, Monogr. Crag Foram., App. I. & II. pl. 1. fig. 66.

*Characters.*—Shell elongate, subcylindrical, arcuate, compactly built; anterior extremity obtuse or truncate; posterior rounded. Margin even; septa marked only by faint lines. Later segments set on obliquely. Length  $\frac{1}{10}$  inch.

This variety furnishes another instance of the close parallelism that exists between the



allied genera *Polymorphina* and *Nodosarina*. As amongst the *Nodosarinæ* (whether curved or straight) varieties are found having the chambers so combined that no constriction marks the course of the septal lines, so in *Dimorphina compacta* we have an even margin and obscure septation arising from the same habit of growth. The peculiarity of contour depending upon the relation of the chambers has been deemed sufficient for "specific" definition in the case of such modifications of *Nodosaria*, *Dentalina*, and *Vaginulina*; and it is only consistent to distinguish similar *Dimorphinæ* by a trivial name. For this reason, although the present variety was associated with some of its congeners in our partially finished "Monograph of the Foraminifera of the Crag," under the general term *Dimorphina tuberosa*, we have since regarded it as meeting better the exigencies of a scheme of subdivision to distinguish it from the more common form having ventricose chambers.

*Distribution*.—*Dimorphina compacta* is of rare occurrence. We know it only as a Tertiary fossil, from specimens obtained by Mr. Searles Wood in the rich Crag deposit at Sutton, which has furnished so many rarities.

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### DESCRIPTION OF THE PLATES.

*General Note*.—The great difference in the size of the various species has rendered it impracticable to make the drawings on a uniform scale. The idea of relative size is conveyed by the small vertical line placed near each figure, which represents *five times* the length of the longer diameter of the shell. The actual measurement of average specimens is given with the descriptions of species.

The *numbers*, 1 to 41, represent "species;" the *small letters* refer to different aspects of the same shell, or different specimens of the same "species."

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### PLATE XXXIX.

Fig. 1. *Polymorphina lactea*, Walker and Jacob, sp.: *a*, copy of Walker and Jacob's original figure slightly enlarged; *b*, typical form, after Williamson; *c*, monstrous double specimen.

[For sketches of the compressed variety, *P. lactea*, var. *amygdaloides*, Reuss, see Woodcuts *a* to *d*, p. 215.]

Fig. 2. *P. gibba*, D'Orbigny: *a* and *b*, typical form; *c* and *d*, compressed variety, *P. gibba*, var. *æqualis*, D'Orbigny.

Fig. 3. *P. gutta*, D'Orbigny. Copied from D'Orbigny's figures.

Fig. 4. *P. acuminata*, D'Orbigny. Copied from D'Orbigny's figure of a Chalk specimen.

Fig. 5. *P. fusiformis*, Roemer: *a*, after Reuss ("*Globulina porrecta*"); *b* and *c*, after Bornemann ("*Guttulina cylindrica*").



[A figure of the stouter fusiform variety ("*Polymorphina liassica*," Strickland) is given at p. 220, Woodcut *e*.]

- Fig. 6. *P. cylindroides*, Roemer: *a* and *b*, copied from Roemer's figures (Tertiary); *c*, after Williamson ("*P. lactea*, var. *acuminata*") recent.
- Fig. 7. *P. oblonga*, Williamson. From Williamson's figures of a recent specimen.
- Fig. 8. *P. anceps*, Philippi: *a* and *b*, exterior aspects of the shell; *c*, diagram showing septation. All after Reuss.
- Fig. 9. *P. Burdigalensis*, D'Orbigny: drawn from D'Orbigny's "Modèle no. 29."
- Fig. 10. *P. communis*, D'Orbigny. Copied from the original figures in the "Tableau Méthodique."
- Fig. 11. *P. problema*, D'Orbigny: *a*, drawn from D'Orbigny's "Modèle no. 61;" *b*, specimen from the Crag.

#### PLATE XL.

- Fig. 12. *Polymorphina compressa*, D'Orbigny: *a*, recent specimen, after Williamson ("*P. lactea*"); *b*, specimen from the Crag; *c* and *d*, Miocene specimens, after D'Orbigny; *e*, broken example from the Crag, showing the mode of septation and anomalous labyrinthic aperture; *f*, portion of thickened shell-wall, in which the pores have become lengthened into tubes; *g*, porous aperture of a specimen from the Crag.
- Fig. 13. *P. regularis*, Von Münster. Copied from Prof. Reuss's figures.
- Fig. 14. *P. complanata*, D'Orbigny. Copied from D'Orbigny's figures (Vienna Basin).  
[Figures of a range of varietal forms are given at p. 230, Woodcuts *f* to *j*.]
- Fig. 15. *P. elegantissima*, Parker and Jones. Recent specimens: *a*, from Melbourne, Australia; *b* and *c* from Storm Bay, Tasmania.
- Fig. 16. *P. trigonula*, Reuss, sp.: enlarged from Prof. Reuss's figures.
- Fig. 17. *P. Thouini*, D'Orbigny: drawn from D'Orbigny's "Modèle no. 23."
- Fig. 18. *P. nodosaria*, Reuss: after Reuss.
- Fig. 19. *P. rotundata*, Bornemann, sp. (the typical form is shown at p. 234, Woodcuts *k*, *l*, *m*): *a* and *b*, variety figured by Bornemann as "*Guttulina incurva*;" *c*, *d*, and *e*, variety figured by Bornemann as "*Guttulina fracta*."
- Fig. 20. *P. Soldanii*, D'Orbigny. Copied from Soldani.
- Fig. 21. *P. Humboldtii*, Bornemann. After Bornemann.
- Fig. 22. *P. concava*, Williamson. After Williamson.
- Fig. 23. *P. rugosa*, D'Orbigny: *a* and *b*, "*Globulina rugosa*," D'Orbigny (Miocene); *c* and *d*, "*Polymorphina rugosa*," D'Orbigny (recent, Cuba).
- Fig. 24. *P. variata*, Jones, Parker, and Brady. Drawn from a Crag specimen.

#### PLATE XLI.

- Fig. 25. *Polymorphina digitalis*, D'Orbigny. After D'Orbigny (Miocene).
- Fig. 26. *P. granulosa*, Egger. After Egger (Miocene).
- Fig. 27. *P. australis*, D'Orbigny. After D'Orbigny (recent, Patagonia).
- Fig. 28. *P. pulchella*, D'Orbigny. After D'Orbigny (recent, Cuba).
- Fig. 29. *P. irregularis*, D'Orbigny. After D'Orbigny (recent, West Indies).
- Fig. 30. *P. myristiformis*, Williamson: *a*, specimen with delicate markings, after Williamson (recent); *b* and *c*, specimens from Eddystone, with stronger interrupted costæ.
- Fig. 31. *P. costata*, Egger. After Egger (Miocene).
- Fig. 32. *P. regina*, n. s. Recent specimen from Storm Bay, Tasmania.
- Fig. 33. *P. frondiformis*, Searles Wood. From Crag specimens.



Fig. 34. *P. ornata*, Karrer. From Karrer's drawings (Miocene).

Fig. 35. *P. tuberculata*, D'Orbigny, sp.: *a* and *b*, after D'Orbigny (Miocene); *c* and *d*, after Egger (Miocene).

## PLATE XLII.

Fig. 36. *Polymorphina spinosa*, D'Orbigny. After D'Orbigny (Miocene).

Fig. 37. *P. hirsuta*, n. s. Drawn from a Crag specimen.

Fig. 38. *P. Orbignii*, Zborzewski: *a* represents "*Globulina horrida*," Reuss (Cretaceous); *b* represents "*G. tubulosa*," D'Orbigny (Miocene); *c*, Crag specimen; *d* represents "*Polymorphina fistulosa*," Williamson (recent); *e*, recent compressed form; *f* and *g*, Crag specimens; *h* represents "*Guttulina damæcornis*," Reuss (Cretaceous), enlarged from Prof. Reuss's figure; *i* represents the parasitic variety adherent to a broken mollusk-shell, recent, from the English Channel (there is a little adherent specimen of *Polytrema* (P) on the same shell); *j*, parasitic specimen from the Crag; *k* and *l* represent a portion of the shell-wall uncovered by the breaking off of the cervicorn growths, showing large perforations; *m* represents a striato-fistulose specimen from the Crag.

## DIMORPHINA.

Fig. 39. *Dimorphina tuberosa*, D'Orbigny: *a*, from D'Orbigny's "Modèle no. 60;" *b*, a less regular specimen, from the Crag.

Fig. 40. *D. obliqua*, D'Orbigny. After D'Orbigny (Miocene specimen).

Fig. 41. *D. compacta*, Jones, Parker, and Brady. From a Crag specimen.

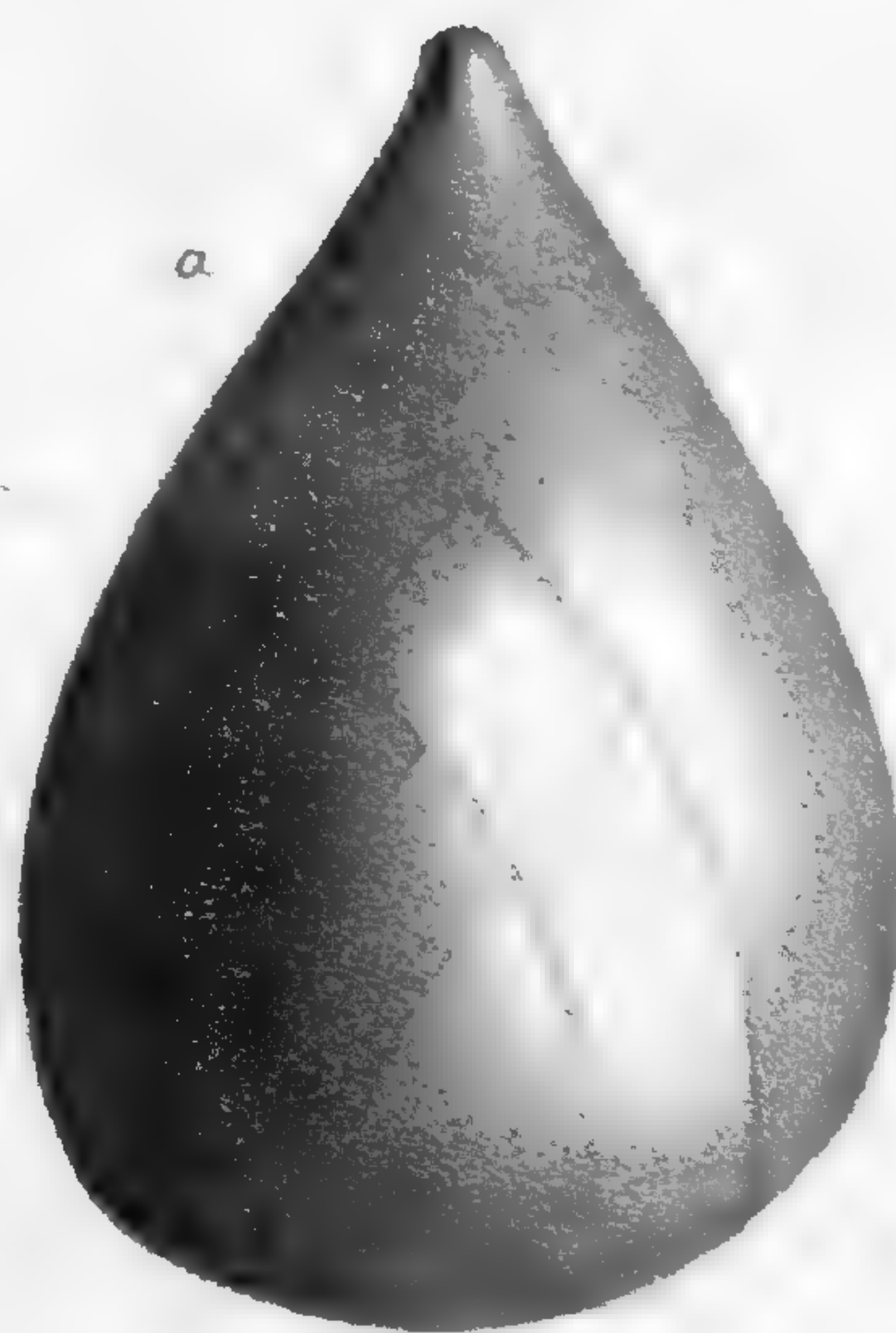
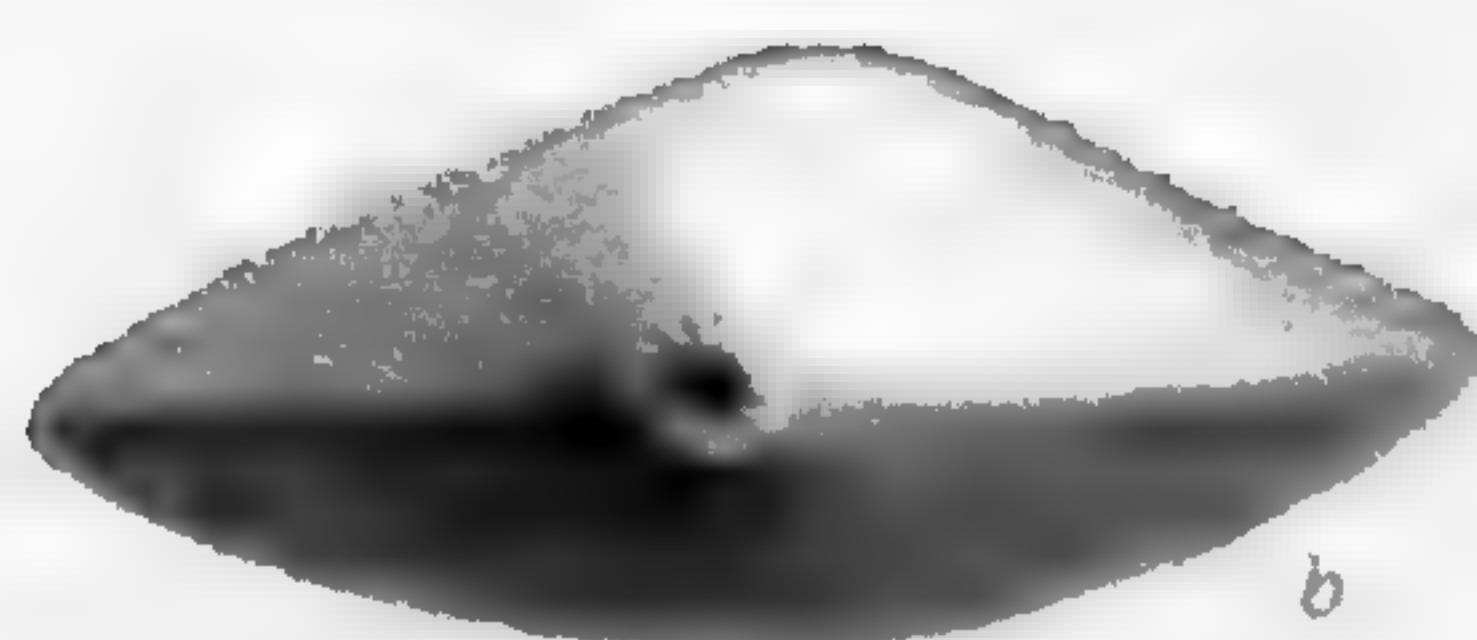
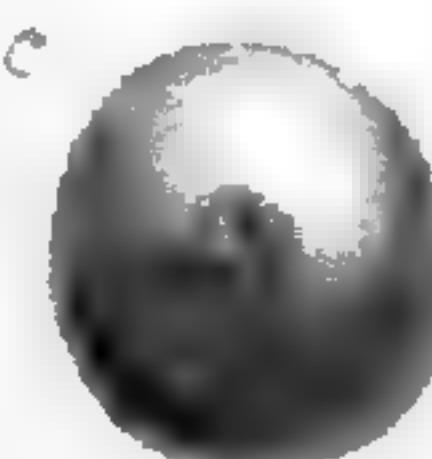
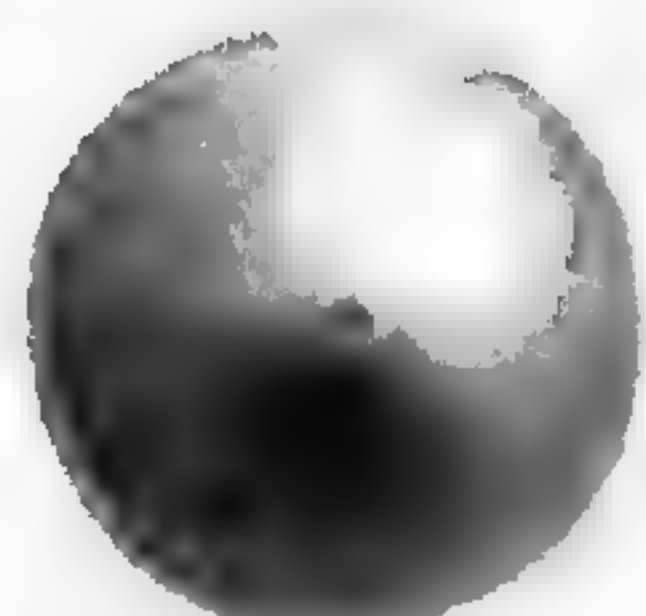
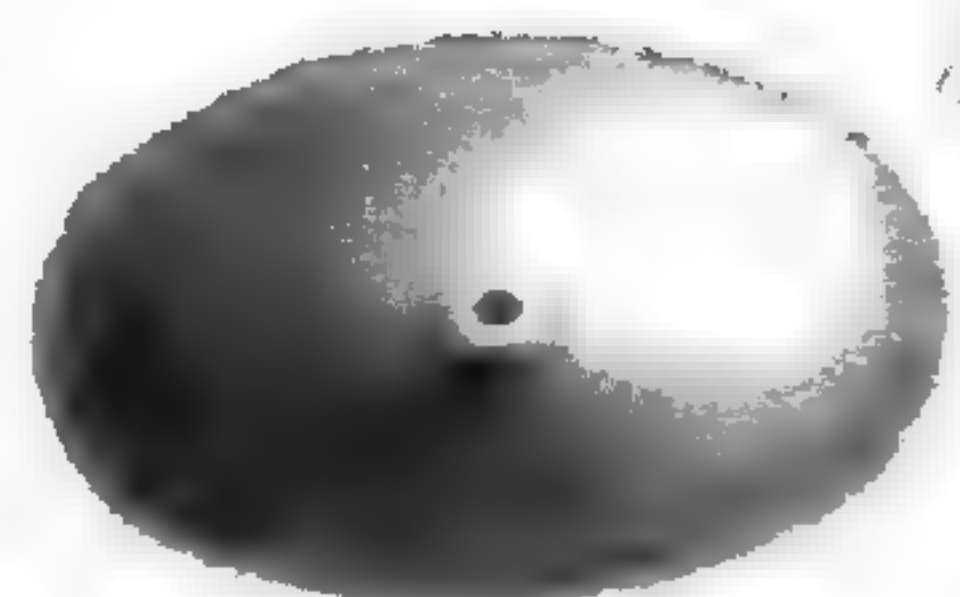
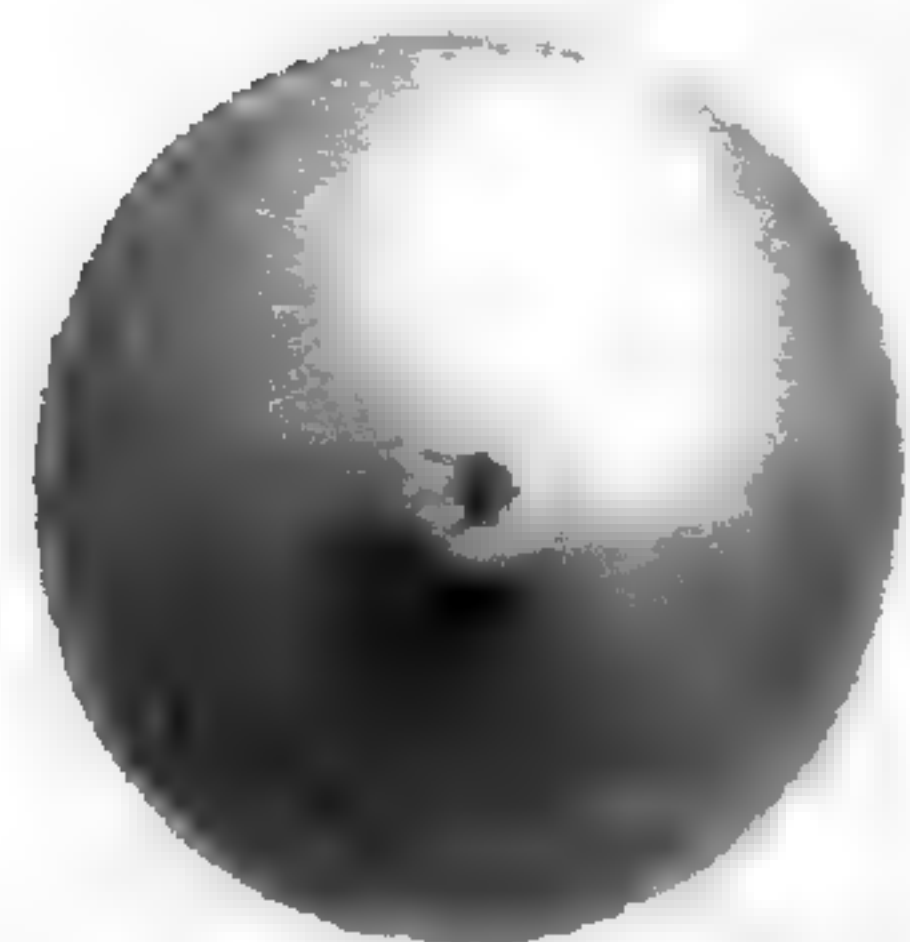
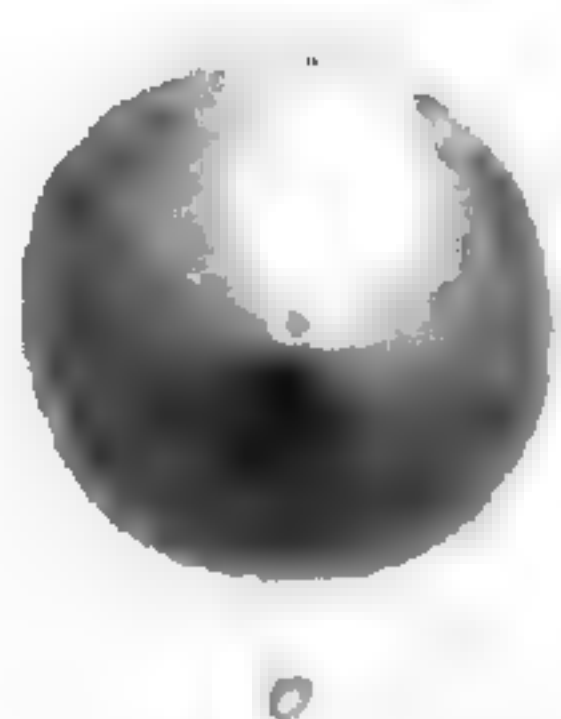
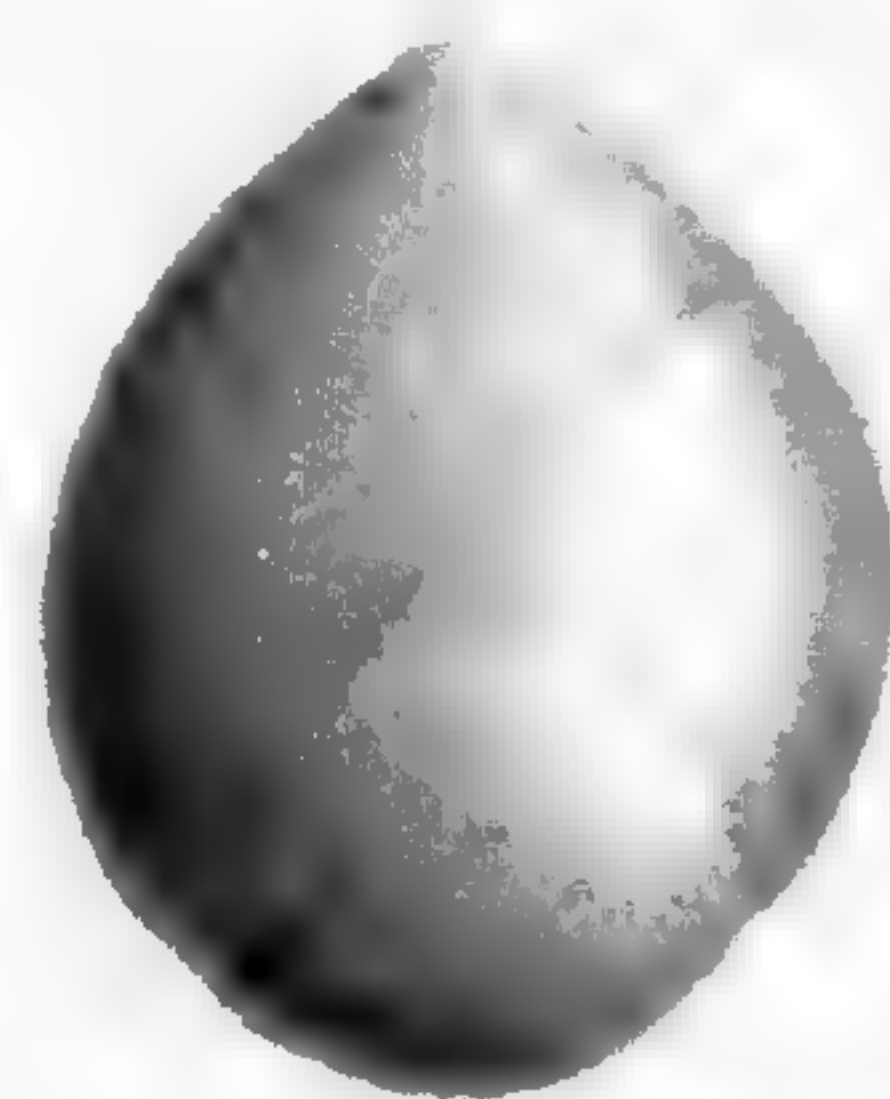
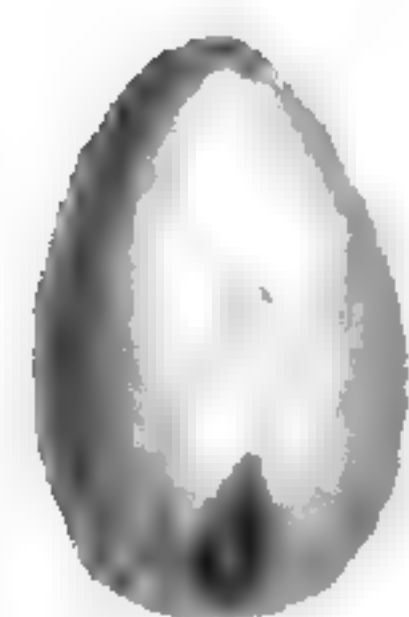
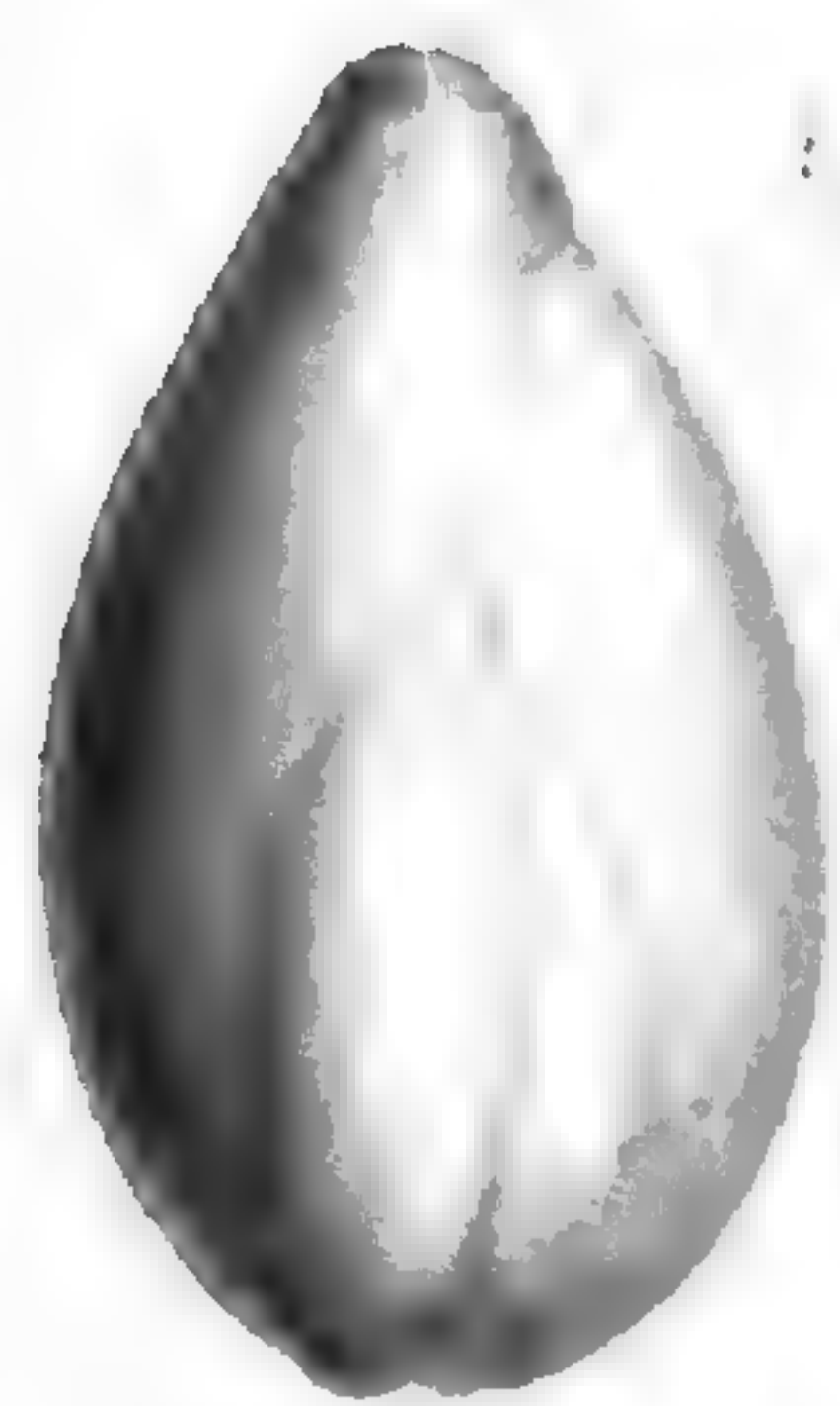
## POSTSCRIPT.

We have not, perhaps, stated with sufficient clearness how close we regard the relationship between POLYMORPHINA and UVIGERINA. Although we have not felt justified, under the limitations of our present knowledge, in uniting these two groups, we could adduce very strong arguments in favour of such a course. We accept the separation of these genera as a provisional and convenient arrangement rather than as a fixed decision founded on definite or strongly marked characters.









6

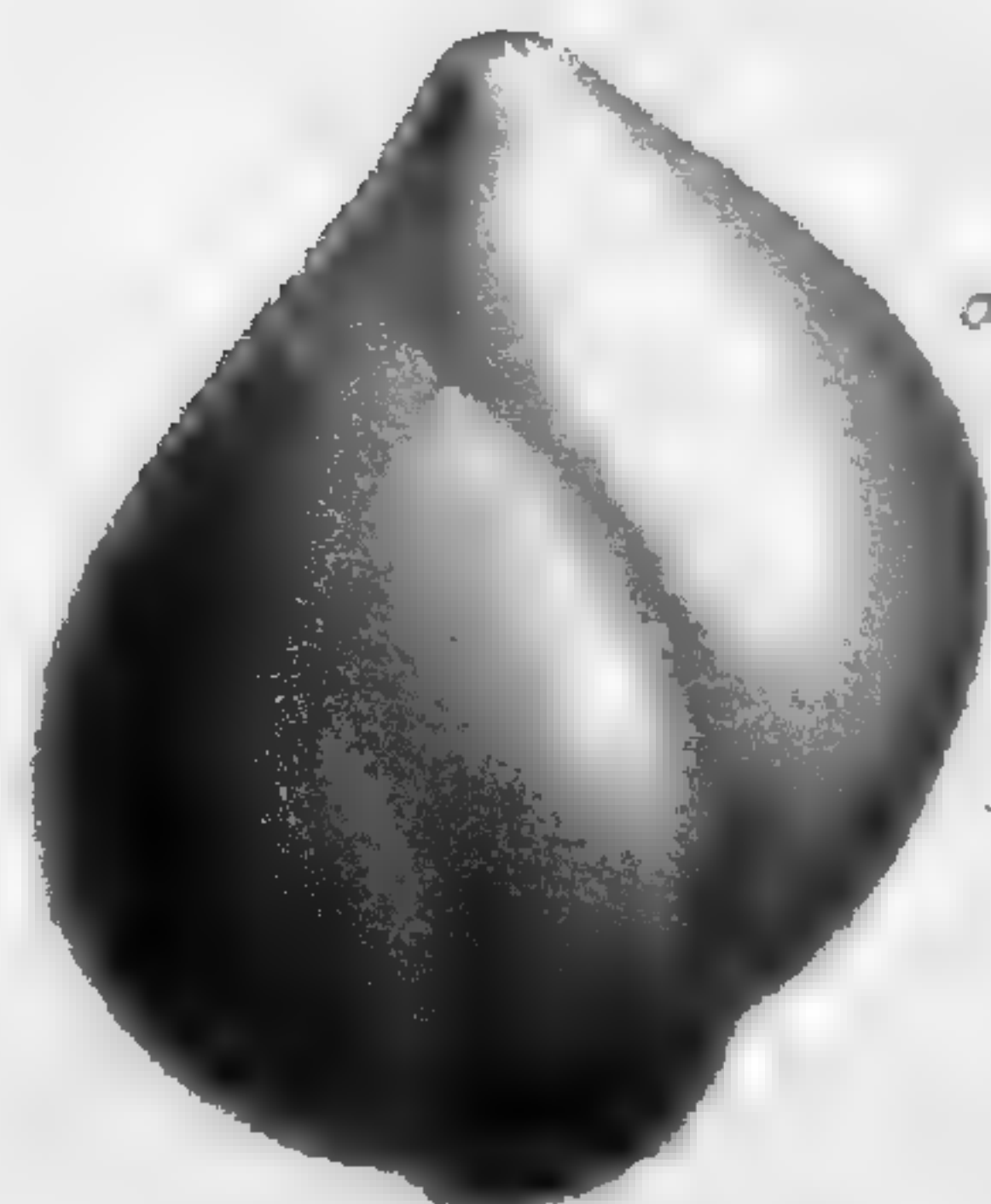
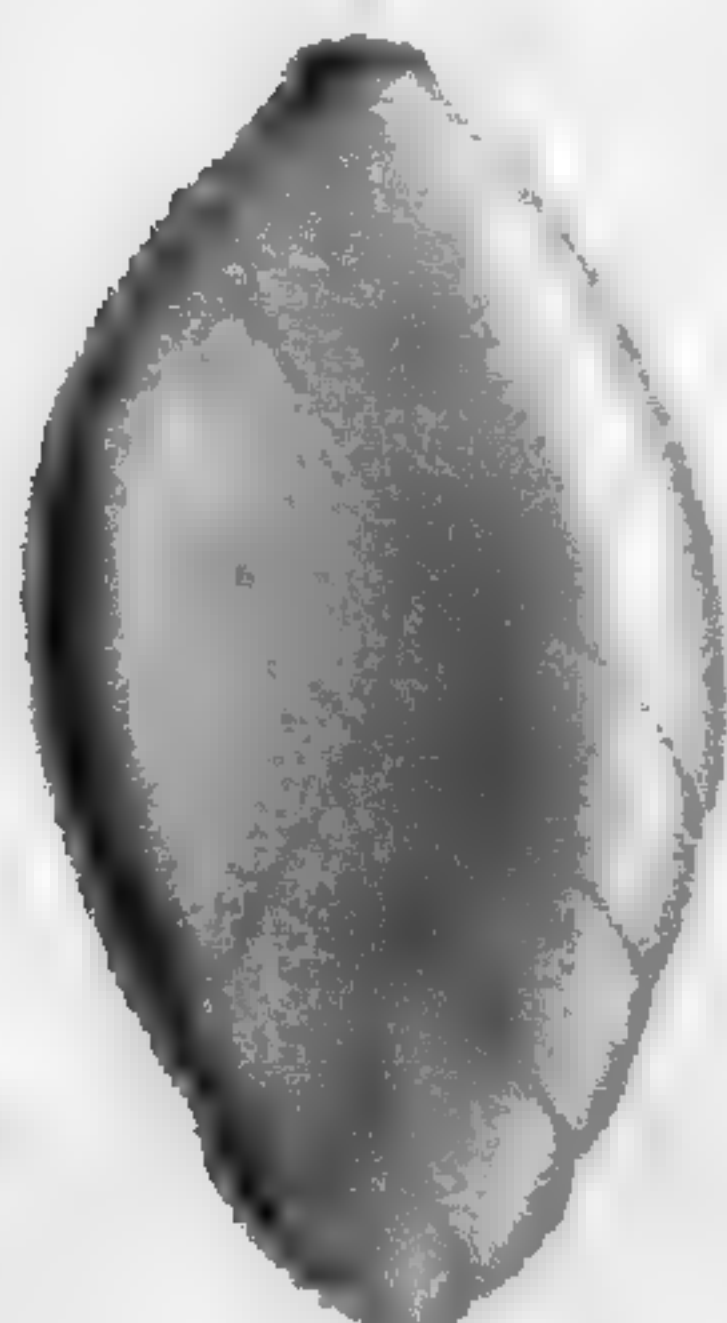


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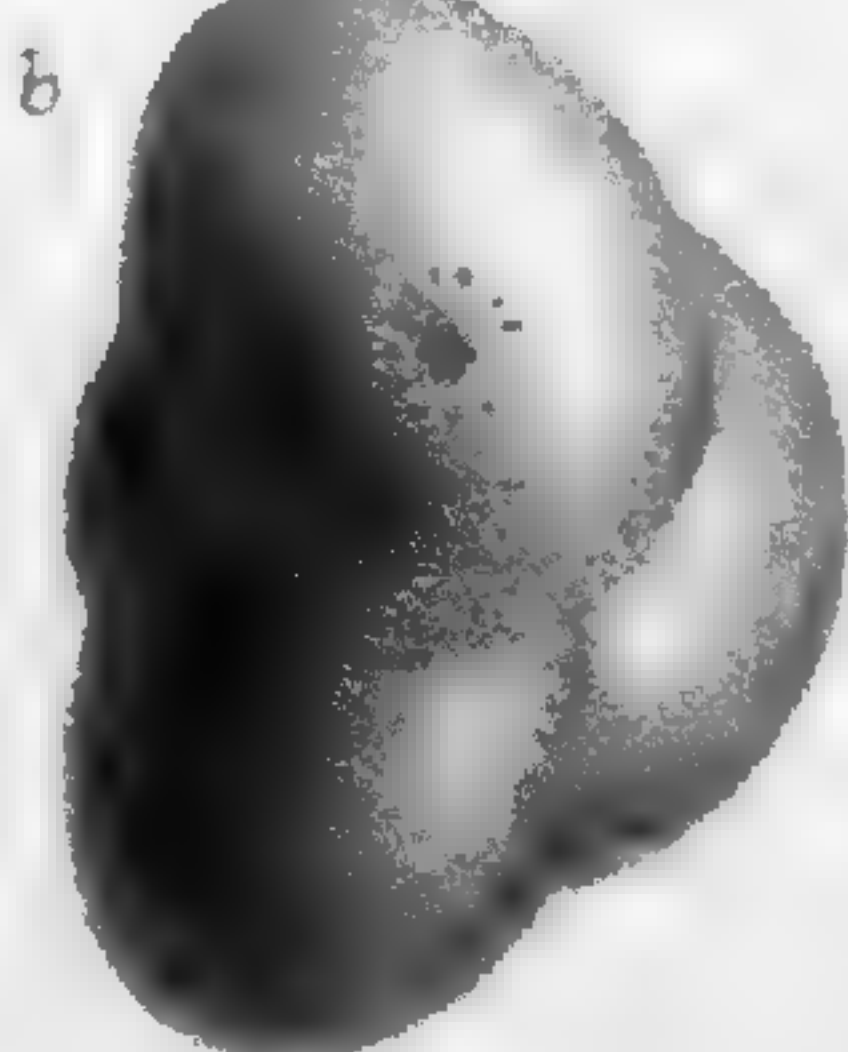


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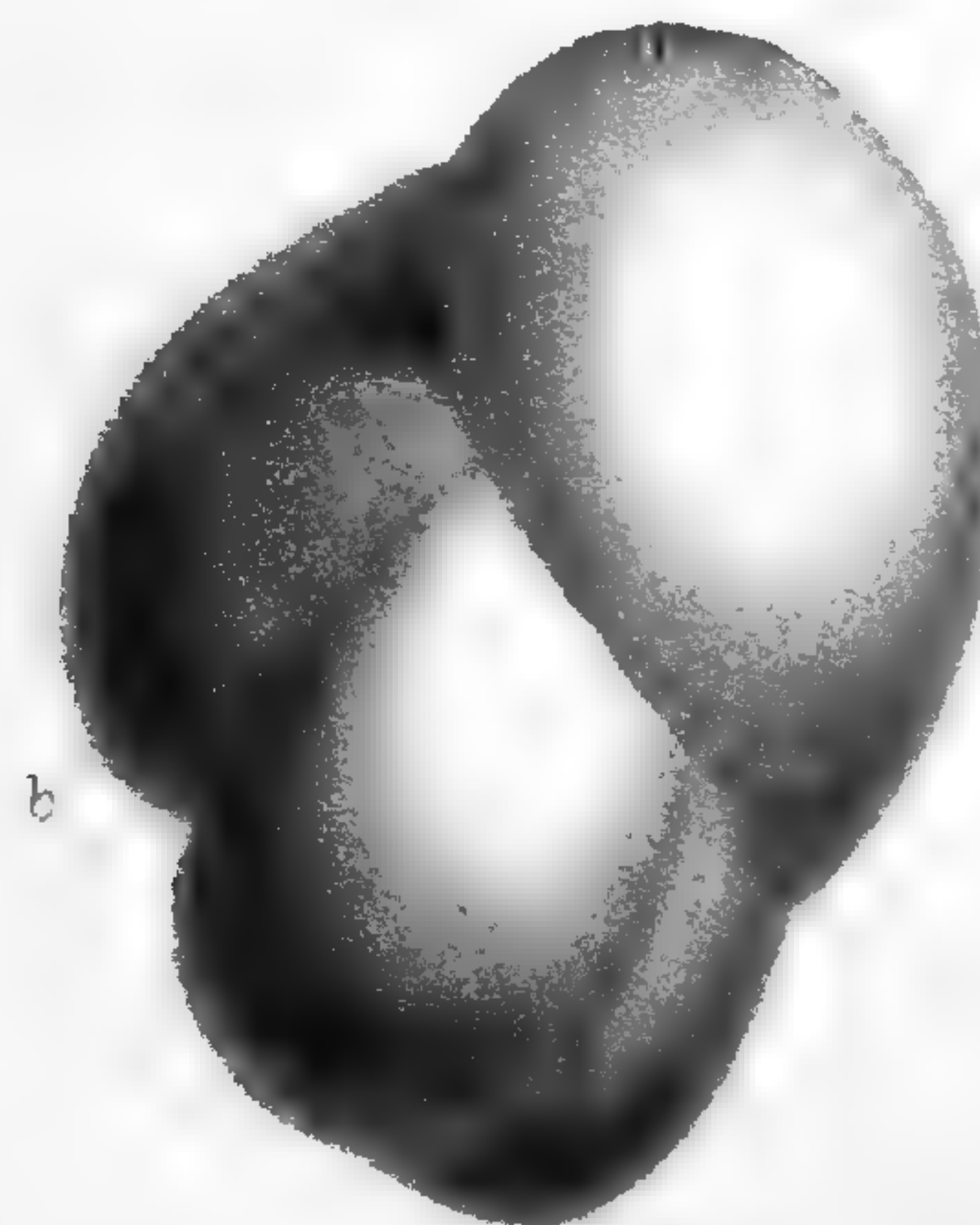
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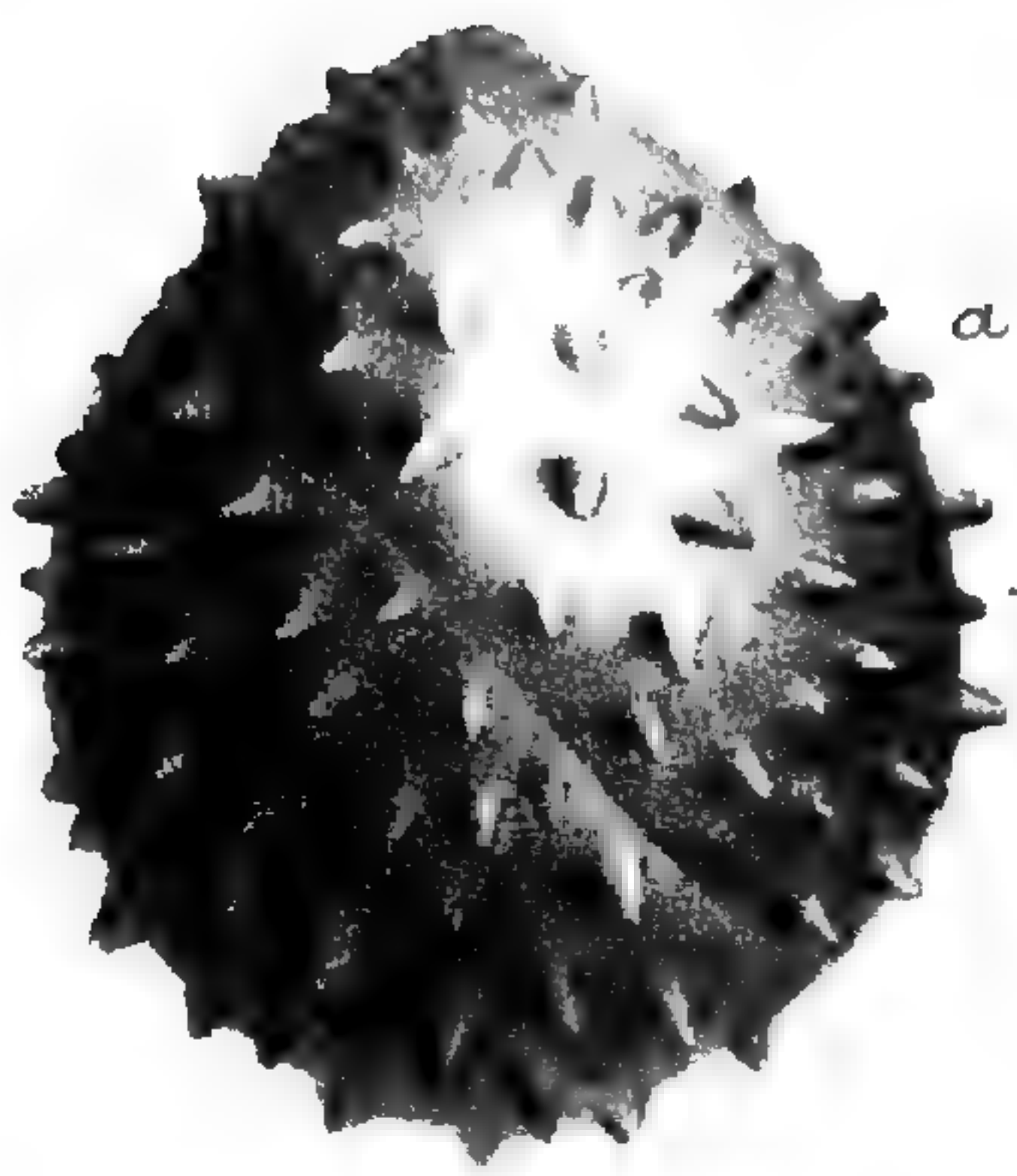






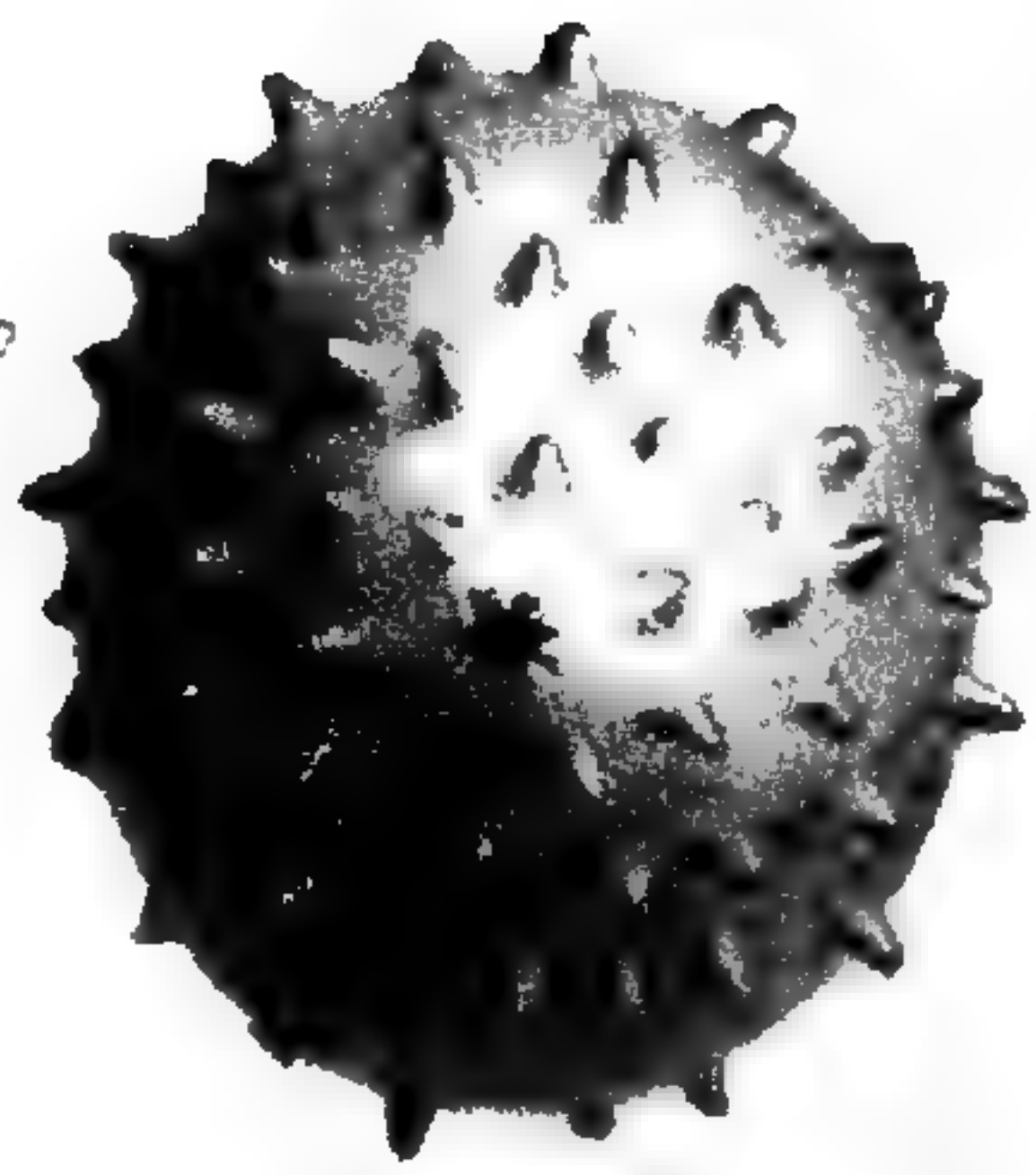


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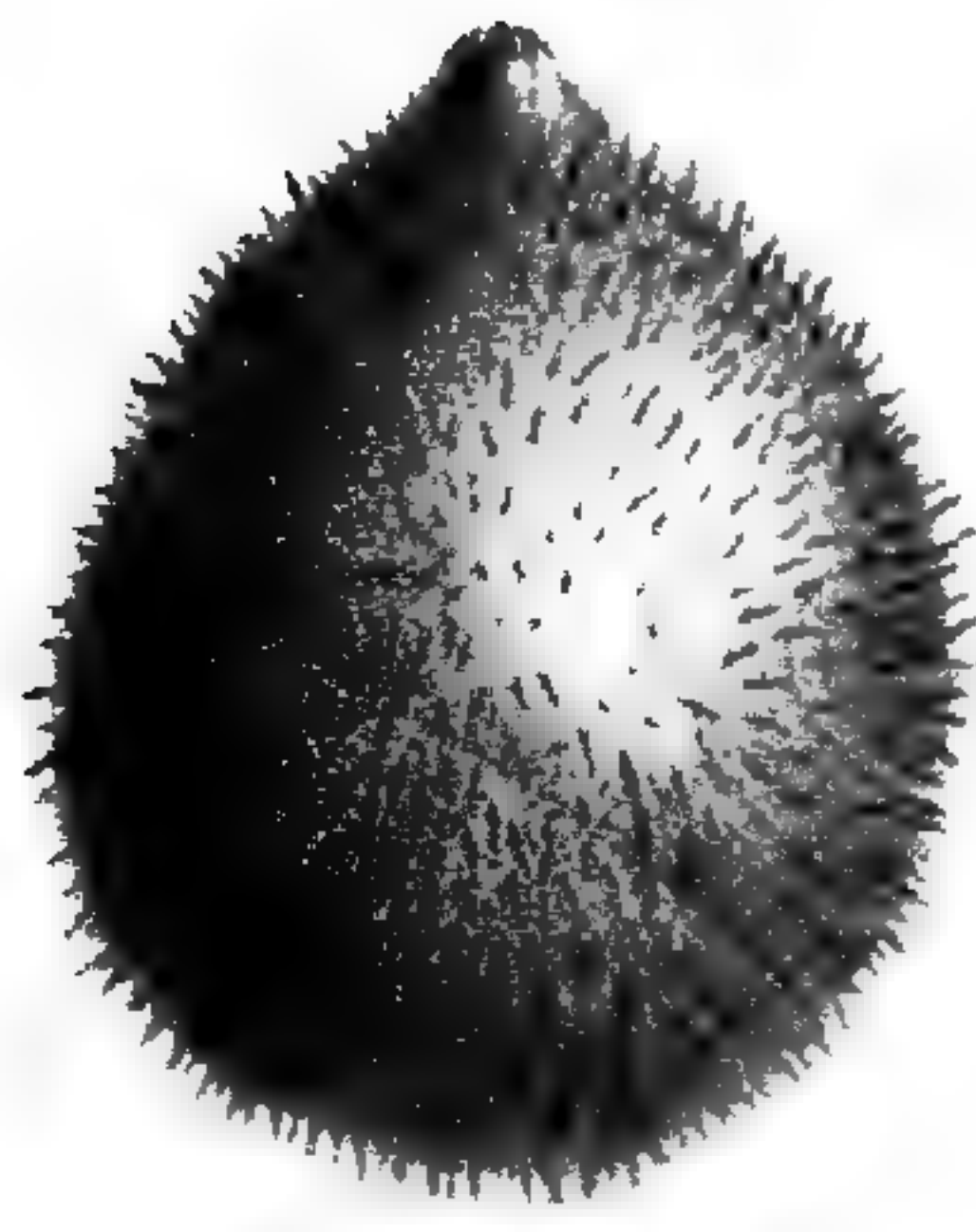


a

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37.



38.



a



b



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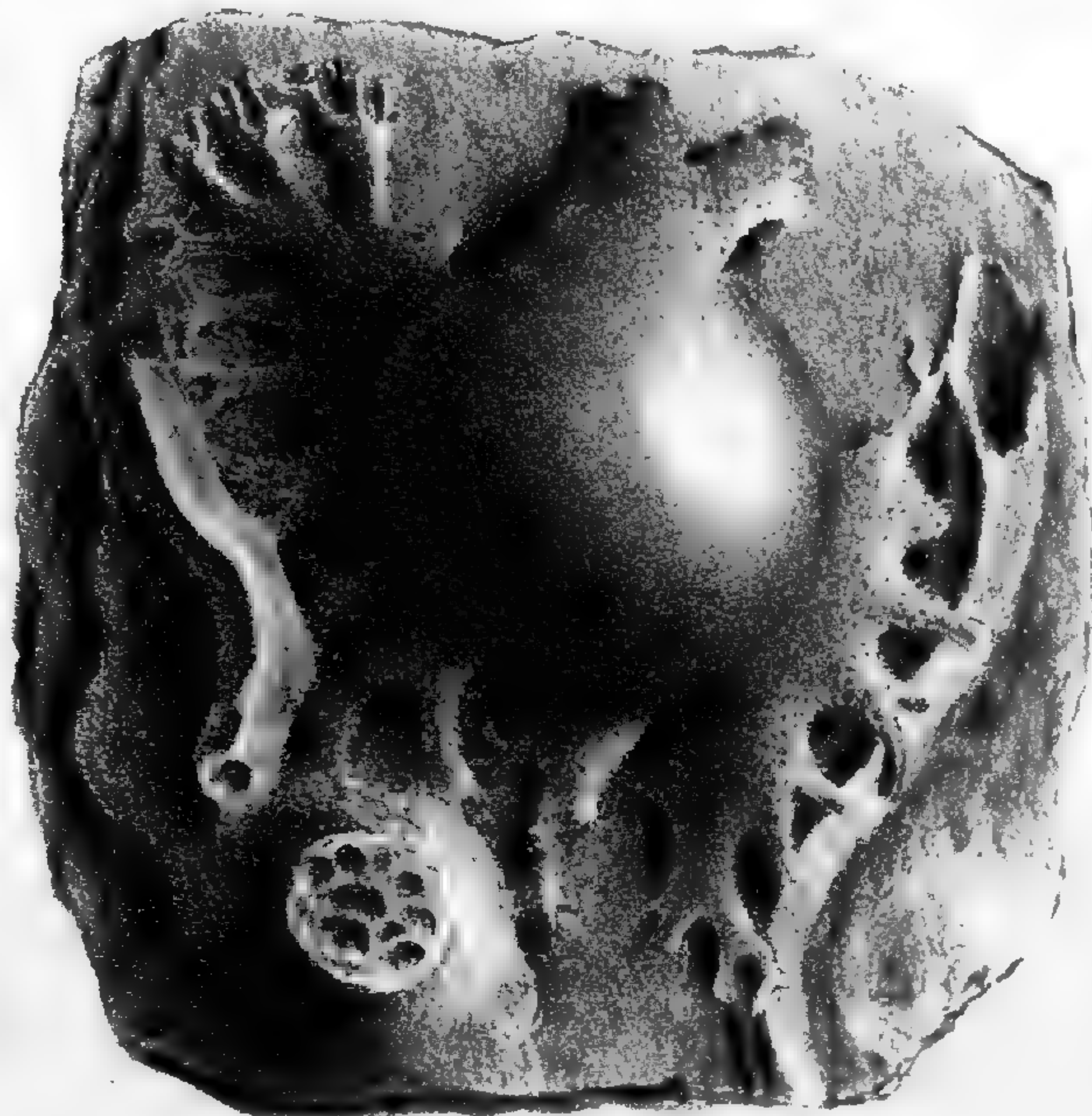


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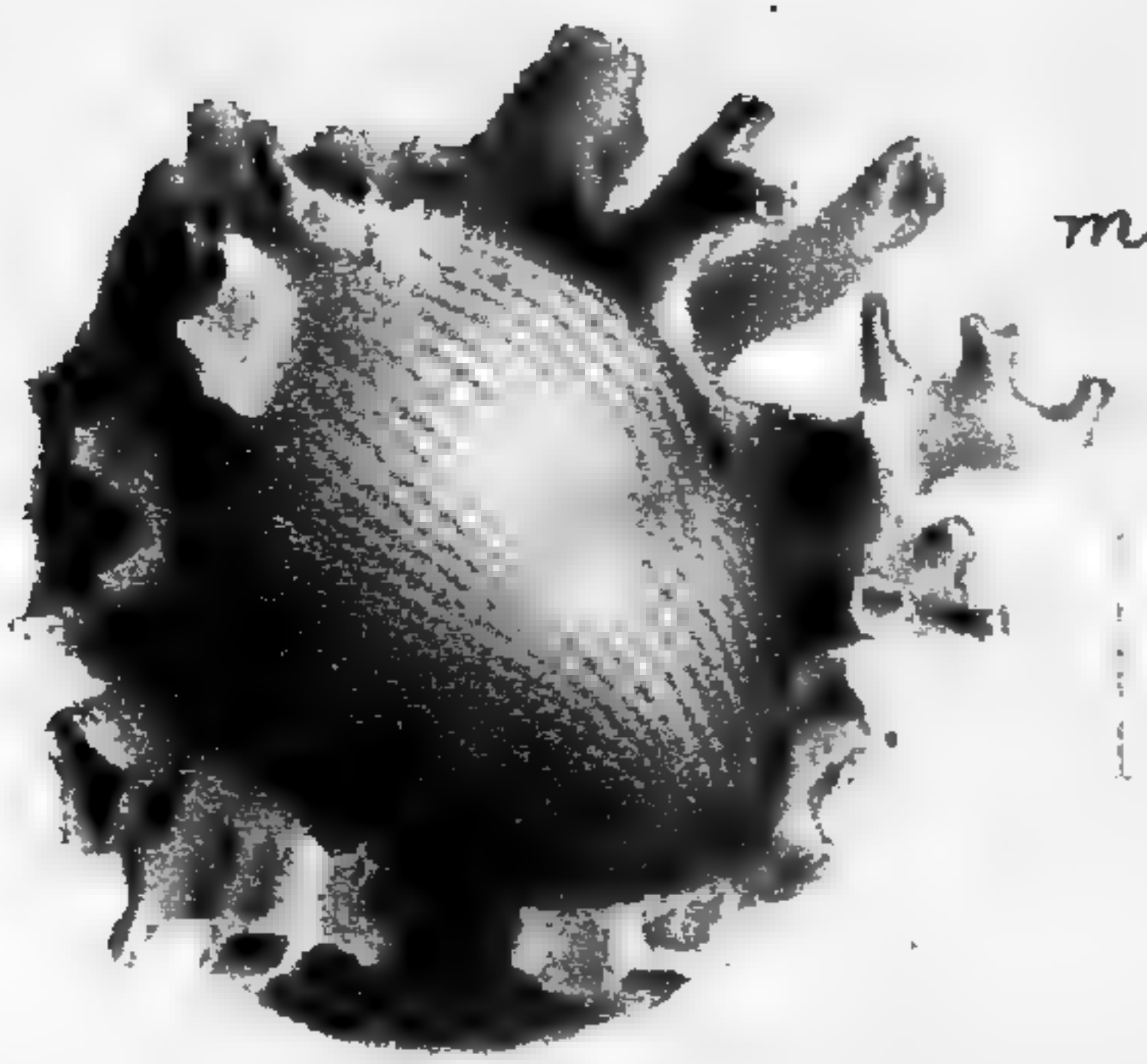
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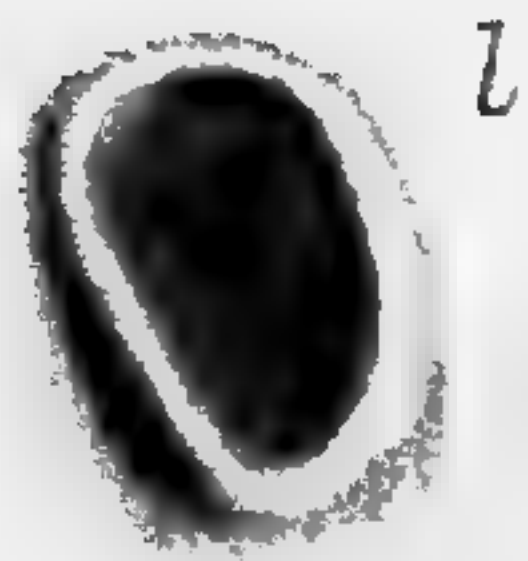
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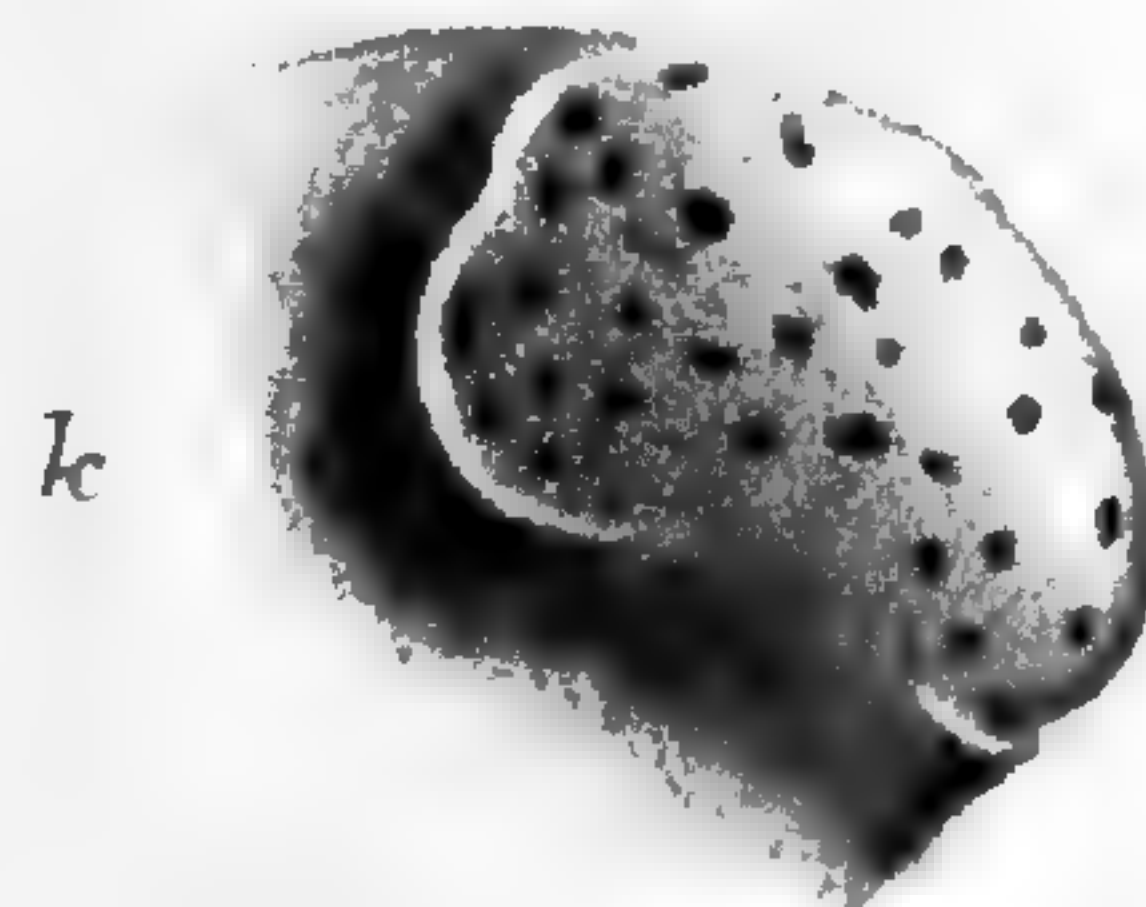
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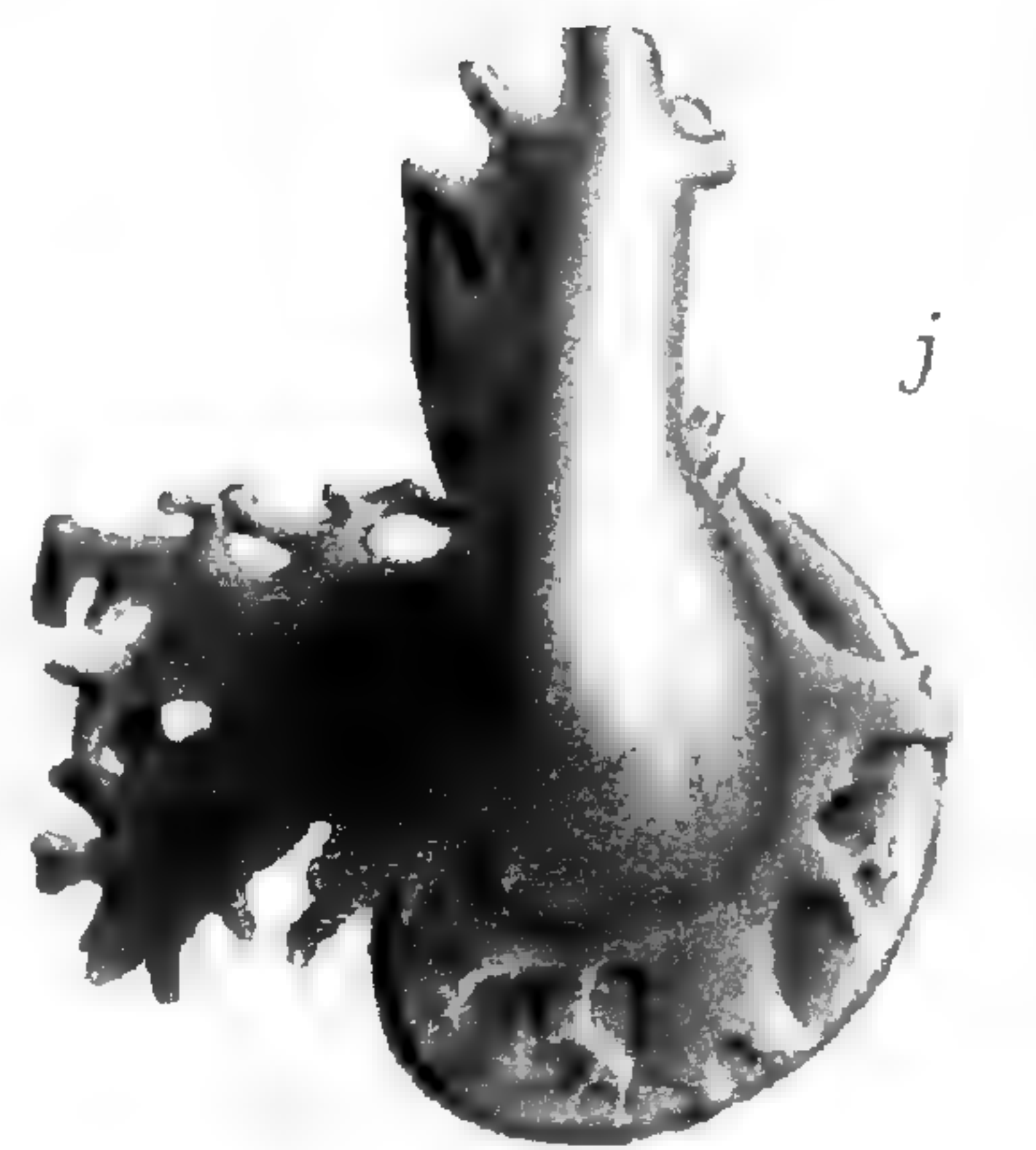
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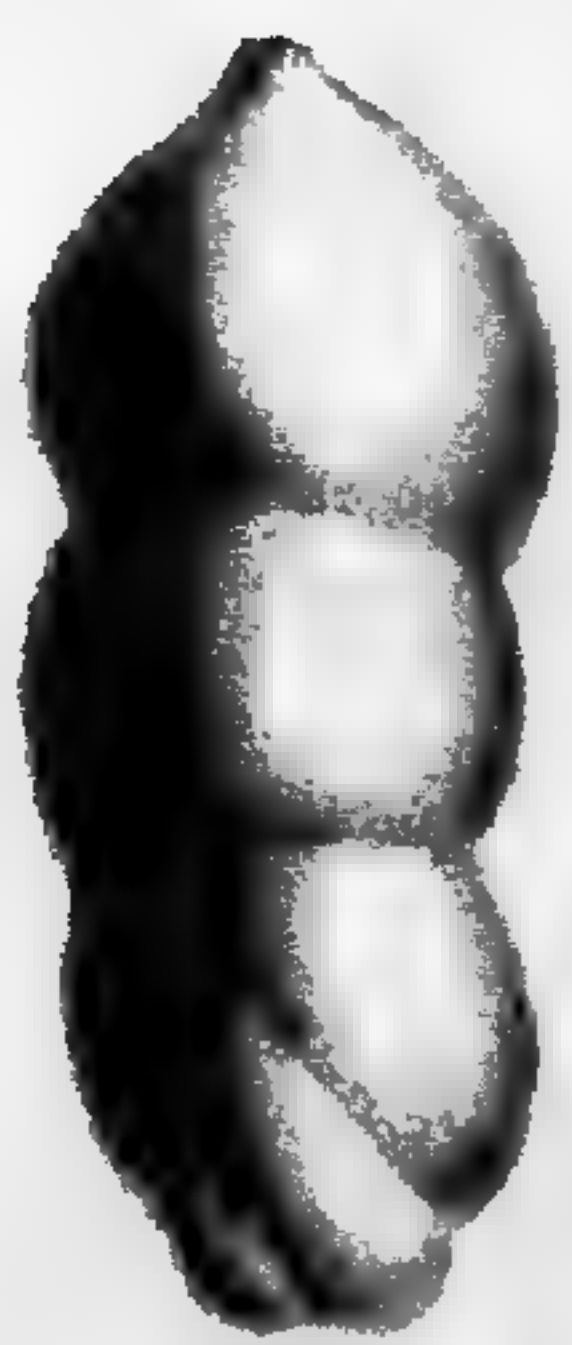


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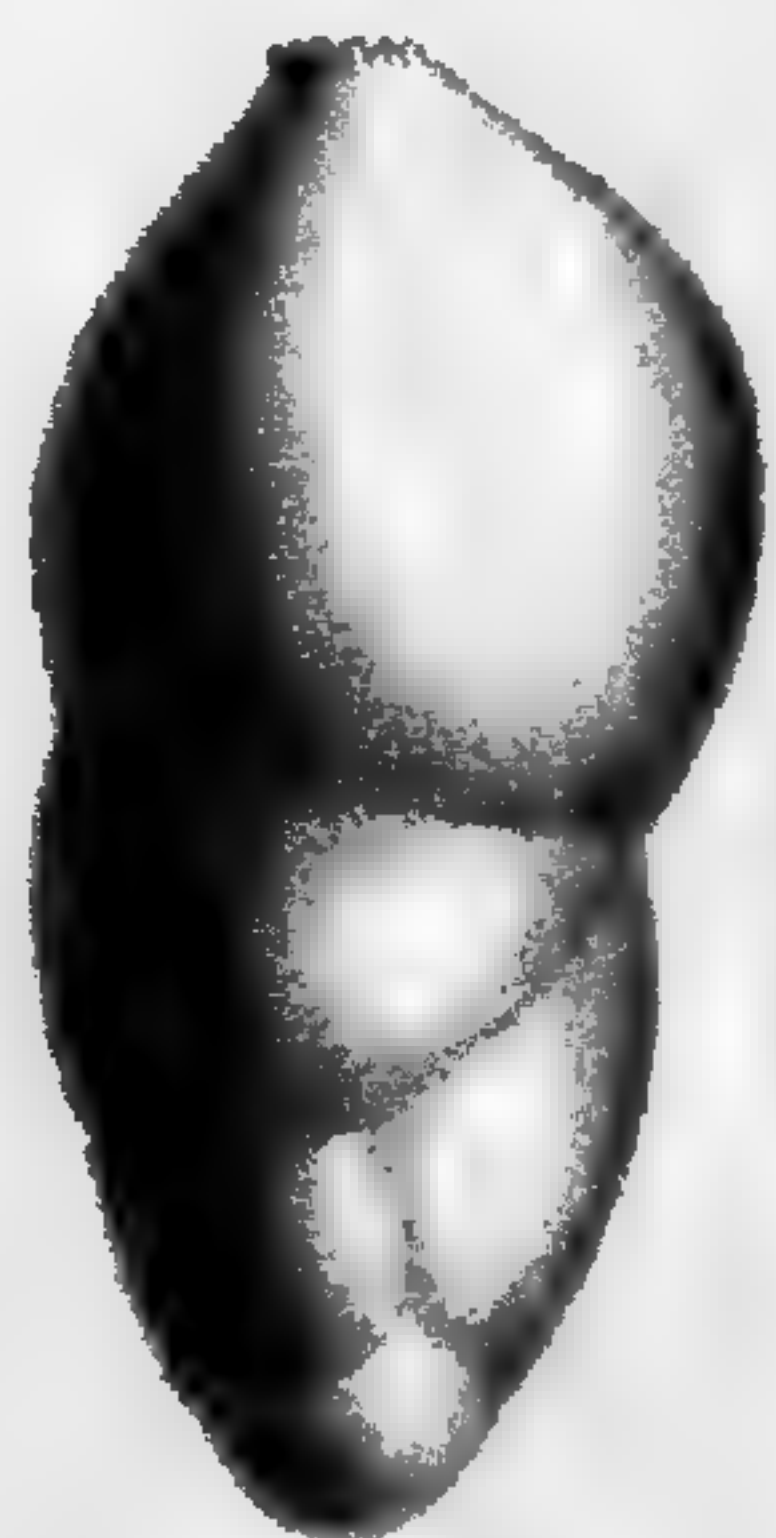
j

39.



a

b



40.



b

c



a



41





XI. *On the Anatomy, Physiology, and Distribution of the Firolidæ.* By ALEXANDER RATTRAY, M.D. (Edin.), Surgeon R.N. Communicated by GEORGE BUSK, Esq., Sec. L. Soc.

(Plates XLIII. & XLIV.)

Read February 18th, 1869.

WHILE modern research has entirely revolutionized the previously formed and principally theoretical views as to the laws which govern the distribution of animal life in the deeper parts of the ocean, and has proved directly that it can and does exist at far greater depths than formerly deemed possible, and indirectly that there are probably few spots where it is entirely absent, the fact still holds good that it becomes progressively more abundant as we near the surface and approach the vivifying atmosphere. In short, it is a region near where the sea and air meet that forms, in both, the principal theatre for the development of animal, as it is of vegetable life. Nevertheless, of these two great life-sustaining media the former is unquestionably most prolific in animal organization, especially in what may be termed microscopic life, with which its surface waters in all accessible latitudes, and particularly in tropical regions, literally teem; and the towing-net, most successful in calm weather, especially after dark, when the sun's glare and heat have declined, readily demonstrates that the beautifully clear and apparently uninhabited waters of mid-ocean furnish a *habitat* for minute beings in such countless profusion and variety as to throw its better-known, because more easily noticed, bulkier inhabitants completely into the shade.

Minute crustaceans are seldom absent from the towing-net, and are often met with in myriads. Next to them are the Hydrozoa, especially the many and varied forms of *Salpa*. Then come the pelagic mollusca, and among them the shell-less nucleobranchs we are now about to consider; but these, in the Pacific at least, are comparatively few in number, so that it is only now and again that, in a crowd of jelly-like *Salpæ*, invisible save by the tiny currents or jets produced by their peculiar jerking mode of progression, we come across a solitary, or at most a few almost equally imperceptible Firolidæ. But the former, though highly interesting in many points of view, unquestionably yield in importance to the latter and the *Heteropoda* as a class, inasmuch as these possess a more highly developed nervous system, organs of special sense, and general anatomical structure, all indicating a higher place in the scale of creation.

So pellucid are many of the oceanic mollusca, even those not, strictly speaking, microscopic, and so delicate their structure, that even the intensely coloured forms cause little diminution in the transparency of the deep or change in its hue, except when in shoals. The presence of *Firoloides*, *Firola*, or *Carinaria* can be detected with difficulty, except in large specimens, when the eyes become apparent as two dark specks, and at either end



the semiopaque yellowish buccal and visceral masses; and it is only by removal from the water, which renders their tissues semiopaque, that their form is evident, and that the intestinal canal, cephalic and pedal ganglia, and other organs, can be traced by holding the animal between the eye and the light. But though this renders investigation comparatively easy, observers have a serious obstacle to overcome in the difficulty of procuring the fresh specimens, and, if possible, living animals, necessary for research, which can only be obtained at sea. In spirit and other preservatives the delicate framework soon becomes shrunk, and the tissues indistinct and scarcely recognizable under the microscope. Hence it is that information is still needed on some points, especially on the anatomy of the circulatory, reproductive, digestive, and glandular apparatus, which under more favourable circumstances would not be long wanting. And on these subjects, therefore, any addition to our knowledge, however trifling, is not without value.

The following observations, which formed part of the writer's service-journal of H.M.S. 'Topaze' in 1861, were made principally on one variety of *Firola* and one of *Firoloides*; but, though specially descriptive, they may be considered generally applicable to the *Firolidæ* as a class.

*Firoloid* (Plate XLIV. fig. 19, & XLIII. fig. 1) possesses all the characteristics of the family, and very much resembles that sketched in Mrs. Gray's 'Molluscous Animals' as *Firola de Kerandrew* (Voy. de la Bonite).

*Firola* (Plate XLIV. fig. 17, & XLIII. figs. 3, 4) differs from it chiefly in possessing a pointed tail, which does not receive a coat from the external hyaline envelope, and in the male generative organs being some distance in front of the branchial nucleus, and on the right side.

#### *Coats of the Firolidæ.*

These are two in number—an outer transparent *tunic*, and an inner semiopaque *muscular* envelope.

The outer hyaloid coat (Plate XLIII. figs. 1-5, A), commencing opposite to the buccal nucleus, extends backwards, covers the ventral fin, gradually thickening to about the middle of the body, where it again diminishes, and finally blends with the muscular coat at the root of the tail. In *Firoloides* (figs. 4 & 5) it commences at the oral orifice, and entirely covers the truncate posterior end. It varies considerably in thickness, and sometimes bulges so much centrally as to double the animal's diameter, making its otherwise vermiform shape resemble an elongated cylinder (fig. 1) tapering towards either end; while in others it is very thin, and sometimes scarcely perceptible. It likewise covers the fin, at the free edge of which it is usually well seen even when with difficulty detected elsewhere. It also gives a thin coat to the eyes (fig. 8, *ag*), and forms the entire substance of the tentacles (fig. 8, *ah*), which contain no muscular fibres, and are therefore non-retractile, unlike those of the Gasteropods generally. Posteriorly it ends without giving a cover either to the genital organs or tail (fig. 1). Under the microscope no special structure can be detected even by a high power, except nerve filaments (Plate XLIII. fig. 1, *w*) traceable from the underlying muscular coat. Its surface is equally hyaline; but in many varieties, both of *Firoloides*, *Firola*, and *Carinaria*, we may observe small round or oval semitransparent cellules; while in others,



especially in *Carinaria*, the outer tunic is rough and raised into pointed papillæ or tubercles, the interspaces being often covered with the above-mentioned cellular patches (Plate XLIV. figs. 14, 15.). The nature of these we can only conjecture, and suppose that the cellules are glands for secreting a slimy fluid like that which covers many Gasteropods, both shelled and shell-less, e. g. *Helix* and *Limax*; while the papillæ may mark minute orifices opening into the aquiferous canals (to be presently spoken of), and thus correspond to the membranous tubes and disk-pores of *Asterias* and *Echinus*. Similar tubercles, said to be of this nature, are frequently found in *Salpa*.

The inner or muscular coat is a stronger and more complete investment, which aids more than the above in preserving the shape of the animal. It extends from one extremity to the other, enclosing the buccal and branchial nuclei, alimentary canal, nervous system, aorta, venous sinuses of the return circulation, and other organs, and consists of two layers.

*a.* The longitudinal or outer is exceedingly thin, and often incomplete along the median line both of the back and belly (Plate XLIV. figs. 9, 10), especially the latter, where a narrow transparent raphe exists, only sparingly supplied with muscular fibres, most evident between the eyes and tail (figs. 9 & 10, *c*)—and least marked between the eyes and mouth (fig. 9, *e*), where the fibres, both longitudinal and transverse, are more pronounced than in any other part of the animal. On either side of the median line, both above and below, this layer is thickened and strengthened so as to form a band (figs. 9 & 10, *b*), most obvious on the dorsal surface between the eyes and tail (fig. 9, *b*). A few decussating fibres occasionally cross the raphe. As a whole, the longitudinal are more numerous, better defined, and, as a layer, stronger than the transverse or inner fibres.

*b.* The circular, transverse, or inner stratum (Plate XLIII. figs. 9, 10) surrounds the body in its entire length, and is most strongly developed between the eyes and mouth (figs. 9 & 10, *e*); but behind those it is often interrupted by the raphe, which only a limited number cross. A considerable part of the animal along the median line is thus free from muscular fibres, the tunic forming the only covering. Between the eyes the transverse fibres are thicker and more highly developed than elsewhere (figs. 9 & 10, *f*), and form strong bands connecting the two eyes, and so well defined, especially on the ventral surface (fig. 10, *f*), as to resemble distinct interocular muscles; while in the same locality both longitudinal and transverse fibres, interrupted by the orbital orifice, sweep round the base of both eyes and become so thickened as to be somewhat like an imperfect orbicular muscle (fig. 9, *g*). This peculiar arrangement and increased muscular development in the neighbourhood of the eyes unquestionably serves a double purpose—first, that of protecting them and the optic nerves, cephalic ganglion, and other delicately organized structures in this vicinity, and, second, that of altering the direction of the eyes and the axis of vision. The transverse fibres are also well marked around and for some distance behind the oral orifice; and from the posterior edge of this on the ventral aspect another well-defined patch (fig. 10, *g*) runs back, gradually narrowing, till it blends with the interocular muscle. Here the longitudinal muscular fibres are also well developed, and run back to amalgamate with those along either side of the raphe posteriorly. The wide



anterior part of this triangular muscular patch embraces one-third or half of the oral orifice (Plate XLIII. fig. 10, *g*; Plate XLIV. fig. 11, *g*), and probably serves to elongate, retract, and curve the proboscis, perhaps to aid in opening the mouth and assist in deglutition, the bolus of food, first seized by the tongue, being forced into the œsophagus by successive contractions of these fibres from before backwards. The arrangement and great development of the muscular coat in the anterior part of the *Firolidæ* accounts for the mobility of the proboscis and eyes.

The ventral fin is flat, and principally composed of muscular fibres enveloped by a thin layer of the transparent outer tunic; and to their arrangement is due its peculiar fan- or fishtail-like action. There are usually three layers, an inner and two outer,—the former consisting of strong fibrillæ running upwards and backwards in parallel lines from the attached to the free edge; while the latter, which are finer, run upward and forward, aggregated into bundles in the narrow neck of the fin, but widening out towards its free edge (Plate XLIII. fig. 1, *B*). The fins of *Carinaroides* (Plate XLIV. figs. 14, 16) have a similar structure (figs. 3, 4). In the latter, however, the external layers are prolonged at intervals, and in small bundles, towards the free edge of the enveloping tunic, subdividing several times, and finally joining corresponding fibrillæ from the muscular layer of the opposite side.

The arrangement of the muscular fibres of the tail, absent in *Firoloides*, varies in different species of the *Firolidæ*; but in all cases it is apparently connected with its function as a steering- and swimming-apparatus. It sometimes receives a coat from the external tunic, but often does not, as in *Firola* (Plate XLIII. fig. 4). In the latter, besides possessing the longitudinal and transverse muscular coat common to the whole body, it has an additional set that form small bands, of which one, elongated and fusiform (fig. 4, *x*), runs towards the tip a little distance below the muscular tunic, and joins a larger and better-marked fusiform strip (fig. 4, *y*), which lies deeper, and then runs onward nearly to the tip of the tail. These bands are connected along their posterior half by cross fibres. A third, more slender (*z*), runs from the tip forward, divides and diverges so as to embrace the branchial nucleus. Besides aiding the fin-like motions of the tail, this may also serve as a basis of attachment for the intestinal canal, to assist its antero-posterior vermiform movement during the processes of deglutition, digestion, and defecation. Progression is effected principally by the ventral fin, which moves actively; while the tail is chiefly employed as a steering-apparatus. Thus the arrangement of the muscular element in both varies much. Each variety appears to have its own, probably characteristic, by which alone it might doubtless be distinguished; but though useful as an additional diagnostic mark, being a microscopic one it is disadvantageous, and therefore not so practically useful or likely to be so frequently followed as others, *e. g.* the presence or absence of a shell, branchiæ, a caudal appendage, the position of the visceral nucleus, &c.

The sucker (Plate XLIII. fig. 1, *c*), oval from above downward, and situated at the upper posterior free edge of the ventral fin, is small, rudimentary, and probably seldom, if ever, used, being principally developed in the outer tunic, and having little apparent connexion with the muscular tissue below. It is present, but only in a rudimentary form,



in all the hereafter enumerated varieties of Pacific Firolidæ, including specimens of *Firoloides*, *Firola*, *Carinaroides*, and *Carinaria*; and the foot is probably exclusively a fin both in form and function.

These muscular envelopes resemble those of *Helix*, *Limax*, and other typical Gastropods, and enable the animal to elongate, contract, turn, progress, and otherwise alter its shape at will. The proboscis seems specially endowed with the power of motion. Under the microscope the longitudinal and transverse layers have more the appearance of fibrous than muscular tissue (Plate XLIII. fig. 11), and consist of parallel strips, sometimes slightly interlaced; but a higher power would doubtless demonstrate the existence of the transverse striæ characteristic of voluntary muscle, as it readily does in a lower form of life, the *Salpa*, where the muscular element does not form a continuous coat, as here, but exists merely in occasional bands; for animals like the Firolidæ, whose nervous system and organs of special sense are so highly developed, must possess the power of wandering about at will, and performing voluntary motions; nor can we suppose that all their evolutions are purely involuntary, instinctive, or both.

A system of aquiferous canals has been said to exist between the external and internal tunics, in connexion with the venous system; others say, independent of it. Their presence is still an open question, and one difficult to verify either way. Certainly different specimens even of the same animal show a variable degree of relative distention or collapse, which may be readily accounted for by the presence of such an apparatus and the admission or expulsion of water at will, more especially as this mutable size is principally referable to the outer tunic, in which these canals are believed to lie. One use is probably that of a somewhat similar system in the *Echini* and *Asteridæ*, and still more nearly that of the ramifying aqueous canals of *Holothuria*, viz. to assist aëration of the blood, especially in those varieties in which a branchial apparatus is wanting, rudimentary, or insufficient for the requirements of the animal, by bringing it and the aërating medium more closely into contact, and, in fact, separated only by the thin muscular coat. But they, perhaps, serve another purpose; for, admitting the probable presence of a system of aquiferous lacunæ or canals either in the external envelope or between it and the muscular coat, and remembering the trifling connexion that exists between these two, the former being nowhere bound down to the latter, except at or near the oral orifice, rudimentary sucker, and vicinity of the branchial nucleus and tail, it is easy to conceive how these may be emptied or filled at need, and how, by contracting the general coat, the canals will necessarily have their calibre increased and filled; whereas, by the converse process of relaxation of the muscular coat and consequent enlargement of the true body of the animal, they will be pressed on, diminished in size, and emptied of their contents. The function of this system, therefore, doubtless corresponds also to that of the swimming-bladder of the fish and, still more, the subcutaneous air-cells so prominently developed in some birds (*e. g.* the Gannet, Pelican, &c.), and, beside aiding the aëration of the blood, further serves to enable the animal to alter its specific gravity at will. By infiltration of the skin of the one with air, and the hyaline coat of the other with water, the weight of the bird or *Firola* is reduced and equalized with that of the gaseous or aqueous medium in which it floats; and thus the



animal is enabled to rise at will, or by expulsion to sink into denser strata,—a beautiful adaptation in both of means to ends. Such an arrangement almost necessitates the presence of some opening or apparatus more under the control of the animal than the superficial tubercles already described possibly can be, inasmuch as no muscular fibres or contractile tissue can be noticed, to aid in opening or shutting their orifices, and thus regulate the entrance or exit of the surrounding fluid. And this appears more likely to be found in or near the buccal cavity or œsophagus, where the muscular coat is most developed and complete, or perhaps, as with the corresponding aquiferous system in the Holothuriæ, near the orifice of the vent, than in any other part of the animal. Macdonald\* has described a small oval opening in the right side of the visceral mass of *Firoloides* and immediately in front of the rectum, which is surrounded by a little sphincter muscle intersected by numerous radiating fibres, by which frequent rhythmical contractions and dilatations are produced. Probably this may be an opening of the above-indicated nature—a supposition supported by the fact that it is in the *Firoloides*, in which the branchiæ are absent, that this is most needed, to effect a rapid change in the blood-oxygenating medium. A communication, however, between these and the proper blood-vessels within the muscular coat, and the constant or frequent admixture of the blood with salt water, appears, on calm reflection, a very unphysiological and untenable supposition.

#### *Nervous System.*

This, like the entire animal, is symmetrical, and consists of certain ganglionic centres, all bilobed, indicating their double nature, arranged along the median line, and united by well-developed nerves of intercommunication. The symmetrical character of the *Firolidæ* is even better seen in the arrangement of their nervous system than in their external configuration; and, with the exception of the long interspace which separates the ganglia, a great similarity is apparent between it and the nervous system of certain classes of the Articulata, *e. g.* the Insecta—a resemblance further strengthened by the comparatively high development of the organs of special sense, especially vision. In short, though a mollusk and non-articulate, the nervous system is more allied to that of the Homogangliata than to the Heterogangliata. There are four ganglionic masses, viz. the buccal, cephalic, pedal, and branchial, all of which lie, with their intercommunicating nerve-cords, close to, and sometimes even embrace the alimentary canal (Plate XLIII. figs. 1–5), which runs, generally speaking, along the median axis.

1st. The buccal ganglion (Plate XLIII. fig. 5, *a*) is the smallest, and lies above the œsophagus, close behind the buccal mass, of which it forms part. It is nearly round; but a slight antero-posterior constriction marks its double character. Anteriorly it sends off two chords (fig. 5, *a'*), doubtless principally motor, which run forward, subdivide, and enter the buccal mass to end in the tongue, front of the œsophagus, and muscular tissue near the mouth; while posteriorly other two (fig. 5, *b, c*) run upward, then backward, to embrace the œsophagus and join two larger, one on either side, from the cephalic ganglion, to form the long so-called “œsophageal collar” (Owen). From this interganglionic cord twigs are given off (fig. 5, *d*) to supply the muscular envelope

\* Transactions of the Royal Society of Edinburgh, vol. xxiii. part 1.



and tunic, the majority running from behind forward, and doubtless derived principally from the cephalic ganglion.

2nd. The cephalic ganglion (Plate XLIII. figs. 1 & 8, *f*), situated between the eyes about the anterior third or fourth of the body, is the most distinctly bilobed, each half (fig. 8) being oval, prolonged, and pointed anteriorly, at least thrice the size of the entire buccal ganglion, and united with its fellow by a thick commissure. The cords given off are symmetrical, and distributed in three ways, viz:—

*a.* Nerves for the organs of special sense, the eye, auditory vesicle, tongue, and tentacles.

*b.* Intercommunicating cords, which unite the ganglion with the buccal in front, and the pedal behind.

*c.* Ordinary nerves, for the œsophagus, muscular envelope, tunic, &c.

The optic nerves (fig. 8, *i*) are short but thick, and originate in the outer and posterior part of each lobe by a broad base, which soon tapers into a cylindrical cord that runs outward, swells, and forms a cup-shaped cavity (fig. 8, *k*), which embraces, before entering, the eye posteriorly, to expand into the retina. Well-marked constrictions separate these protuberances (from which the optic nerves arise, fig. 8, *h*) from the principal mass of the ganglion; and we may regard them as distinct “optic lobes,” both on account of their size and their containing nerve-cells like those seen in the main mass, of which they are in fact mere prolongations or appendages.

The auditory, like the optic nerves, are large in comparison with the organs to which they are sent, and arise on either side (Plate XLIII. fig. 8, *m*) from the posterior part of the optic lobe by a single cord, which runs outward and backward to enter and become expanded on the capsule of the auditory vesicle (fig. 8, *a k*); but the mode of its ultimate distribution requires elucidation. It occasionally gives twigs to surrounding tissues (fig. 8). The minute structure of the optic and auditory nerves shows merely the usual hyaline interior, enveloped in a cylindrical sheath; and in neither can any peculiarity be observed to mark their special character, or distinguish them from the ordinary motor or sensory nerves of the body.

A smaller nerve (Plate XLIII. fig. 5, *e*) usually arises on either side from the front of the cerebral lobes and inside the cerebro-buccal cords, runs a distinct course along the œsophagus without communicating, and is lost apparently in the salivary glands, but possibly ends in the tongue as the nerve of taste. The specially endowed tactile organs, or tentacles, are each supplied with a comparatively large branching nerve (Plate XLIII. figs. 1 & 8, *a h*) from the outer and anterior aspect of the cephalic ganglion, which sends off lateral filaments and finally ends near the tip.

The lobes of the cephalic are united to the buccal ganglion in front, and to the pedal behind, by large nerves, viz:—

*a.* The cephalo-buccal (Plate XLIII. fig. 5, *l*) arise on either side from the anterior prolonged part of the cephalic lobe as a single cord (fig. 8, *b*) which runs along the alimentary canal, giving off side branches to it and adjacent tissues of the muscular and external coats, till near the buccal mass, where they bend upward to embrace the œsophagus, and then divide close to the ganglion into two, the larger of which, as already



described, joins the buccal ganglion, while the smaller runs onward, subdivides, and is lost in the tissues of and near the mouth.

*b.* The cephalo-pedal (Plate XLIII. figs. 1 & 8, *g*), which exceed the former in size, and, next to the optic nerves, are the largest in the body, arise posteriorly from the cephalic ganglion internal to the optic, run back towards the pedal ganglion on either side and above the œsophagus, but often widely apart, giving off branches to the muscular coat, tunic, &c.

Besides the purely sensory nerves and those of intercommunication, the cephalic gives smaller twigs to the tissues in its vicinity, *e. g.* the œsophagus, aorta, muscular and outer tunics, sclerotic, &c. (Plate XLIII. fig. 8), which form a kind of plexus round the ganglion.

3rd. The pedal ganglion (Plate XLIII. fig. 1, *n*), next in size to the cephalic, is found, as its name implies, near the base of the ventral fin, the representative, according to Huxley, of the anterior division of the foot or propodium of the typical gasteropods, and consists of two oval lobes, prolonged anteriorly and united centrally by a thick commissure. As a whole it is more globular than the cephalic, like which its internal structure consists of nucleated cells in a general envelope prolonged as nerve-sheaths (Plate XLIII. fig. 7). It sends off intercommunicating branches to the ganglia above and below, and also supplies the neighbouring tissues.

The important cephalo-pedal nerves have already been described.

The pedo-branchial cords (Plate XLIII. figs. 1 & 4, *o*), also large, spring from the right and left lobes, run backward, above and on either side of the alimentary canal, pursue a wavy course, giving off filaments as they pass to the lower part of the œsophagus, stomach, &c., till, in front of the branchial nucleus, they suddenly bend (fig. 4) nearly at right angles, to embrace the intestinal canal and join the branchial ganglion.

Smaller nerves are distributed, first, to the foot, the external coat, and predominant muscular tissue, all of which are well supplied; second, to the muscular and hyaloid coats; and, third, to the stomach, œsophagus, and male generative organs (fig. 4).

4th. The branchial ganglion (Plate XLIII. fig. 4, *p*), smaller than either of the former, and more like the buccal in size, lies below the posterior end of the intestinal canal, in front of the visceral nucleus and heart. It is joined in front by the two pedo-branchial cords (figs. 1 & 4, *o*), and gives off the following. One long filament (*q*) runs along the upper aspect of the intestinal canal to be distributed on the œsophagus and stomachic dilatation, besides giving off twigs to the male generative organs when present here. Two others (*r*) run upwards, embrace the lower part of the intestinal canal, and join a plexus (*u*) to be presently described. Arising from one or both of these a long thread (*r'*) runs along the abdomen close to the muscular coat, to join with others sent from the pedal ganglion. Posteriorly it supplies the muscular and transparent coats and the organs constituting the branchial nucleus (*t*)—namely, the stomach, rectum, liver, heart, branchial apparatus, male and female generative organs. What may be termed the “caudal plexus,” just alluded to (*u*), lies above the branchial nucleus near the dorsal surface. More or less quadrilateral, it is joined at either corner in front by a cord from each lobe of the branchial ganglion (*r*), and one from the pedo-branchial nerves of inter-



communication (*s*); while from its sides and posteriorly it gives filaments (*v*) to the tunic and muscular coat of and near the tail, and large twigs to the caudal muscles.

The minute structure of the nervous system is very simple, and consists of two elements, ganglionic cells and nerve matter, enclosed in a sheath, and readily distinguished by their faint yellow tinge. The sheaths, which originate in the fibrous envelope of the ganglia (Plate XLIII. figs. 7, 8), are from one-fourth to one-fifth or one-sixth of the diameter of the nerve, and contain the nerve proper, transparent and structureless. Their ultimate ramifications and mode of termination in the tissues are not easily demonstrated. Nor is it possible to distinguish between the sensory and motor element on the one hand and the excito-motor on the other, the difference between the two, if appreciable at all, being still little understood, while the nervous system of such minute animals is too delicate to enable us to determine the relative supply to and exact distribution of either in the various organs. On the other hand the ganglia consist of a mass of rounded nucleated cells, comparable to the cortical part of the human brain, the whole enveloped in a stout fibrous coat which preserves their form. Their cellular nature is most readily demonstrated in the cerebral and pedal, which are both largest and most easily brought into view. This cellular element is sometimes prolonged into the at first funnel-shaped sheath of the larger nerves (Plate XLIII. figs. 7, 8). The function of these ganglia doubtless differs. Thus it is probable that the special senses, viz. sight, hearing, and taste, are directly supplied from the cephalic, which also furnishes a large portion, if not the whole, of the nerves of ordinary sensation, either directly, or indirectly through the intercommunicating cords and other nerve-centres; indeed, from the prominent place which it occupies in the nervous system of the Firolidæ and Heteropoda generally, and the nature of the organs it endows, this ganglion may fairly be regarded as the equivalent of the anterior or cephalic pair of the Articulata, and representative of the sentient brain of the higher animals; while the other three are probably the principal, if not sole source, of motor nerves for the different parts near which they respectively lie,—the pedal being the largest, in correspondence with the development and activity of the swimming-fin; and the branchial or posterior terminal, which supplies the tail, as well as the alimentary and reproductive organs, appears to bear a marked relation to the size of the steering-apparatus.

#### *Organs of Special Sense.*

Besides taste and touch, both present in the true Gasteropods and doubtless existing in fair development, as they do, though perhaps in a rudimentary state, in more elementary forms of life, we find two other senses in the *Firola*, with well-defined appropriate organs, viz. hearing and seeing. Olfactory nerves cannot be detected, and the perception of smell is doubtful.

The eyes (Plate XLIII. figs. 1, 8), very perfect of their kind, indicating a corresponding development of the sense of sight, are placed about the anterior third or fourth of the dorsal surface, and a little behind and nearer the median line than the tentacles. Though non-pediculated and fixed, they jut slightly outward and forward (fig. 8) with a certain projection which evidently corresponds to the eye-pedicles of the pulmo-



niferous Gasteropods. Like minute black specks to the unaided eye (Plate XLIV. figs. 13 &c.), they are hour-glass-shaped under the microscope, and readily distinguished by the crimson hue of the retina, which is only equalled in brilliancy by the eyes of some oceanic Myriopoda occasionally found in the towing-net. The component parts are seven in number, viz. :—

*a.* The optic nerve (Plate XLIII. fig. 8, *i*), which has already been described.

*b.* The sclerotic (fig. 8, *a b*) is cup-shaped, its cavity looking outward and forward, moderately thick, becoming thinner and narrowing in calibre in front, and constricted about one-third from its anterior orifice, where a sharp ridge (*a d*) projects into its cavity, and divides it into a small anterior and a larger posterior chamber; and in front joined by the thin posterior edge (*a e*) of the external eye-cover or cornea that likewise contributes slightly to form the anterior chamber occupied by the vitreous humour.

*c.* The retina (*a c*). The interior of both chambers, semigranular and bright crimson, is lined by the expansion of the optic nerve, which penetrates the thick posterior part of the sclerotic; but the manner in which this is effected, and the minute structure of the retina, need further inquiry. The colour may be the natural tint of the retina; but as the nervous system generally, both ganglia and cords, and the optic nerve itself, close to where it enters the eye, have only the usual pale yellow tinge previously spoken of, we may consider it due to the presence of the following or

*d.* Pigmentary layer; but whether this exists beneath the retina, as in the human subject, or overlies it, as in the Cephalopoda (Owen), it is not easy to determine.

*e.* The vitreous humour. The contents of the sclerotic cavity, which correspond to the vitreous humour of the human eye, are hyaline, and apparently structureless.

*f.* The crystalline lens (*a f*), globular, pellucid, and highly refractive, is situated in front of the vitreous humour, about two-thirds of its anterior being covered by the cornea; while its posterior third adjoins the vitreous humour, and makes a segmental projection into the sclerotic. When subjected to pressure after immersion in spirit, the lens splits towards its centre, like those of higher animals.

*g.* The cornea (*a g*) is merely a prolongation of the general outer envelope, like which it is perfectly transparent and structureless. Thick in front, it gradually thins as it bends back to embrace the crystalline lens and join the anterior edge of the sclerotic. This pellucid concavo-convex eye-cover, with the globular crystalline body that closely fits into it, and the vitreous humour behind all, constitute an admirable complex and powerful lens, doubtless well adapted for the requirements of sight. The constriction by which the cavity of the sclerotic and the contained vitreous humour are divided into two (*a d*), evidently performs the function of a rudimentary pupil, perhaps quite fixed, but possibly acted on in some measure by those muscular fibres so peculiarly arranged around the eyes, apparently in connexion with vision. Posteriorly, and on the sides, the eyes are surrounded by the general tissues, and are not contained in any space like the orbital cavity of the Vertebrata, and have no special muscles, like the iris in the interior of, or the recti and oblique around the human organ. But the structure now alluded to suggests that, by the single or conjoint action of the longitudinal and transverse fibres, the direction of the axis of each eye may be materially altered at will, so as



to increase the *lateral* range of vision; while by those which curve round and form a kind of orbicular, the eyeball may be pressed on, so as to change the arrangement, relative position, and curve of the lenses, and hence alter the focus of the eye and give a more extensive *antero-posterior* range, which enables the animal to perceive objects at greater or shorter distances. An organ so complex, and with a large special nerve-supply and a well-pronounced nervous system, all indicate an equal development of the sense of sight, and furnish presumptive evidence that this function is not confined to the appreciation of light and darkness, but probably extends to the discrimination at least of form, colour, and distance. When swimming, the head and body, as far back as the tentacles, are often bent nearly at right angles, as well seen in Plate XLIV. fig. 13. By this arrangement the tentacles (which possess no muscular fibres and are therefore immobile in themselves) and the eyes become more prominent; the former enjoy free play, and the latter a far wider range of vision; so that sight, touch, and taste, the senses most employed in the search for food, are materially aided. To the frequent contraction and dilatation of the orbicular fibres, and the rapid alteration of the focus of the ocular lenses in vision, are doubtless due the appearance of winking sometimes observed.

The auditory apparatus consists of the two nerves already described, which run outward and backward to the auditory vesicles (Plate XLIII. fig. 8, *a, k*) behind the optic nerves, usually about their middle or outer third. The nerve appears their only attachment to surrounding tissues. The vesicles are globular, pellucid, and probably ciliated internally, two-thirds of their cavity being filled by a smooth, round, opaque otolith. The minute structure of this apparatus and, especially, the mode of distribution of the nerve still require observation. Its rudimentary nature, however, proves that the sense of hearing must be imperfect, and probably does not extend beyond a limited appreciation of sound.

*Olfactory apparatus.*—Neither this nor a special nerve of smell can be detected. Both are supposed to be wanting in the mollusca generally; but they have been discovered by Owen in their highest form, the Cephalopoda, and may possibly exist in the *Firola* and other Heteropods, which rank next in the animal scale, in a rudimentary condition and combined with the sense of taste, their nerves being united.

The sense of touch doubtless exists in *Firola* and the Firolidæ generally. Minute filaments from the ganglia on their intercommunicating cords, doubtless purely sensory, and perhaps derived originally from the cephalic ganglion, are frequently seen penetrating the muscular coat to end in the outer tunic. The non-retractile tapering tentacula, which correspond to the inferior or anterior tentacles of the *Helix*, appear more highly endowed as special organs of sensation, and are each supplied with a large branching nerve from the cephalic ganglion (Plate XLIII. figs. 1, 8). Plate XLIV. fig. 13 shows the animal applying these organs to the vessel in which it was kept, as if to ascertain its nature. In some of the Firolidæ they are absent.

#### *Circulatory System.*

Our knowledge of the anatomy of the circulatory organs and breathing-apparatus of the Heteropoda, and the connexion which necessarily exists between them, is by no means so complete as could be desired.



A heart (Plate XLIII. figs. 4, 6, H), consisting of an auricle and ventricle, is distinctly visible in *Firola*, in front of the branchial nucleus, and usually in close proximity to the ciliated breathing-apparatus when present.

The ventricle (fig. 6, H) is oval. From its upper end springs the aorta; and below, it communicates with the auricle. Its walls consist of a thin but clearly defined membrane, strengthened by a mesh of striated muscular fibres, first pointed out by Huxley, by the contraction and expansion of which the blood receives an onward impulse through the aorta. The auricle (fig. 6, E), situated below and separated from the ventricle by a slight constriction, is much less perfect, and consists in front of a muscular network like that of the ventricle, only less complete, connected below with the ciliated branchial tube, and above with the ventricle, the muscular fibres of the two occasionally intermingling. The cavity, of which this forms the anterior wall, is large and has more the character of a sinus than a well-defined auricle. The contraction of this muscular web necessarily propels a certain portion of the contained blood into the ventricle, and, at the same time, draws an equivalent of non-oxygenated fluid from the periintestinal cavity or venous system, part of which comes into contact with, and is aerated by the ciliated branchial apparatus or branchiæ when present. The circulation thus kept up is languid; and the function of the singular heart is doubtless not so much to keep the blood in a continuous circuit as in perpetual slow motion and constantly changing, so as to present a fresh supply to the aerating medium, whether that consists of a branchial apparatus, a subspiral band, or merely the venous sinuses of the body generally, one or all combined. A more rapid current is not required. No complete double circulation is needed for the aeration of the blood, nor has all of that fluid to pass quickly and repeatedly through the oxidating medium for renewal, as the heart supplies enough motive power to keep the blood moving sufficiently fast for all physiological requirements.

The aorta (Plate XLIII. figs. 1 & 4, D), somewhat dilated at its origin, springs from the upper part of the ventricle, gives a branch backward to the viscera, and, without diminishing much, if at all, in its course, runs up the centre of the body near to the œsophagus, but lying, like it, close to the ganglia and their intercommunicating cords. Near the pedal ganglion it sends a vessel to the swimming-fin (fig. 1, D), then courses on towards the buccal mass, where it becomes lost, and doubtless ends, like the pedal artery, in the return circulation. With the above exception, the aorta gives off no branches in its entire length; but, from its exceeding thinness and transparency, it is apt to be overlooked. It has usually a constricted or beaded appearance (fig. 4), from irregular contractions of its coat, which seems to consist of a simple membrane, in which no special structure or muscular fibres can be detected. According to Huxley there are no special veins in the return circulation, and the blood returns to the heart through the periintestinal cavity; and certainly strong evidence in support of this lies in the fact that no tissue can be detected between the muscular coat and contained viscera, which appear to float free in the blood of this rudimentary venous system—and among them, curiously enough, the vessels of the efferent circulation, viz. the aorta, pedal and branchial arteries, blood-vessels bathed on both sides in blood, which thus convey the aerated fluid direct and unmixed from the breathing-apparatus to the active organs which most require it, *e. g.* the liver,



fin, and buccal mass, the other viscera and tissues being sufficiently nourished and oxidized by contact with the less highly vitalized fluid of the afferent current.

#### *Respiratory Apparatus.*

This consists, in this form of *Firola*, of an elongated cylindrical tube (Plate XLIII. fig. 4, F L) attached to the under surface of the ventricular sac, its long axis directed antero-posteriorly; its anterior end truncated, and its posterior extremity opening externally near the anal orifice. Its centre is occupied by a tube which runs nearly its entire length, and is about one-third the diameter of the larger cylinder. The exterior of the central tube and interior of the outer one are thickly covered with very active cilia, by which a constant renewal of the water-supply is effected through the open posterior end, the current having the double purpose of changing the oxygenating medium, and of carrying away fæcal accumulations from the adjacent anus. The whole is attached to the under surface of the auricular sinus; and the blood is possibly aërated, partly, at least, through the membrane which separates them, and partly in the cavity of the respiratory organ itself. Simple juxtaposition cannot be the only connexion between the heart and breathing-organ; and some communication must exist between the two to permit the passage of blood to be oxygenated in the interior. The entire subject still requires study. Where no branchial apparatus or localized and special breathing-organ exists, as in *Firoloides*, (Plate XLIII. fig. 1), or is found only in a very rudimentary form, the vitalizing process is doubtless carried on during its passage through the venous sinuses or periintestinal cavity, especially those next the surface. Although the breathing-apparatus varies much in different families and even genera of the Heteropoda, each species, doubtless, possesses its own peculiarity; nor is its presence or absence a matter of such uncertainty as some suppose.

#### *Digestive System.*

In *Firola* and *Firoloides* this consists of:—first, the parts which form the buccal nucleus, viz. the oral orifice, buccal cavity, tongue, upper part of œsophagus, &c.; second, the stomach and intestinal canal; and, third, the secretory organs which aid digestion, viz. the salivary glands and liver.

The oral orifice is terminal, circular, non-labiate, comparatively large, and capable of considerable dilatation and contraction from the presence of circular fibres, which form a kind of oral muscle. Behind it lies the “buccal nucleus” (Plate XLIII. figs. 1, 2, 3, E), so termed, except during the protrusion of the tongue, when the whole is pushed forward (Plate XLIV. fig. 12), partly by the œsophagus, but chiefly by the muscular coat. The buccal cavity is round or oval antero-posteriorly, and principally occupied by the tongue. The latter, or glottideum, is so armed with teeth as to form a rasping-organ, the root of which is large, cartilaginous, and chiefly composed of oval transparent cells (Plate XLIII. fig. 2, *y*), on which rests the lingual ribbon (Plate XLIII. figs. 2, 3; Plate XLIV. fig. 11), which doubles beneath the lingual mass, but unfolds while feeding, and protrudes as in Plate XLIV. fig. 12, with its point more or less curved, and the teeth on the tip and dorsum erect and prominent. The lingual ribbon (Plate XLIV. fig. 11, *y*) is



elongated, tapering anteriorly, and widening posteriorly; while its central part, or rachis, widens on the other hand from behind forward. The rows of teeth, from twenty-seven to thirty in number, are comparatively soft, though perfectly adapted for disintegrating the soft tissues of the Pteropods and other animals on which they doubtless feed.

Behind the buccal nucleus the œsophagus commences by a funnel-shaped dilatation (Plate XLIII. fig. 2, κ) where the muscular fibres are stronger than elsewhere. This soon narrows into a tube-like intestinal canal, which runs along the central axis from one end of the animal to the other, almost in a straight line (Plate XLIII. fig. 1, λ), varying in diameter, when quiescent, from one-sixth to one-fifteenth of the width of the body. Its coats, and those of the stomach and rectum, have a longitudinal and transverse layer of involuntary muscular fibres (Plate XLIII. fig. 4, m) lined by an inner (mucous?) coat, the rugæ of which are apparent while the wavy peristaltic action of the canal is going on from above downward during the passage of food. About the posterior third of *Firola* (Plate XLIII. fig. 4, s), and behind the ventral fin, there exists a fusiform dilatation to about three times the diameter above and below; at the anterior orifice of which (s') the canal presented an evident constriction, obviously meant to prevent return of food. At the lower or posterior end a second fold (s'') projected into the canal, which might be supposed to represent the pyloric, as the other did the cardiac valves of the human stomach. The bolus of food (not figured here, to make anatomical details clearer) contained in this cavity appeared to move about, not with a regular circulatory motion, as in the human subject, but to and fro from end to end, as if by peristaltic action alone, which impulse is thus propagated uninterruptedly along the whole length of the intestinal canal. A corresponding dilatation existed well in front in *Firoloides* (Plate XLIV. fig. 13). In other varieties (*e. g.* *Firoloides*, Plate XLIII. fig. 4) only one exists, viz. where the alimentary tube curves down and enters the visceral (pallial) division of the body, above and in front of the liver. This is probably the true stomach, and the enlargement observed in the above-mentioned instances only accidental and caused by the passage of food—an opinion confirmed by the circumstance that it is into the posterior wall of the latter that the biliary duct yields its secretion. Behind the stomach a short intestine runs downward and backward to terminate in the vent (Plate XLIII. figs. 1, 4). The peristaltic action appears to be the only independent movement the stomach possesses; nor, from the nature of the food, which consists of animals with soft tissues identical with or very like their own, is any other needed, as little trituration is necessary, the solvent action of the salivary, gastric, and hepatic secretions being alone sufficient to prepare them for absorption.

Two sets of glands appear subservient to digestion, viz. the salivary and liver. The former (Plate XLIII. figs. 2, 3, 5, n), two in number, and comparatively large, lie under the buccal mass, curving downwards and backwards on either side of the œsophagus, and form elongated tubes, narrowing posteriorly, each having a central duct of large calibre, joined obliquely on each side by certain short and wide unbranched sacculi—a very simple glandular arrangement, the main duct of which opens into the buccal cavity well in front and beneath the tongue. As already described, these glands and the sense



of taste appear to receive their nerve-supply from the cephalic, and not from the buccal ganglion.

The branchial nucleus is largely composed of a dark-red or brown rounded liver, which lies behind the stomach and rectum, bulging well into the former, and striated as if lobulated (Plate XLIII. fig. 4, L). Its minute anatomy requires further study; but from its position near the posterior end of the intestinal canal, and not far from where the food makes its exit from the body, the secretion probably partakes more of the nature of an excretion than of one necessary to digestion.

Absorption of the products of digestion is doubtless effected, as in the Mollusca generally, by the venous lacunæ or sinuses which surround the œsophagus and fill up the periintestinal cavity, and doubtless totally distinct from the aquiferous canals outside the muscular coat. Surrounded and bathed by the blood, the intestinal tube and stomach deliver the nutriment their lining membrane absorbs directly into that fluid, to be elaborated and applied to the purposes of assimilation.

#### *Generative System.*

The anatomy and physiology of the generative system, and especially the development of the ova and young, still require observation. Like the order generally, they are bisexual. A male organ is seen in many, consisting of a well-developed penis having a central canal, a terminal bulbous glans-like swelling, and two testicular-looking bodies posteriorly, each showing a central tube or excretory canal, which joins that of the penis. In *Firoloides* (Plate XLIII. fig. 1) this lies at or near the lower and anterior part of the branchial nucleus—but in *Firola* (Plate XLIII. fig. 4, P) some distance in front, and supplied with nerves both from the pedal and branchial ganglia, as in Plate XLIII. fig. 4, P. In *Carinaroides pedunculata* (Plate XLIV. fig. 16) and *Carinaroides*, Plate XLIV. fig. 14, it also occupied the right side, and is large and apparently sheathed and retractile. Its position probably varies, even in different species. A large ovary is said by some to form part of the visceral nucleus, lying behind and filling a concavity in the liver. A peculiar appendage often projects from the terminal extremity of *Firoloides*, with a pedicle sometimes short and thick (Plate XLIV. fig. 7), in others long (Plate XLIV. figs. 8, 9, 10), but with no swelling, perhaps from its having broken off (Plate XLIII. fig. 1). Plate XLIV. figs. 5 & 6 are enlarged views of one variety with eight distinct segments, gradually increasing in size toward the free end, and each attached to its fellow above and below by an annulated constriction, as if they ultimately broke off and became detached. The largest compartment was empty, and could be flattened by pressure, appearing semiopaque under the microscope. The wall, thick towards its attached end, became gradually thinner towards its outer extremity, while the centre appears hollow and tube-like. No other peculiarity could be observed in their structure; and they were present in one form or another in nine out of twenty-three *Firolæ* and *Firoloides*, and could be readily observed by the unaided vision. In spirit they shrivel slightly.



*Distribution and Varieties.*

Said to be "amongst the most abundant of the Pelagic Mollusca, and float in myriads on the surface of the Mediterranean and Atlantic" (Owen); the *Firolidæ* are not so numerous in the Pacific, at least its eastern or American half. Thus, during several voyages across the equator, between Vancouver Island, in  $48\frac{1}{2}^{\circ}$  N. latitude, and Valparaiso, in  $33^{\circ}$  S. latitude, extending over 170 days, during which the towing-net was kept constantly going when practicable, they were met with only eleven times, six bringing single specimens, and eight the highest number procured at one haul. *Carinaria* and *Cardiapoda* are by no means common; those obtained were chiefly *Firola* and *Firoloides*, particularly the latter, sixteen of the twenty-five being *Firoloides*. The *Atlantidæ* are more numerous than either. The subjoined Table will show the different varieties thus obtained, the locality, number, &c. Although most abundant near the equator, where high temperature favours the development of aquatic life, the Table shows that their range of distribution in the Pacific is wide, as with the *Heteropoda* generally. In this instance it spread over  $77^{\circ}$  of latitude (viz. from  $40^{\circ}$  N. to  $31^{\circ}$  S.) on the one hand, and on the other from mid-ocean to within sixty miles of the American shore; and further observations will doubtless widen the area.

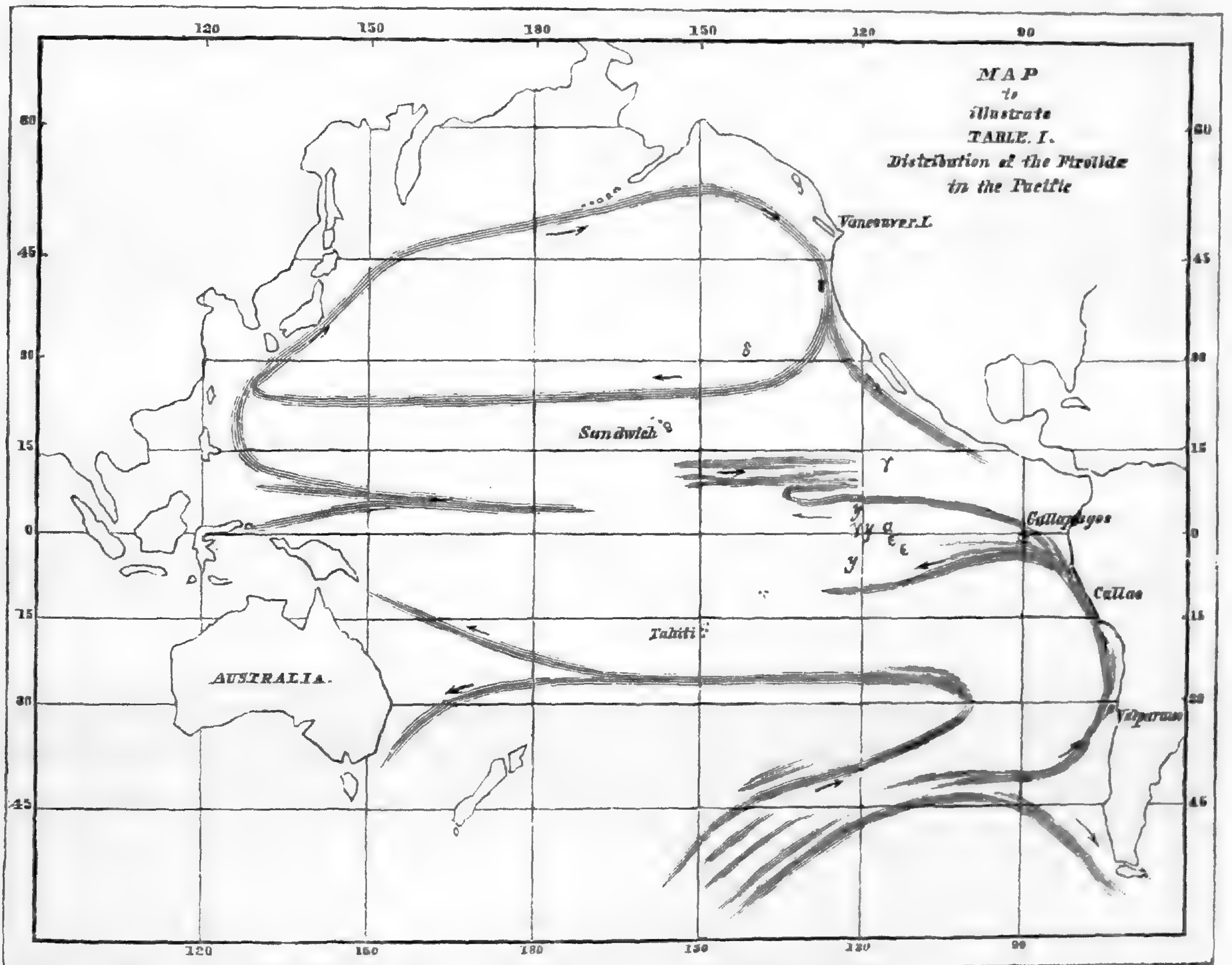
TABLE.

When obtained.		Name.	Nr. obtained.	Locality.		Sea.		Reference.	
				Lat.	Long.	Temp.	Sp. gr.		
Feb. 11, 1860.....	$\alpha$	<i>Carinaria</i> , or <i>Carinaroides</i> (mutilated, visceral nucleus absent).	1	Equator	$115^{\circ}$ W.	$76^{\circ}$ F.	1026	Plate XLIV.	fig. 15.
July 8, 1861.....	$\beta$	<i>Carinaroides pedunculata</i> ..... <i>Cardiapoda pedunculata</i> ( <i>D'Orb. Voy.</i> ) <i>Cardiapoda carinata</i> ( <i>D'Orb. Voy.</i> )	4	$31^{\circ}$ S.	$73^{\circ}$ W.	55	1027 $\frac{1}{2}$	XLIV.	16.
May 4, 1861 ..	$\gamma$	<i>Firola caudina</i> ( <i>Rang</i> ) .....	1	$13^{\circ}$ N.	$115^{\circ}$ W.	81	1025	} XLIV.	14.
May 14, 1861..		<i>Carinaroides</i> .....	2	Equator	$119\frac{3}{4}^{\circ}$ W.	79	1025 $\frac{1}{2}$		
Sept. 7, 1861.....	$\delta$	<i>Firola</i> .....	1	$32^{\circ}$ N.	$137^{\circ}$ W.	71	1026	XLIV.	17.
Feb. 7, 1860 ..	$\epsilon$	<i>Firoloides</i> .....	1	$4^{\circ}$ S.	$110^{\circ}$ W.	77	1026	} XLIV.	18.
Feb. 11, 1860..		<i>Firoloides</i> .....	2	Equator	$115^{\circ}$ W.	76	1026		
April 22, 1861.)		<i>Firoloides</i> .....	1	$40^{\circ}$ N.	$127\frac{3}{4}^{\circ}$ W.	56 $\frac{1}{2}$	1029		
Feb. 14, 1860.....	$\zeta$	<i>Firola Keraudrenii</i> .....	3	$2^{\circ}$ N.	$120^{\circ}$ W.	78	1025	} XLIV.	19.
May 14, 1861.....		<i>Firola Desmarestia</i> .....							
May 16, 1861.....	$\eta$	<i>Firola Keraudrenii</i> .....	8	Equator	$119\frac{3}{4}^{\circ}$ W.	79	1025 $\frac{1}{2}$	}	
March 11, 1864....		<i>Firola Desmarestia</i> .....							
		<i>Firola Keraudrenii</i> .....	1	$5^{\circ}$ S.	$120\frac{1}{2}^{\circ}$ W.	79	1025 $\frac{1}{2}$		
		<i>Firola Desmarestia</i> .....	1	$35^{\circ}$ S.	$7\frac{1}{2}^{\circ}$ E.	69	1027	XLIV.	20.
		<i>Firoloides</i> or <i>Anops</i> (South Indian Ocean).	1						

Many interesting problems remain to be solved with regard to these animals, e. g. whether they are arctic and subarctic, as well as temperate and tropical forms; and if so,



what is the range of each. Certain of them, e. g. *Carinaria mediterranea*, found chiefly in the sea after which it is named, have a fixed and limited home, out of which they are prevented from straying into materially colder or warmer waters by surrounding land, except when accidentally borne into the Atlantic by the efferent Gibraltar current. But it is not so with the majority of this group, which have not an inland and almost land-locked sea like this in which to swim, but great oceans, whose waters are being constantly changed by those mighty currents that form so marked a feature in their physical geography; and it is a question of some interest how arctic, temperate, and tropical



varieties comport themselves in other zones,—whether or not they are drifted about involuntarily and helplessly, and kept continually circling round the globe, subjected in the many and rapid changes of latitude to equally sudden and great variations in the temperature and specific gravity of the fluid in which they float, and if, for example, tropical forms can exist in arctic seas, which are known not to have the same low temperature as the air overhead, or, on the other hand, arctic forms in tropical waters. To this our still restricted knowledge does not appear sufficient to warrant more than a limited and indefinite answer; but it is likely that, as with land and the largest forms of aquatic animals, each has its own special region where it is found in the greatest abund-



ance and in the highest activity, and its own range,—a wide one, it is true, as the Table shows, and wider, perhaps, than with the majority of terrestrial or marine animals, because the range of aqueous is not so great as that of aerial climate, but still well defined, which they cannot pass with impunity, and pass only at the cost of impaired vitality and perhaps loss of life.

Notwithstanding the unquestionable existence of ocean climates, and zones of animal and vegetable life characteristic of and peculiar to each, and the probability that the *Firolidæ* are not universally scattered, but systematically distributed according to meteorological laws, different families having their own peculiar range, out of which they are seldom found, the great extent of this in the present instance is instructive and goes far to show that the marine fauna, and especially the minute and less-developed forms endowed with limited locomotive powers like those under consideration, and therefore apt to be involuntarily carried hither and thither and from high to low latitudes, or *vice versá*, by winds, tides, and ocean-currents, and thus drifted out of those waters for which their anatomical and physiological structure best adapts them, must possess higher adaptability to great and sudden physical and climatic changes, especially in the temperature and density of the water in which they float, than land animals, which, for obvious reasons, are less subject to this casualty. That the *Firolidæ* possess this power of accommodation in a marked degree is evident from the fact that the specific gravity of the Pacific, where the above were found, ranged from  $1023\frac{1}{2}$  near the equator to 1029 in the higher latitudes, and its heat from  $50\frac{1}{2}^{\circ}$  to  $83^{\circ}$ —a range of no less than  $5\frac{1}{2}$  of specific gravity and  $32\frac{1}{2}^{\circ}$  of Fahrenheit\*.

The tropics, which Maury has so felicitously termed the “womb” of the sea, is undoubtedly the birthplace of perhaps all the above-tabulated forms; for, though sometimes met with in temperate latitudes, it is there we find them most abundant (map); and though they are drifted to many parts of the Pacific, and often carried into the colder latitudes of either hemisphere by the irresistible ocean currents against which their limited natatory powers are unable to contend, we may fairly presume that they are not cosmopolite, and cannot exist in every ocean, and in the waters of so many different temperatures and densities as that would necessitate; and perhaps we should not far err were we to believe that while warm tropical seas are their native home, and this the zone in which the most vigorous part of their doubtless brief career is spent, it is in the colder regions that those fortunate enough to escape being preyed on end their existence. Carried thither, their life of slender tenure gradually ebbs away as their originally warm native element cools on reaching high latitudes and enters the chilly seas, which possess a very different heat and weight, in which they finally die. The life of the *Firola* or *Firoloides* may, indeed, be taken as a type of the existence of many of the minute and microscopic organisms which have the ever-changing surface waters of the ocean as their *habitat*, whether fitted for warm or cold waters. Conveyed from one ocean to another, as the waters of the globe, like its winds, perform their “circuit,” their limited life is ultimately ended by static and thermometric changes in the fluid in which they

\* These were the highest and lowest observed during three voyages between Vancouver Island and Valparaiso, those in the Table being for the places indicated.



float, and derive both the food which nourishes and the oxygen which vivifies them, if these changes are much beyond those limits which they are fitted to endure. Those circulatory currents which exist in the Pacific and, indeed, all the great oceans probably serve, as a rule, to keep particular varieties in their native seas; but when accidentally carried by branch streams into colder waters unsuited for their organization, then they doubtless die—a sequel which, as with animals of higher organization, perhaps most frequently results from external agencies; and with all that escape a violent end from predatory enemies, this is perhaps the usual cause and mode of death.

We are equally ignorant of their distribution in depth; but the anatomical and physiological structure of all the known varieties shows that they are surface animals, and probably seldom extend more than a few yards below the sea-level, where the water is most highly oxygenated. Like most of the soft gelatinous animals caught by the towing-net, they avoid the heat and glare of the sun, and are generally entrapped at night, when they come to the surface to breathe and feed, this being doubtless their time of greatest activity, and day the period of repose, when they sink a moderate distance into a calmer, darker, and less sultry medium.

In Plate XLIV. are outlines of the different varieties of Firolidæ caught by the writer in the Pacific during 1860 and 1861, in the regions indicated in the Table (p. 270) and Map. Fig. 20, Plate XLIV. was obtained in the South Indian Ocean during a subsequent voyage to Australia in 1864, and is evidently allied to and doubtless one of the Firolid family, in which, however, no eyes, tentacles, tail, or very evident visceral nucleus could be seen; but which had a well-marked and large swimming-fin minus a sucker, a double envelope, consisting of an external hyaline coat, covering the entire body, and an internal muscular one, showing distinct transverse and longitudinal fibrillæ, similar to those described. Very active when caught, it was certainly not a mutilated *Firola*, as has been suggested with regard to *Anops Peronii* (D'Orb.); and we doubt if this least-developed group of the Firolidæ (*Anops*) is not one of real existence, though perhaps not so abundant as the others; for this is the only specimen met with, after long and systematic use of the towing-net, in the Atlantic, South-Indian, but especially the Pacific Ocean. These figures, sketched from life, are of the natural size. At least five of them, viz. figs. 14, 15, 17, 18, 20, appear to be new. *Carinaroides* (Plate XLIV. fig. 16) is evidently identical with *C. pedunculata*, D'Orb. Voy., and *Firoloides* (Plate XLIV. fig. 19) with *F. Keraudrenii*, as indicated in the Table. The Map and Table show the part of the Pacific where they are severally caught. *Firoloides* (Plate XLIV. figs. 13 and 18), whose active and singular form renders it readily distinguishable, was met with thrice, and enjoys a wide range. *Carinaroides* (fig. 14) is easily known by its short deeply-keeled tail. In none of the Pacific varieties, except *Carinaria* (fig. 15), does the caudal appendage appear so lengthy and highly developed as in the Atlantic and Mediterranean Firolidæ. Were observers to carefully keep their specimens (easily preserved in weak spirit), it would greatly facilitate correct classification, and obviate much error.



*Classification.*

The literature of the Heteropoda, especially its lower forms, is trammelled with that unfortunate tendency to excessive multiplication of names, and indefiniteness in classification, so common in many departments of natural history—as if zoologists, in meeting with, to them, new or like varieties, were undecided in what family or class to place their specimens, and, unimpressed with the importance of correct and systematic tabulation, got out of the difficulty by sketching and giving a new synonym to an animal perhaps already known and in the enjoyment of several titles. Hence greater accuracy in defining species and varieties, a lucid and not too minute arrangement, and a simple easily understood nomenclature, at all times a desideratum in scientific research, are well worth attempting with the Heteropods, and fortunately is comparatively easy, as a careful survey of all that are known will show that they may be severally ranged in different groups, each possessing distinctive characters.

Even on limited observation, nothing can be more evident than how readily the diversities in their structure may be turned to account in determining varieties when external configuration alone makes discrimination difficult. Such minute and careful microscopic examination as that of the lingual dentition is too troublesome to be generally available; and we naturally seek for some easier means by which we may at once, and, if not by the naked eye, at least by a low magnifying-power, fix the position of specimens as we meet with them. This may be readily accomplished by attending, first, to the presence or absence of a shell; second, to the character of the visceral nucleus, whether pedunculated or forming part of the soma; third, its position with regard to the tail proper; and, fourth, the presence or absence of a breathing-apparatus and its nature. A very cursory glance at the order will show that its different varieties may be conveniently separated into two primary divisions.

1st. The Atlantidæ, including *Atlanta* and *Oxygyrus*, whose bodies are curved and capable of being wholly retracted into a spiral shell; and,

2nd. The Firolidæ, including the *Carinaria*, *Carinaroides*, *Firola*, and *Firoloides*, whose form is straight and elongated, and either wholly naked or furnished with a very small shell, covering the appendicular visceral nucleus.

The difference between these is so marked that it is easy to refer specimens to either. But it is with the members of the second that the chief difficulty appears to lie; and we find them variously divided and profusely named by terms often apparently indiscriminately used—so much so that there is some trouble in ascertaining what is or which is an *Anops*, a *Pterotrachea*, *Firola*, *Firoloides*, *Carinaria*, *Cardiapoda*, *Cerophera*, or *Carinaroides*, and in wading our way to safe conclusions amidst a confused multitude of soubriquets and the application of double and even triple names to the same variety. The presence or absence of the rudimentary shell and the character of the branchial nucleus, however, enable us to further safely and easily subdivide the Firolidæ into:—

1st. The *Carinaria*, with a vitreous shell, and the *Carinaroides* or *Cardiapoda*, with a cartilaginous or horny one, protecting the visceral nucleus, which is pedunculated; and,

2nd. *Firola* and *Firoloides*, which are destitute of a shell, and have a sessile visceral nucleus.



The position of the visceral nucleus and character of the branchial apparatus further permit us to distinguish between the two latter thus:—

*Firola*. Body terminated by a tapering tail, visceral muscles situated in front of the latter; respiratory organ consisting of well-developed branchiæ or a ciliated subspiral band.

*Firoloides*. Body abruptly truncate posteriorly; visceral nucleus terminal; respiratory apparatus consisting of a very rudimentary ciliated organ, or altogether absent.

This distinction between *Firola* and *Firoloides*, first pointed out by Lesueur, is unquestionably the easiest and the best, and too little attended to by observers. In following it, however, they must avoid confounding the tail proper (metapodium) with the singular annulated filiform appendage often present when the former is wanting, as in some varieties of *Firoloides*. The presence or absence of the tentacles and the position of the fin, on which stress has been laid by some, do not appear characteristic or distinctive of species, or available for the purpose of classification. The subjoined Table shows the distinguishing zoological marks of the Heteropoda according to this arrangement.

Heteropoda.	ATLANTIDÆ.—Body curved and retractile into spiral shell .....	{	<i>Atlanta</i> .—Shell calcareous, spiral; operculum oval, nucleus median.		
			<i>Atlantoides</i> ( <i>Oxygyrus</i> ).—Shell corneous, involute; operculum trigonal; nucleus lateral.		
	FIROLIDÆ.—Body elongated and naked, or nearly so.	{	Visceral nucleus only, protected by a shell, pedunculated, situated at posterior third or fourth.	{	<i>Carinaria</i> .—Shell vitreous, spiral. <i>Carinaroides</i> ( <i>Cardiapoda</i> ).—Shell corneous, involute, or absent.
		{	Visceral nucleus shell-less and sessile.	{	<i>Firola</i> .—Body terminated by a tapering tail; visceral nucleus situated in front of this; respiratory apparatus consisting of true branchiæ, or a ciliated subspiral band. <i>Firoloides</i> .—Body abruptly truncate; visceral nucleus terminal; respiratory apparatus consisting of a rudimentary ciliated organ, or entirely absent.

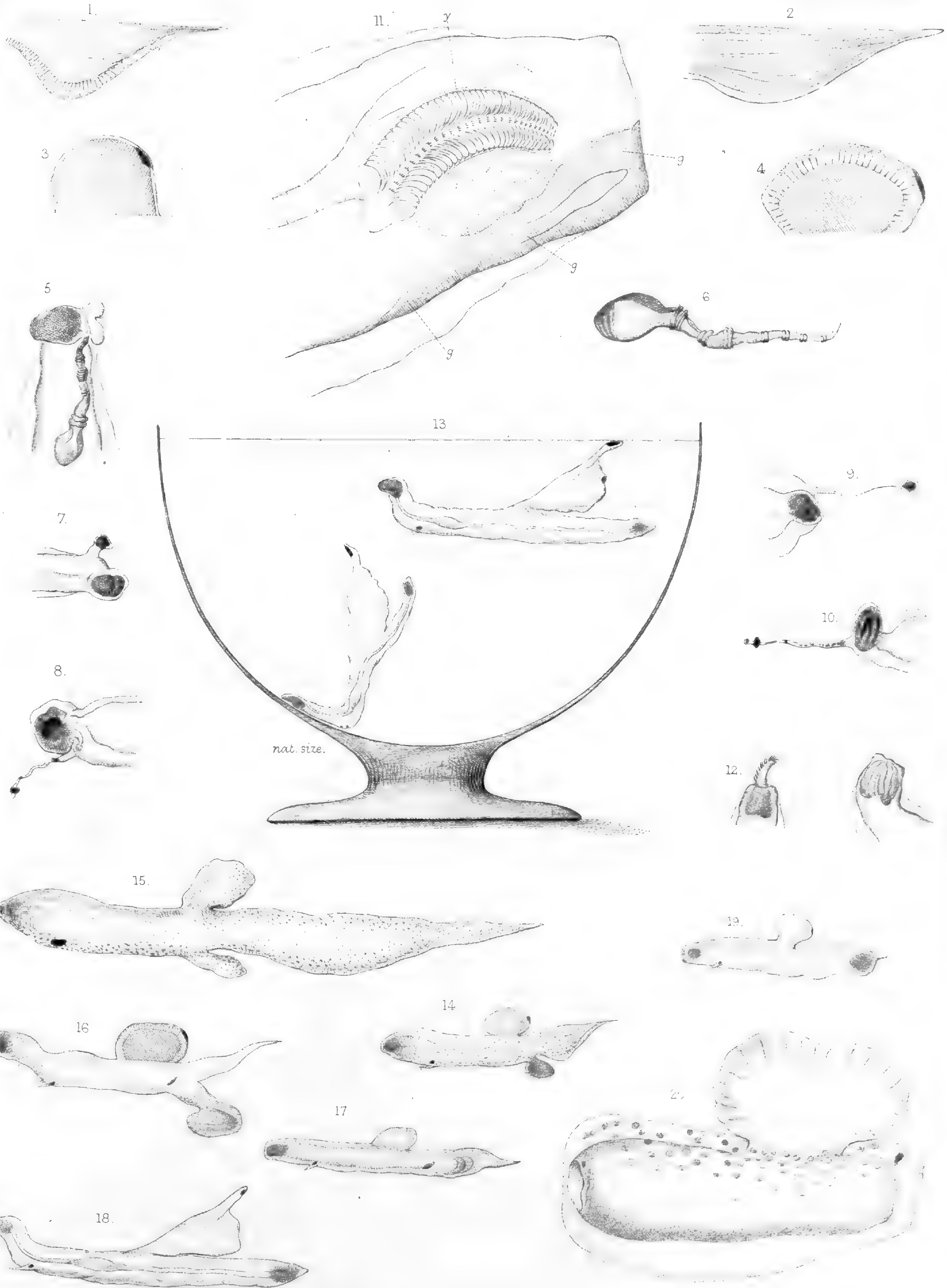














XII. *Notes on the Thysanura.*—Part IV.

By Sir JOHN LUBBOCK, *Bart., F.R.S., V.-P. Linn. Soc., &c.*

(Plates XLV. & XLVI.)

Read June 3rd, 1869.

SINCE my last paper on the *Thysanura*, which was read before the Linnean Society in 1867, I have met with six more British species, three of which have been already recorded as occurring on the Continent, while the others appear to have been hitherto overlooked. The first three are *Lepidocyrtus curvicollis* Bourlet, *Degeeria domestica* Nicolet, and *Lipura maritima* Guérin; the fourth is a species allied to *D. domestica*, the fifth an *Isotoma*, which I propose to name *Isotoma grisea*; and the sixth forms the type of a new genus. In placing on record the existence of Nicolet's *Degeeria domestica* as a British species, I must add that I have never found it myself, but have received specimens from Mr. M'Intire, and that, for reasons given below, I cannot regard it as belonging to the genus *Degeeria*, but rather as constituting the type of a separate genus of much interest as being in some respects intermediate between *Templetonia*, *Lepidocyrtus*, and *Degeeria*. It has the hairs and scales of *Lepidocyrtus* and *Templetonia*, and the general form of *Templetonia* and *Degeeria*, from the former of which, however, it differs in its antennæ.

I also add descriptions of the only three British species of Lepismidæ with which I am acquainted.

## LEPIDOCYRTUS CURVICOLLIS Bourlet.

*Lepidocyrtus curvicollis* Bourlet, Mém. Soc. R. Lille, 1839; Mém. Soc. Douai, 1842.

*Cyphodeirus capucinus* Nicolet, Mém. Soc. Helv. 1842.

*Lepidocyrtus curvicollis* Gervais, Hist. Ins. Aptères.

— *capucinus* Gervais, Hist. Ins. Aptères.

Bourlet's description of this species is as follows:—

“Thorace gibboso, capite deflexo, corpore toto squamis plumbeis.

“2 millim.  $\frac{1}{2}$ . Mêmes caractères que ci-dessus. Sous les pierres et le bois pourri, en tout temps, excepté l'hiver”.

I have found a few specimens belonging apparently to this species, and have also received some from Mr. M'Intire. In its ordinary position the head is completely hidden by the projecting bars of the thorax. It seems to me to be identical with the *Cyphodeirus capucinus* of Nicolet, whose description I subjoin.

“Entièrement d'un jaune orangé, sauf les antennes, dont les deux premiers articles sont d'un jaune plus pâle, et les deux derniers d'un gris assez foncé. Corps cylindrique, luisant, peu velu, à poils très-courts. Premier segment très-allongé antérieurement, triangulaire, creux en dessous et recouvrant la tête de manière à n'en laisser voir



que le bord antérieur quand on la regarde en dessus (fig. 1a). Deuxième segment, du double plus long que le suivant. Le sixième plus long que les trois précédents pris ensemble, et recouvert sur les côtés latéraux par un prolongement angulaire du cinquième. Yeux noirs. Filets de la queue blancs et finement striés transversalement.

“Cet insecte offre un léger reflet métallique produit par quelques écailles; longueur environ 2 millimètres. Se trouve dans les jardins, sur la terre; très-rare: vit solitaire.”

Nicolet must, I think, have had before him immature or injured specimens. When full-grown, and unrubbed, this species is very beautiful, and reflects the most gorgeous metallic tints. Its general appearance is most singular; the depressed position of the head, and the gait, give it a ludicrous resemblance to a Hippopotamus; and at the same time the body does not look as if it belonged to the head and legs, but rather as if it were some foreign body being carried on the back.

The head is scarcely seen from above. The fringe of scales on the front of the thorax is turned down; and there are a certain number of long hairs, some of them bent.

The eggs are laid in heaps, and are spherical, with a diameter of about  $\frac{1}{30}$  of an inch. They are at first smooth, but after a few days are covered with filaments.

#### ISOTOMA GRISEA, n. sp.

Dark grey, with a leaden tinge. Eyes on a black spot. Legs and antennæ of the same colour as the body. Second and third segments of antennæ equal in length. The whole body covered with very short, close, white hairs; the posterior part of the abdomen with a few longer ones. Terminal segment of spring straight, or turned slightly outwards. Feet without tenent hairs; the large claw has a single tooth on the inner side.

Length  $\frac{1}{2}$  of an inch. Under boards, on a hotbed. Common. September to March.

I long thought this was the young of some larger species; but having watched them in their native haunts, and kept them for some time in confinement, I am satisfied that it is an independent species. My specimens do not exactly coincide with any of those described by Nicolet. The forms of the antennæ and of the spring distinguish it from the species forming his first section of the genus; nor is there any one in the second which it much resembles.

#### LIPURA MARITIMA Guérin.

*Achorutes maritimus* Guér. Icon. du Règne Anim. Ex. Ins. p. 11; Suites à Buffon, Aptères, vol. iii. p. 439.

Dark purple. Eyes five in number, two in front and three behind.

Length  $\frac{1}{8}$  of an inch.

This species was found by M. Guérin at Treport, in Normandy. He described it as an *Achorutes*; but he expressly says it could not jump, and there can be little doubt that, as M. Gervais has already suggested, his specimens really belonged to the genus *Lipura*.



I have myself found *Lipura maritima* abundant among the rocks, and on pools, at low water, near St. Andrews; and Dr. Allman has kindly sent me specimens from Kinsale.

#### BECKIA, n. g.

*Body* scaly. *Antennæ* 4-jointed. *Eyes* wanting. *Thorax* not projecting overhead. *Abdominal segments* unequal.

This is a particularly interesting genus, and forms a link between *Lepidocyrtus* and *Degeeria*. In many respects it resembles *Degeeria*, but differs in the absence of eyes and the presence of scales. It is even more closely allied to *Lepidocyrtus*, from which the principal difference consists in the absence of eyes. *Templetonia* differs from *Beckia* in having the terminal segment of the antennæ ringed, and in the presence of a dark eye-patch, with a single lens. I have dedicated the genus to Mr. Beck.

#### BECKIA ARGENTEA, n. sp.

Silvery, with bright metallic reflections. No eyes. Third segment of the antennæ rather shorter than the second or fourth. A thick fringe of hairs in front of the thorax. Filaments of the tail scarcely reaching to the ventral tube.

Length  $\frac{1}{15}$  of an inch.

I have also a second species of *Beckia*, somewhat broader than *B. argentea*. This is, perhaps, the *C. albinos* of Nicolet. Considering the absence of eyes, the activity of these species is truly remarkable. They make, however, great use of their antennæ in feeling the ground before them.

#### SEIRA, n. g.

*Body* scaly. *Antennæ* 4-jointed; terminal segment not ringed. *Eyes* on a dark patch. *Thorax* not projecting over the head. *Abdominal segments* unequal.

I have proposed this genus for the scaled species which were placed by Nicolet among the *Degeeriæ*, because it seems to me manifestly unnatural to unite in the same genus species with and without scales. Like the preceding genus, *Seira*\* forms a very interesting link between several genera—a fact which I have endeavoured to indicate in the name. Indeed some of the species approach very closely to *Lepidocyrtus*; and as regards *S. Buskii*, I was long in doubt whether to regard it as a *Seira* or a *Lepidocyrtus*. The form of the thorax, which is the characteristic on which that genus was founded, admits of every gradation, and therefore is not of very easy application.

#### SEIRA DOMESTICA.

*Degeeria domestica* Nicolet.

Nicolet's description of this species is as follows:—

“Mêmes antennes que le précédent, mais blanches, ainsi que le dessous du corps, les pattes et la queue. Dessus du corps écailleux, d'un blanc sale très-luisant, avec

\* From *σειρά*, a chain.



quatre bandes transversales et plusieurs taches d'un gris foncé un peu rougeâtre. Tête blanche. Yeux noirs. Poils gris et longs. Sixième segment comme dans l'espèce précédente.

“Longueur :  $1\frac{1}{2}$ –3 millimètres. Cette espèce se trouve dans les maisons, où elle vit solitaire ; rare.”

Mr. M<sup>c</sup>Intire has found this species occasionally in Millbank and Brixton prisons. It is, however, as Nicolet says, “rare.” I have never met with it.

The antennæ are long and slender.

#### SEIRA BUSKII, n. s.

Dark violet, with metallic reflections. Head, legs, and base of antennæ yellowish. Eyes on a black patch, and connected by a black band. Spines yellowish at base, colourless towards the extremity.

Length  $\frac{1}{15}$  of an inch.

The basal segment is rather shorter than the second or third, which, again, are, though very little, shorter than the apical. The hind legs are longest. The feet are all alike. There is one tenent hair, not much swollen at the end. The small claw is without teeth. The large one has three teeth on the inner, and one on the outer margin.

I have only found this species in greenhouses and hothouses ; perhaps, therefore, it is not an indigenous British species.

[24th May, Thun.—Since the above paper was sent in to the Society, I have paid a visit to Switzerland for the purpose of collecting Nicolet's species, and comparing them with those of England. The Thysanura would probably have been much more frequent during the autumn months ; still I succeeded in finding a good many species, on some of which it may be worth while to say a few words\*.]

#### TEMPLETONIA NITIDA.

I had already come to the conclusion that *Podura nitida* of Templeton, one of our commonest as well as prettiest English species, was identical with the *Degeeria margaritacea* of Nicolet, as well as with the *Heterotoma crystallina* (= *Ætheocerus crystallinus*) of Bourlet. In this view I was confirmed by finding it common in Switzerland.

#### ORCHESSELLA MELANOCEPHALA.

Like Nicolet, I found *Orchesella melanocephala* very common in the woods of Chaumont above Neuchatel. The longitudinal lines, however, in the great majority of specimens were so much more distinct and striking than in Nicolet's figure, as to give the insect a very different aspect. I should not have called the fourth segment of the antennæ “violet” in any of the specimens I found. Lastly, the terminal segment of the antennæ was, like the preceding, pale at the base.

#### SMYNTHURUS AUREUS, mihi.

I found this species sparingly.

\* *Pauropus* I found repeatedly at Grindelwald ; and as it has also been discovered in Sweden, there can no longer be any doubt that it is an indigenous European species.



*S. LUTEUS*, mihi.

This species also was abundant. Yet it seems to have been overlooked by Nicolet. Perhaps he took it for the young form of *S. viridis*.

I also met with a very pretty little species of *Smynthurus*, which differs from any of Nicolet's species. It is white, with two broad transverse purple bands, one occupying the whole of the front part of the body, the other occupying the middle of the abdomen; the antennæ are yellow, and connected at the base by a line of yellow passing into purple; the eyes are on a black patch, and behind each is a purplish band; underneath, the body is altogether white, with two opaque round spots on each side of the spring. This pretty species cannot be confounded with any other; the dorsal surface is divided into five subequal parts—the first, third, and fifth being white, the second and fourth purple, or to the naked eye black.

I hesitate, however, to describe it as a distinct species, because in the form of the antennæ, the feet, and the spring it so very closely resembles *S. luteus*, from which, on the contrary, it differs so much in colouring.

## PAPIRIUS.

I found three species of this genus namely, *P. cursor* mihi, *P. Saundersii* mihi, and *P. nigromaculatus*. As far as colouring goes, these three species agree very closely with the three species named respectively by Nicolet *Smynthurus fuscus*, *Smynthurus ornatus*, and *Smynthurus Coulonii*. In all these cases, however, he distinctly figures the antennæ as having the characters of *Smynthurus*. It would therefore be very desirable to ascertain whether there are really any species of the true genus *Smynthurus* answering to Nicolet's description, or whether perhaps he omitted to notice the difference in the antennæ.

## MACHILIS POLYPODA.

*Lepisma polypoda* Linn. Syst. Nat. ii. 1012; Fabr. Ent. Syst. p. 62.

*Machilis brevicornis* Latr. Nouv. Ann. Mus. i. 79.

*Forbicina polypoda* Temp. Trans. Ent. Soc. vol. i. p. 92.

*Machilis polypoda* Gervais, Hist. Nat. Ins. Apt. vol. iii. p. 448; Nicolet, Ann. Soc. Ent. France, 1847, p. 345.

Brown, with metallic reflexions.

Length  $\frac{1}{2}$  an inch.

Woods and dry places.

I have only met with one specimen of this species. In Ireland, according to Templeton, it is very common. The head is small; the thorax is not distinct from the abdomen; the prothorax cylindrical; the mesothorax is enlarged and elevated; the metathorax is less raised, short and broad.

The abdomen is 10-jointed and tapers gradually backwards.

The eyes are large, compound, black, and meet in the middle line.

The antennæ are shorter than the body, but in my specimen were imperfect at the ends; they differed, however, considerably from Templeton's figure 1 c. The terminal



whip-like portion is divided into much more numerous subsegments, which towards the end become moniliform, have each a whorl of hairs, and fall into groups of seven, each group separated by a well-marked division.

The larger palpi are six-jointed, the three basal segments point forwards, the third being smaller than the other two; the three terminal ones are recurved, and about as long as the two basal. In Templeton's figure only the first two segments point forwards; and they are succeeded by a recurved many-jointed "whip." This does not at all agree with my specimen.

The lesser palpi are three-jointed; the basal segment is shorter than the other two, which are nearly equal in length, the terminal one being somewhat swollen, though not so much so as in Templeton's fig. 1 *d*.

Geoffroy describes the corresponding organs of his *Forbicina teres saltatrix* as two-jointed, another point in which it differs from *M. polypoda*.

The feet are biunguiculate.

I do not find it observed by previous writers that each of the four posterior legs bears an appendage on the basal segment, closely resembling the eight anterior ventral appendages. Their presence appears greatly to strengthen the argument of those who regard these appendages as rudimentary legs. It is moreover peculiarly interesting, if we remember that the peculiar genus *Scolopendrella* has a very similar pair of appendages attached between each pair of legs except the first.

In *M. polypoda* the anterior abdominal segment appears to want these appendages. In the following eight segments they are attached near the posterior margin, and are about equal in size, except the last, which is considerably larger than the rest. Between this last pair is a strong, straight, stiff appendage, which gradually tapers from the base, ending, however, abruptly. It is divided into about thirty subsegments, each with a whorl of stiff, short hairs.

#### LEPISMA SACCHARINA Linn.

*Lepisma saccharina*, Fauna Suec. ed. 2, No. 1925; Guérin, Icon. Ins. plate ii. fig. 2.

*Forbicina plana* Geoff. Ins.

*Lepisma saccharina* Gervais, Ins. Apt. iii. p. 451.

*Lepisma saccharina* Temp. Trans. Ent. Soc. i. p. 92.

Silvery white, with a yellowish tinge about the antennæ and legs.

Length  $\frac{1}{3}$  of an inch.

Head free. Mesothorax and metathorax somewhat wider, but shorter, than the prothorax. Abdomen gradually tapering.

Eyes black, remote. Antennæ long, tapering; basal segment short, others numerous and still shorter; at some little distance from the base they become rather longer, and gradually divide into two subsegments. They are about two-thirds as long as the body, but are generally imperfect.

The longer palpi are five-jointed. At the base are several stiff spines, bifurcate at the extremity. The mandibles consist of three parts:—1st, a fleshy rounded lobe; 2nd, a pointed process, horny at the extremity; and, 3rd, the main part, provided with four strong teeth and a molar surface.



The smaller are three-jointed, much expanded at the apex. The lower lip is four-lobed; but the lobes are rounded, not pointed as in Treviranus's figure\*.

The legs are five-jointed, and the feet biunguiculate. The two basal segments bear a number of stiff spines with bifurcate extremities, like those on the larger palpi (in addition to ordinary hairs). On the underside of each thoracic segment is a sort of flap, beautifully covered with scales. That of the prothorax is very large; the other two are smaller, particularly the one belonging to the metathorax.

The abdominal appendages are confined to the two posterior segments. They are represented, however, on the anterior ones by a group of stiff yellow setæ. There is moreover a second, similar group nearer to the median line, which appears to represent a second process, formed by a prolongation of the ventral margin of the penultimate segment.

Gervais † considers that these appendages should be compared to the branchial appendages in Neuroptera rather than to true legs; he observes, "Cette manière de voir, que nous avons proposée peu de temps après, rend également compte de l'absence de trachées déjà constatée par plusieurs observateurs chez les véritables Thysanoures, c'est à dire, chez la famille des Lépismes." The branchial appendages of Neuroptera, however, are dorsal, while those of the Lepismidæ are ventral; moreover, in opposition to the above assertion, the Lepismidæ undoubtedly have tracheæ, although the system may not be very largely developed. It seems to me curious that there should be any difference of opinion on this point, because, from the transparency of the creature, the tracheæ in the legs are visible without dissection. It is true that Treviranus ‡ was unable to satisfy himself as to the presence of tracheæ; but I can only account for this on the hypothesis that he did not examine freshly killed specimens.

The egg-tubes and the formation of the ovum resemble those of Petrobius, as described by me in the 'Philosophical Transactions'\*

The posterior dorsal plate has a squarish termination.

#### REPRODUCTION OF LOST PARTS.

M. l'Abbé Bourlet, who was unfortunately ignorant of Mr. Templeton's memoir, gave as a character of his genus *Heterotoma* (a name which he subsequently changed for *Ætheocerus*), and which is composed of the species forming Templeton's genus *Orchesella*, that the segments of the antennæ varied from 2 to 5, those even of the same individual being often dissimilar in the number of their segments. He was aware that M. Macquart regarded these differences either as abnormal or accidental; but he rejected this explanation because:—1°. Dans le cas où les antennes sont inégales, le dernier article de la plus courte, quel que soit son rang numérique, n'est jamais conforme à l'article correspondant de l'autre antenne; 2°. il affecte constamment une forme analogue à celle de l'article terminal, ou le cinquième; 3°. il en est de même pour les antennes égales, mais ayant moins de cinq articles; dans ce cas, le dernier est toujours plus gros et plus

\* Vermischte Schriften, Tab. ii. fig. 4.

‡ Vermischte Schriften, vol. i. p. 16.

† Suites à Buffon. Insectes Aptères, vol. iii. p. 446.

§ Phil. Trans. 1861, p. 619.



long que le terminal de l'antenne normale, quoique ayant une forme analogue et la même couleur; 4°. on n'aperçoit à l'extrémité de l'article aucune trace de fracture; 5°. plusieurs jeunes Podurides et un grand nombre d'adultes ont été trouvées ainsi conformées; le nombre de celles-ci était, à l'égard des *Ætheocerus* à antennes de cinq articles, comme cinq est à huit; 6°. cette conformation des antennes ne se rencontre que rarement dans les autres Podurides; 7°. toutes les fois que dans les autres genres on trouve des Podurides dont les antennes ont été brisées, la cicatrice est toujours visible et la forme des articles n'a pas varié; 8°. j'ai renfermé dans des vases une certaine quantité d'*Ætheocerus* dont les antennes offraient les différentes conformations observées par moi; j'y ajoutai plusieurs congénères qui avaient ces organes brisés au moment où elles furent trouvées, ou à qui je les avais moi-même mutilés; au bout de trois mois elles furent retrouvées toutes exactement dans le même état."

Two years later he repeated this argument in the same words in the Transactions of the Soc. d'Agricult. du Départem. du Nord, at Douai, 1841-2.

Yet it is, I think, certain that the antennæ of the species forming his genus *Ætheocerus* (or *Heterotoma*) are normally six-jointed, although they are very frequently mutilated. It is true that in antennæ possessing less than six segments, the terminal one does to a certain extent resemble the terminal segment of an un mutilated antenna; but this is the case, as I have satisfied myself by repeated experiments in artificially mutilated specimens. It is also quite true that the antennæ which are composed of less than six segments show no trace of fracture; but it is equally certain that this is also the case in mutilated specimens after a change of skin. If one removes part of the antenna of an *Orchesella*, the injury is very apparent until the creature moults, after which the end of the antenna becomes more or less regular, according to the time which has elapsed between the wound and the moult. M. Bourlet states that this condition of the antennæ occurs only among the *Heterotomæ*; this, however, is by no means the case. Most of the other genera, indeed, having shorter antennæ, are less liable to injury; and mutilated specimens are therefore much less frequent among them than in the genus *Orchesella*.

*Choreutes*, however (*Macrotoma* Bourlet), also has long antennæ; and here the mutilations are so frequent that Bourlet actually describes the genus as having three-jointed antennæ, four being the right number. I myself, though I have found hundreds of specimens, have never found a full-grown *Choreutes plumbea* with perfect antennæ. This almost invariable mutilation is an extremely curious fact.

M. Bourlet affirms that really mutilated specimens always show the "cicatrice." The term is scarcely correct; and, as I have already observed, the mark only remains until the next moult. Lastly, M. Bourlet states that, having mutilated the antennæ of several specimens, and placed them with others in which the antennæ were unsymmetrical, he found them at the end of three months exactly in the same condition. This statement is quite contrary to my invariable experience, and, unless he tried it in very cold weather, he must, I think, have made a mistake. In summer the moults always follow one another at comparatively short intervals; and at the first moult after mutilation I have always found a considerable tendency to reparation, which becomes still more manifest after two or three changes of skin.



The explanation of M. Bourlet's mistake, however, is to be found in the fact that an antenna once seriously mutilated never regains its normal number of segments. Such, at least, has been my experience. It is possible that very young specimens may have more complete powers of reparation. I doubt very much, however, whether it is so, because I have observed in *Chloëon* (*Ephemera*) that the terminal segments of the antenna, if once removed, are never replaced (although the antenna continues to grow), so that not one specimen in twenty of those which I examined had perfect antennæ when the insects were half-grown.

As illustrating the partial recovery which takes place, I will take the following cases from my note-book

On the 11th of April, I removed the terminal portion of the right antenna of a pale *Orchesella cincta*, at the middle of the second segment, as shown in Pl. XLV. fig. 1. On the following day the animal moulted, and the mutilated antenna was as in fig. 2, the second segment being a little elongated, but not much altered, probably on account of the short time which intervened between the mutilation and the moult. On the 19th of April the antenna was as in fig. 3, and consisted of three segments. The second and third were quite unlike those of normal specimens, the second being unusually large, and the third, which is normally quite short, being elongated and somewhat club-shaped. Subsequently both these segments, and especially the third, elongated somewhat (fig. 4), but they made no further approximation towards the normal form.

Again, on the 5th June, I treated another specimen in the same manner, leaving the antenna in the state shown in Pl. XLV. fig. 5. On the 17th June it had moulted, and was as in fig. 6. Here, the mutilation having taken place near the extremity of the segment and some days before the moult, it will be seen that more change has taken place than in the preceding case. The antenna is three-jointed, the two apical segments presenting the same peculiarities as in the preceding specimen. Subsequently the terminal segment elongated as in fig. 7; but no further change took place.

I made a few more similar experiments with similar results, but was reluctant to multiply them too much, being unwilling to cause unnecessary pain, and seeing no reason to expect any materially different results.

It is remarkable that in all these cases the terminal segment acquires a length even greater than that which it possesses in normal specimens. This is well shown also in *Choreutes*. In this genus I have satisfied myself, both by direct experiment, and also by watching specimens which I had met with accidentally, that if the terminal segment is removed it is never replaced, though the third segment acquires an unusual length. I have even seen specimens, under these circumstances, in which the third segment acquired a length almost equal to that of the third and fourth segments of a normal antenna.



## ANATOMY.

*Intestinal Canal.*

According to Nicolet (*l. c.* p. 46), the digestive organs of the *Thysanura* consist of six parts—namely, l'ésophage, le jabot, le ventricule chylique, les vaisseaux hépatiques, l'intestine grêle, et le cæcum." By the "cæcum" he evidently means the rectum. Nicolet gives his description of these parts as applicable to the order generally, and does not mention which genus or genera he particularly examined. In those which I have dissected, and particularly in *Tomocerus*, *Orchesella*, and *Smynthurus*, the digestive organs pass straight through the body without any circumvolutions from the head to the tail, and fall into three divisions, the œsophagus, the stomach, and the rectum. I think there are no Malpighian vessels.

Von Olfers, the only naturalist who has, since my paper in the 'Linnean Transactions' (which, however, he does not appear to have seen), occupied himself with the anatomy of the *Thysanura*, also describes and figures the intestinal canal, at least in *Orchesella*, as a straight tube passing directly from one end of the body to the other, and falling into three divisions, the œsophagus, the ventriculus, and the rectum.

The œsophagus is rather long, narrow, and composed of an inner chitinous membrane, thrown more or less into folds, and a cellular envelope, outside which, again, is a loose and very delicate membrane. Nicolet describes a crop as existing between the œsophagus and the intestine stomach; but he admits that it is only "une simple dilatation de l'ésophage, dont le diamètre varie selon que l'insecte a plus ou moins mangé."

Von Olfers was, I believe, the first to observe that from one side of this swelling, which is somewhat thickened, rises an elongated membranous tube. This he regards as the salivary gland; and he considers that it really rises immediately behind the mouth, passing backwards along the œsophagus, to which, however, it is so firmly attached that "ne vi quidem separari possint" (they can hardly be separated even by force). In fact, if the "salivary gland" and the stomach be pulled in opposite directions, as far as my experience goes, the former gives way.

The stomach is capacious, and extends in a straight line from the posterior end of the œsophagus to the commencement of the intestine. It is of even width throughout. Externally it is provided with both longitudinal and transverse muscles, which give it a pretty reticulated appearance (Plate XLV. fig. 13). The transverse series is the most numerous, the spaces between the muscles being something less than twice the width of the muscles themselves. In some places, as in Plate XLVI. fig. 15, they anastomose frequently. This appeared to me to be more the case in some specimens than in others. The distances between the transverse muscles are much larger. The stomach contains, besides the food, a large number of clear round cells containing smaller cells or vacuoles. It is, moreover, often occupied by a number of Gregarinas.

According to Nicolet, the Malpighian vessels are probably six in number. He says, "Les vaisseaux hépatiques, dont je n'ai pu au juste reconnaître le nombre, mais que je crois être de six, sont tubuleux et filiformes ou du même diamètre dans toute leur



longueur; ils sont insérés immédiatement au-dessus du rétrécissement pylorique; leur longueur égale à peine la moitié de celle du ventricule chylique; du reste, leur extrême ténuité et leur peu de consistance ne m'ont pas permis de les étudier en détail" \*. Von Olfers also describes them as "filiformia, tenerrima;" but he only saw four. When the Malpighian vessels are very numerous, it is naturally difficult to count them; but as they are in this group so few, Nicolet can certainly not have seen them very distinctly when he remained in doubt as to the number.

For my own part I have examined *Orchesella fastuosa*, the species in which they are figured by Von Olfers, as well as *Tomocerus plumbeus*, *Smynthurus*, and other species, but have never been able to satisfy myself that any such organs really exist.

The intestine has, in *Tomocerus*, a length of about  $\frac{1}{3}$  of an inch. It is straight, and of even diameter. It is strongly muscular, being provided throughout its whole length with transverse muscles, which lie close together, and are about  $\frac{1}{1500}$  of an inch in diameter.

#### *Respiratory Organs.* (Plate XLV. figs. 7, 8.)

The condition of the respiratory system of the *Thysanura* is a question of much interest.

Nicolet describes a series of spiracles situated at the sides of the superior arches of the abdomen. The tracheæ extend, according to him, in an undulating line from the head to the tail, each undulation corresponding to a segment, and sending out on the one side a short branch to the corresponding spiracle, and on the other a number of branches which ramify over the different organs of the body. There are also on each side six pneumatic sacs which lie longitudinally, communicate by a short duct with the main tube, and give out from the posterior end two branches, one of which goes to the side of the body, passing under the principal trachea. He figures the tracheæ arranged in this manner in *A. fimetarius*, and, though not expressly saying so, appears to regard the description as applicable to all the *Podurelles* (Thysanura).

In my first memoir in the 'Linnean Transactions' (vol. xxiii. p. 429), on the contrary, I have described the tracheæ of *Smynthurus* as opening by two spiracles in the head, opposite the insertion of the antennæ—that is to say, on the lower side of the head, if it is placed with the antennæ and eyes upwards, or on the back part when it is in its natural perpendicular position.

As regards *Achorutes* and the allied genera, Von Olfers repeats the statements of Nicolet. His own observations were made on *Smynthurus oblongus*, *Tomocerus plumbeus*, and *Orchesella fastuosa*. In these he found the respiratory system formed on one plan. They have two spiracles only; and these are situated on the inferior side of the thorax, close to the first pair of legs. From each spiracle start three principal trunks, one of which goes forwards, one upwards, and one backwards. The first two are immediately divided into a great number of branches, which are extremely narrow. The other passes to the middle line, lies close to the corresponding trachea of the other side, without, however apparently uniting with it, and then also breaks up into a number of fine branchlets.

I have again examined *Smynthurus*, and can only confirm my previous statements. Von Olfers, without being acquainted with my memoir, agrees with me, as we have

\* L. c. p. 47.



seen, that there is only one pair of spiracles. He considers, however, that they are situated in the thorax, close to the place of insertion of the anterior legs, while I think they are in the head.

I will not be so bold as to say that there certainly is no spiracle in the place indicated by Von Olfers; the animal is so small and so inconvenient for dissection, that I will not venture to make a positive assertion in opposition to one who has evidently worked with much care and skill. Nevertheless I think he has been misled by the fact that at this part the tracheæ are held in place by the rather large branch given off to the anterior leg. I think I have traced all the tracheæ up into the head, and that the only spiracles possessed by *Smynthurus* are situated in the head, at the place where it is attached to the body.

As regards the other species, I differ still more from M. Nicolet and Von Olfers. I have examined *Tomocerus plumbeus*, as well as species of *Achorutes*, *Lepidocyrtus*, *Iso-toma*, *Lipura*, and am satisfied that they do not possess any tracheal system answering to the descriptions either of Nicolet or of Von Olfers.

#### THE GENERATIVE ORGANS.

I have already described the generative organs of the *Smynthuridæ* in my first paper. Those of *Tomocerus*, which may be taken as representing the *Poduridæ*, are very simple, and in both sexes consist of two tubes, commencing near the anterior end of the abdomen. They widen gradually as they pass back, and open on the ventral side of the posterior segment behind the base of the spring.

#### NERVOUS SYSTEM.

##### *Tomocerus.*

In the head are two ganglions, the supra- and infracesophageal, which are connected by two short commissures, between which the œsophagus passes as usual.

The remainder of the nervous system consists of three ganglia, lying in the thorax and first abdominal segments. The posterior ganglion is much the largest and is double. The hinder portion is somewhat square-shaped, and sends off several strong nerves backwards.

##### *Smynthurus.*

Nicolet was unable to discover the nervous system in the linear Thysanura while that of the globular species appeared to me much more difficult to make out. As described by him, *Smynthurus* has, like *Tomocerus*, two ganglia in the head, and three in the thorax. The supracœsophageal ganglion is large, and gives off the nerves for the eyes and the antennæ.

#### MUSCULAR SYSTEM.

##### *Smynthurus.*

*Muscles of the Caudal Appendage.* (Plate XLV. figs. 9–11.)—So far as I am aware, no naturalist has hitherto given any account of the muscular system in the Thysanura.



With patience and spirits of wine, however, I have been able to make out the principal muscles pretty clearly.

*Muscles of the Spring.*—These muscles (Plate XLV. figs. 9–11) are nine in number on each side of the body. The stoutest of all (Plate XLV. fig. 10, *a b*) rises on the ventral side of the body, close to the middle line, and immediately in front of the reversible base of the saltatory apparatus. It passes upwards, expanding gradually, and is inserted by two heads on the side-wall of the body (Plate XLV. fig. 10, *b*).

The second muscle, which is much smaller (*c d*), rises behind the first, and somewhat further from the middle line, being separated from the corresponding one on the other side by the central thickened part of the reversible base of the spring. It passes straight upwards, without altering in diameter, and is attached to the skin at *d*, behind but on the same line as the preceding muscle.

The third muscle (*e f*) rises close to the preceding, but a little outside it, and, passing upwards and forwards, is attached close to the posterior branch of the first muscle, by which, therefore, in Plate XLV. fig. 10, it is necessarily concealed.

The fourth (*g h*) lies parallel to, and rather behind the second; it is, however, rather shorter, and consequently does not reach so far up towards the back.

The fifth (*i j*) rises close behind the last three. It is shorter and broader, and passes straight backwards to the posterior wall of the body, where it is inserted between the spring and the small terminal abdominal segment. The other four muscles belong to a different group altogether. The first of them (Plate XLV. fig. 10, *k l*) rises rather behind and outside the ventral attachment of the muscle *a b*. It then passes upwards and forwards and is inserted on the lateral wall of the body immediately above the ventral tube, and about halfway between it and the central line of the back.

The sixth muscle (*m n*) rises close to the preceding, between it and the first, and has the same general direction, but is inserted higher up.

The seventh (*o p*) rises close to *c*, and consequently further back than either of the preceding, nor does it pass quite so far forward. It is attached not very far from *k*, but behind it.

The last of this group (*q r*) rises close to *n*, and is inserted below *o*.

Plate XLV. fig. 10, *s t*. This is a small muscle which moves the second segment of the spring.

There are also several other small muscles in the posterior part of the abdomen, and belonging either to the terminal abdominal segment or to the rectum.

If a *Smynthurus* be examined after death, the tail will almost invariably be found extended as in Plate XLV. fig. 11. If, moreover, we consider the mode in which the muscles just described act on the spring, we shall see that the most powerful of them tend to draw it forward, and not to extend it.

When, indeed, we see a *Smynthurus* leap, one is apt to be surprised at the muscular force which it must possess. It would appear, however, that its power of jumping arises from the elasticity of the spring, and not from direct muscular action. I presume that this is a more economical arrangement of force. It certainly may require less strength to pull the spring gradually forwards into position than it would to strike it



against the ground with force enough to throw the *Smynthurus* so high up into the air. We see the difference very well in a crossbow; the muscular effort required to set the bow is much less than that which would be necessary to project the arrow as far if applied directly. One might suppose that though the force required to pull the spring forward might be much less than that necessary to move it backwards, still, as the spring is habitually carried with the points forward, there would be a constant strain in the one case, and only an occasional effort wanted in the other.

When, however, the spring points straight forwards, there is perhaps little strain on it; moreover there is a little catch (Plate XLV. figs. 10 & 11), which is an organ homologous with the spring itself, but situated on one of the anterior segments; this passes between the two arms of the spring, and keeps them in place. It answers in fact to the catch in a crossbow, and as soon as it is drawn forwards, the muscle pulls the spring downwards, and its own elasticity does the rest.

*A priori* it might have been supposed that a position of rest was one of relaxation, in which the muscles were, so to say, at ease, but ready to spring up to attention in a moment if necessary. On the contrary, however, we find very often that a position of rest is a state of opposite tensions.

Take, for instance, our own case. The upright position which seems so easy and natural to man, is, says Prof. Huxley, in his excellent lessons in elementary physiology, "the result of the contraction of a multitude of muscles which oppose and balance one another. Thus, the foot affording the surface of support, the muscles of the calf must contract, or the legs and body would fall forward. But this action tends to bend the leg; and, to neutralize this and keep the leg straight, the great muscles in front of the thigh must come into play. But these, by the same action, tend to bend the body forward on the legs; and if the body is to be kept straight, they must be neutralized by the action of the muscles of the buttocks and of the back."

I will take one more illustration from a very different part of the organized kingdom.

In most of the Orchids, as Mr. Darwin has shown us in his excellent work on that order of plants, the pollen from one flower is carried by insects to another; and if this is not done, the flower is not fertilized and the seed is not developed. Now, in our own small Orchids, when an insect lights on the flower the sticky end of the pollinium adheres to the insect, and is thus carried away; in some of the large tropical Orchids, however, the part of the flower which insects visit is so far from the pollen-masses that a different arrangement is necessary. In *Catasetum*, for instance, there is a long sensitive process, or antenna, which hangs over the part on which insects alight, in such a manner that they can scarcely fail to touch it. Directly they do so, the flower throws its pollen-masses in the direction of the insect, and with such force that they will fly two or three feet. I have myself seen a flower, when its antenna was touched, throw the pollen-masses for about two feet, across a small table and to a window, on which they stuck.

This is not effected by muscular action; but the stalk on which the pollen-masses stand is bent round a protuberance, and held in position by a delicate membrane. When the sensitive antenna is touched, this membrane gives way, and the elasticity of the pollen-stalk throws it forwards with much force, as just described.



*Ventral Tube.* (Plate XLV. figs. 10, 11, 12.)—I have already described the arrangement of the muscles belonging to this curious organ in my previous paper; but I refer to it again because I think the figures now given will make the mechanism more clear.

As I have there pointed out, it is evident that the protrusion of the two filaments could not be effected by muscular influence, excepting, indeed, by the indirect effect of those muscles which contract the cavity of the body, and thus, intensifying the general pressure, squeeze out as it were the two filaments.

For retraction, however, there are two muscles,  $a' b'$  and  $c' d'$ . The first is attached to the extreme end of the filament (which in Plate XLV. fig. 12, is represented as partially retracted); it passes all along the filament, and then close to the walls of the body, between them and four lateral muscles, which tend to keep it in place, and is then attached to the back, not far from  $m$ , and near the median line. The other muscle ( $c' d'$ ) is attached to the middle of the filament; it runs parallel to the preceding, also passes between the four lateral muscles and the skin, and divides into two ends, which terminate near one another, and still close to the central line of the body. One of the filaments, in a state of almost complete extension, is represented in Plate XLV. fig. 11. In Plate XLV. fig. 10 are seen the same parts during retraction:  $e'$  is the filament, turned, of course, inside out; and the muscles are lettered as before.

The presence of two muscles instead of one is necessary, owing to the length of the organ. It is evident that by itself the muscle  $a b$  would be able only partially to withdraw the filament, the length of the latter being greater than the distance from the insertion of the muscle to the end of the ventral tube,  $e'$ ; the terminal portion of the filament would therefore still be left outside, if it were not for the muscle  $c' d'$ . Moreover, when the organ is about to be protruded, it is probable that the muscle  $c' d'$  relaxes first, and thus the filament passes out regularly, whilst, if there were only one muscle, it might from its length, get into a knot.

#### *Muscular System of Tomocerus.*

I will now pass to the abdominal muscles of *Tomocerus*, and will more particularly describe those of the 3rd and 4th abdominal segments, as these are specially concerned in the mechanism of the spring.

*Fourth Abdominal Segment.* (Plate XLVI. figs. 18, 19, 20.)—If we commence the description of the abdominal muscular system from the dorsal line, the first muscle we shall meet with is a straight wide muscle (1), which lies on each side of the dorsal vessel, rises at the front margin of the segment, and passing directly backwards, through the segment and over the intersegmental membrane, is attached to the anterior margin of the following segment. In several cases I have found it continuous with the corresponding muscle of the preceding segment.

2. This muscle lies outside the preceding, and therefore, in Plate XLV. fig. 7, is under and hidden by it. In some specimens it is straight, in others, as in the one figured, it lies a little diagonally.

3 crosses under, or rather outside, no. 2. Like the two preceding, it rises at the anterior margin of the segment, and passes to that of the penultimate one.



4. This muscle is one of those that move the tail. It rises close to, but at the side of the preceding, and passes diagonally backwards and downwards, curling round no. 5, which will be described next, and eventually reaching its posterior attachment at the dorsal side of the root of the tail.

5. This muscle rises with a double head immediately below the preceding, and, passing backwards, twists as it were round it, and is also attached to the posterior margin of the following segment.

6, 7. This is a transverse muscle. Its upper end is double, and is attached not far from, but rather in front of, the middle of the segment. It passes straight down, and is inserted into the central ventral piece.

8 is inserted close to the anterior end of no. 5, and passes diagonally backwards and downwards, outside no. 6, and is attached to the lower side of the penultimate segment.

9 lies immediately outside no. 4, but is somewhat straighter, as it is not affected by no. 5.

10 rises nearly in the centre of the side-wall, opposite the middle part of no. 6, and, passing backwards, is attached close to the posterior end of no. 4.

11 lies just outside no. 10, and has the same direction and attachments. In some specimens these two muscles seemed to form one only.

12. This powerful muscle is the principal extensor of the tail, and passes forwards along the ventral surface, through the antepenultimate segment, and is attached at the anterior end of the third abdominal segment.

*Third Abdominal Segment.*—1. This muscle corresponds to the muscle, no. 1, of the fourth segment, immediately in front of which it lies, and with which, in some specimens, as already mentioned, it even forms one continuous muscle. It generally, however, commences near the middle line of the back, on the side of the dorsal vessel, and directly in front of the anterior end of the corresponding muscle of the following segment, and, passing straight forwards, is attached to the anterior margin of the segment.

2. This muscle, as in the fourth segment, is smaller than, and lies under, or rather outside of, the preceding.

3 rises at the anterior end of the segment, partly under and partly at the side of no. 1, and passes rather diagonally backwards under no. 2.

4 runs at the side of, and parallel to, no. 3.

5 rises at the side of no. 1, and passes forward parallel to it, but, instead of being attached at the anterior end of the segment, passes forward, completely through it, to the anterior edge of the second, where it is inserted, partly below, and partly at the side of, the muscle no. 1 of that segment.

6, 7. These two muscles correspond to those which I have indicated by the same numbers in the fourth abdominal segment. They rise, side by side, at the lateral edge of no. 5, and not very far from the anterior margin of the segment. They are largest at their dorsal extremity, and pass straight downwards.

8. This powerful muscle rises at the anterior margin of the antepenultimate segment, at the side of no. 5, and passes downwards and forwards, dividing into two branches, which, at their lower and anterior extremity, are intimately connected with the neigh-



bouring portions of nos. 6 and 7, as well as of the muscle no. 16, which has not yet been described. The lower branch terminates in the third segment before arriving at its anterior margin; but the upper branch is longer, and penetrates into the next segment.

9 rises below, and close to, no. 8. It has the same general course, but diverges somewhat, and ends at about the middle of the segment. It will be seen, from my drawing, that the end lies under the muscle marked no. 16, and over that marked no. 15. It cannot, therefore, be directly attached to the skin in this position, because the muscle no. 15 comes directly in the way. The true attachment of this end of the muscle, like that of nos. 6 and 7, and the posterior branch of no. 8, with all of which it is closely connected, is not easy to make out. I believe, however, that a delicate membrane passes from its lower extremity, both backwards and forwards, over no. 15, and that, by thus acting on the centre of that membrane, the same effect is produced as if the muscle were actually attached to the skin at the point where it terminates.

10 rises under the posterior terminations of nos. 5 and 8, and passes forwards with a slight inclination downwards. It passes on the outer side of nos. 6 and 7, and is attached, in the ordinary way, to the anterior margin of the segment.

11 lies outside the preceding. Some of the upper fibres did not, in the specimens I examined, reach so far as the margin of the segment.

12. No. 12, which belongs partly to this segment and partly to the antepenultimate, has already been described.

13. This powerful muscle rises by a double head. One portion lies under no. 12, which is cut away at that part in Plate XLVI. fig. 19, in order to show no. 13; the other and larger portion is attached by a broad base to the gently curved arch, which here runs along the segment. Both branches soon unite, and pass straight forward completely through this segment, to the anterior margin of the second.

14. This and the following are short, but powerful, transverse muscles. The present one rises under no. 13, but extends somewhat in front of it, and passes downwards and a little forwards to the ventral part of the segment.

15. This muscle is attached, like the preceding, which it crosses, to the gently curved arch already mentioned. It is attached above, in front, and below behind the preceding muscle, outside of which it runs. These two muscles are fan-shaped; and though their ventral ends are of moderate size, their dorsal extremities are so wide that between them they extend over the whole length of the segment.

16 also rises by two heads, and lies outside no. 15; it passes forward, straight into the thorax, and is attached close behind the head.

*Second Abdominal Segment.*—In this segment the dorsal muscles are much weaker than in the preceding. In several cases I even found nos. 1, 2, 3, and 4 entirely deficient. No. 5, on the contrary, seems to be always present. There are, indeed, two muscles marked thus. The one rises in the third abdominal segment, as I have already mentioned, and passes forwards, dividing into two heads, which are attached to the anterior margin of this segment. The other, which corresponds with it, rises at the posterior end of this segment, at the edge of the muscle just described, and, passing through the present segment, is attached to the anterior margin of the first abdominal segment.



## ON THE CLASSIFICATION OF THE THYSANURA.

Linnæus placed his genera *Lepisma* and *Podura* immediately after the Diptera, and at the head of the Aptera, followed by *Termes*, *Pediculus*, *Pulex*, *Acarus*, *Phalangium*, *Aranea*, *Scorpio*, *Cancer*, *Monoculus*, *Oniscus*, *Scolopendra*, and *Julus*, in the above order.

The system adopted by Geoffroy was very similar. He classed *Podura* and *Lepisma*, however, between *Pediculus* and *Acarus*.

Fabricius, on the contrary, on account of the structure of their mouths, united them with the Neuroptera in his order Synistata; and in this view he was followed by Blainville.

The order Thysanura was established in 1796 by Latreille, who placed it between *Pulex* and the Parasita. In the 'Considérations Générales' (1810), he arranged it with the Myriopoda, and Parasita among the Arachnida.

Lamarck, in his 'Animaux sans Vertèbres,' adopted the group Thysanura, which he united with the Myriopods to form his Arachnides Crustacéennes, constituting the first section of his Arachnides antennées-trachéales. He even regarded the Thysanura as more nearly allied to the Crustacea than to the Insecta; they are, he said, "assurément point des Crustacés et encore moins des Insectes." In separating them thus widely from the other Hexapods, he seems to have been mainly influenced by the absence of metamorphoses.

Cuvier, on the contrary, regarded them as true insects, and arranged them as the second order, preceded by the Myriopoda, and followed by the Parasita.

Burmeister, in his 'Handbuch der Entomologie,' treats the Thysanura as a separate tribus, which he places between the Mallophaga and Orthoptera.

According to Bourlet, the Thysanura follow the Myriopods, and constitute the first order of insects.

Lucas adopts Laporte's name of "Monomorphes" for the Thysanura, and places them between the Myriopods and the Anoplura.

M. Gervais, in the 'Histoire Naturelle des Insectes Aptères,' points out the great diversity which exists between the Lepismidæ and the Poduridæ. Referring to the classification of Fabricius and Blainville, who placed the Thysanura amongst the Neuroptera, he says, "Les Thysanoures ainsi envisagées sont donc des Névroptères frappés d'un arrêt de développement. C'est ce que nous admettons parfaitement pour les Lépismes et genres voisins, mais il nous paraît impossible d'en dire autant, ou du moins dans le même sens, pour les Podures. Le petit nombre des anneaux du corps des Podurelles les rapproche des Insectes épizoïques, et le reste de leur organisation diffère complètement de celle des Lépismes. Il serait donc plus convenable de créer à leur intention un ordre particulier parmi les Insectes hexapodes, dont le corps n'a pas le nombre normal d'anneaux. Nous laisserons à cet ordre des Podures et des Smynthures le nom de *Podurelles*, c'est à dire qui saute avec sa queue, puisque c'est là nu de leurs caractères les plus généraux".

Gerstäcker, in the 'Handbuch der Zoologie,' places the Thysanura amongst the Orthoptera, on account of the absence of metamorphoses, and the mandibulated



mouth. Although, however, the Poduridæ and Smythuridæ certainly do possess mandibles, still their mouth differs very greatly from that of all other mandibulated insects.

The points which we have principally to consider in relation to the classification and position of the Thysanura are:—the absence of metamorphoses; the absence of wings; the presence or absence of tracheæ; the structure of the mouth; the saltatory caudal appendage; and the ventral tube.

The last-mentioned organ, though observed by most of the preceding writers, has not, I think, attracted the attention it deserves. It is, in fact, the true characteristic of the group. The absence of wings and of metamorphoses is not peculiar to the Thysanura; in fact the presence of metamorphoses is closely connected with that of wings. To the tracheæ we must not attach too much importance; for though absent in the great majority of the group, they occur in *Smythurus*. The peculiar mouth-parts of the mandibulate genera are entirely absent in Anura; and the caudal appendage is wanting in the *Lipuridæ*.

Thus, then, the ventral tube is characteristic as being general to the true Thysanura, and still more so as being peculiar to them; for I know of no similar organ in any other group of Articulata. The presence of tracheæ, the structure of the mouth, and the abdominal appendage, all indicate a wide distinction between the Lepismidæ and the Poduridæ, and, when considered in conjunction with the fact that the ventral tube is absent among the former, force us to the conclusion that the two groups are much less closely allied than has hitherto been supposed.

We must, indeed, in my opinion, separate them entirely from one another; and I would venture to propose for the group comprised in the old genus *Podura* the term *Collembola* as indicating the existence of a projection or mammilla enabling the creature to attach or glue itself to the body on which it stands.

We now come to consider whether it should be classed among the Insecta, or whether Lamarck was right in separating it from that great class. Taking each of the characteristic points separately, we begin with the absence of metamorphoses. To this we must not attribute too much importance. There are species of Orthoptera and of Neuroptera which are almost in a similar position. So, again, as regards the absence of wings, the same argument holds good: in all orders of insects there are wingless species. Moreover, although it may seem paradoxical to say so, the character of an organ is of greater classificatory value than the absence of it. Thus, for instance, we have cattle and deer without horns, but no cows have deers' horns or *vice versâ*. So the presence of four wings is absolutely peculiar to the Insecta; but some insects have only two wings, and in all the large orders there are species without any wings at all. The absence of wings is therefore no conclusive evidence against classing the *Collembola* amongst the Insecta.

The absence of tracheæ is more significant. That of wings involves only inability to fly, but that of tracheæ implies that respiration is carried on in a different manner. The importance, however, of the difference is reduced to a minimum, because



there are no other special organs for respiration, and the process seems to be carried on through the skin. Moreover, while *Papirius*, like most of its allies, has no tracheæ, *Smynthurus* has a well-developed system. I know hardly any other case of species, so closely resembling one another in other respects, differing so entirely as to one of the most important parts of their internal anatomy.

The structure of the mouth, as far as it goes, is unfavourable to the view of those who regard the Collembola as true insects. I quite agree with Dr. Meinert that the mouth differs essentially from both the principal types found among insects, without, however, making any near approach to that of the Myriopoda or the Arachnida\*.

The presence of a saltatory caudal appendage must be taken for what it is worth. It is very remarkable that no similar apparatus is possessed by any one of the almost innumerable insects, many of which, however, possess the power of leaping in a high degree. Nor, on the other hand, do any of the Collembola jump like *Gryllus*, *Haltica*, or *Pulex*, by means of their hind legs. The true value of such a character as this, however, is as difficult to estimate as it is easy to apply.

The same observations apply to the gastric tube, which, as I have already observed, is even more characteristic of the Collembola than the caudal appendage.

As the upshot of all this, then, while the Collembola are clearly more nearly allied to the Insecta than to the Crustacea or Arachnida, we cannot, I think, regard them as Orthoptera or Neuroptera, or even as true insects. That is to say, the Coleoptera, Orthoptera, Neuroptera, Lepidoptera, &c. are, in my opinion, more nearly allied to one another than they are to the Poduridæ or Smynthuridæ. On the other hand we certainly cannot regard the Collembola as a group equivalent in value to the Insecta. If, then, we attempt to map out the Articulata, we must, I think, regard the Crustacea and Insecta as continents, the Myriopoda and Collembola as islands—of less importance, but still detached.

Or if we represent the divisions of the Articulata like the branching of a tree, we must picture the Collembola as a separate branch, though a small one, and much more closely connected with the Insecta than with the Crustacea or the Arachnida.

The Collembola fall into five well-marked families. Two of these (the Smynthuridæ and Poduridæ) have long been recognized. The former, however, must certainly be divided into two, the Smynthuridæ and Papiriidæ, characterized respectively by the presence and absence of tracheæ. It is true that the former family will contain only two genera, the latter only one; but if our classification is to have any scientific value, it is impossible to place in one family species which differ so much in their internal anatomy.

The Poduridæ must be divided into three families—the Poduridæ proper, the Lipuridæ, and the Anuridæ. The two former have mandibulated mouths, the latter suctorial; the former is saltatorial, the two latter do not possess the characteristic spring. The

\* I say any "near" approach, because as Mr. Humbert has pointed out to me, the mouth parts of *Scolopendrella* in some points approach those of the Collembola. This genus, indeed, appears to be more interesting and peculiar than either Gervais or Newport supposed. For instance, it has on the underside of each segment a pair of appendages closely resembling those of the Lepismidæ—a fact which suggests doubts whether the subabdominal appendages of that group really represent the legs of Myriopoda.



Lipuridæ and Anuridæ contain at present only a single genus each. The Poduridæ, on the contrary, contain nine genera, which may be distinguished from one another, as in the following table:—

Body globular..	{	Without tracheæ .....			<i>Papirius.</i>				
		With tracheæ .....	Antennæ 4-jointed .....		<i>Smynthurus.</i>				
Body elongated ..	{	Saltatorial	Saltatory appendage long ..	Antennæ 8-jointed .....	<i>Dicyrtoma.</i>				
				Antennæ 6-jointed .....	<i>Orchesella.</i>				
				Antennæ 4- or 5-jointed ..	With scales	Terminal segment of antennæ ringed	Two terminal segments ringed .....	Eyes 7 in each group	<i>Choreutes (or Tomocerus).</i>
								Eyes absent..	<i>Tritomurus.</i>
							Third segment simple .....		<i>Templetonia.</i>
						Terminal segment of antennæ simple	No eyes .....		<i>Beckia.</i>
							With eyes.		
							Head exposed.....		<i>Seira.</i>
							Head more or less concealed under thorax .....		<i>Lepidocyrtus.</i>
						Without scales ..	Abdominal segments .....	unequal .....	<i>Degeeria.</i>
				subequal .....	<i>Isotoma.</i>				
Non-saltatorial .....	{	Saltatory appendage short .....	Foot biunguiculate .....		<i>Achorutes.</i>				
				Foot with one claw .....		<i>Podura.</i>			
						<i>Lipura.</i>			
				Mouth mandibulated.....		<i>Anura.</i>			
Mouth suctorial .....									

EXPLANATION OF THE PLATES.

PLATE XLV.

- Fig. 1. Outline of a mutilated antenna of *Orchesella cincta*, April 11, × 60.
- Fig. 2. The same, April 12, × 60.
- Fig. 3. The same, April 19, × 60.
- Fig. 4. The same, May 8, × 60.
- Fig. 5. Outline of another mutilated antenna of the same species, June 5, × 60.
- Fig. 6. The same, June 17, × 60.
- Fig. 7. The same, June 24, × 60.
- Fig. 8. Part of head of *Smynthurus*, from below, to show the orifice of the tracheæ.
- Fig. 9. Part of respiratory system of *Smynthurus*, × 30.
- Fig. 10. *Smynthurus*, side view, with the spring retracted, × 125.
- Fig. 11. *Smynthurus*, side view, with the spring extended, × 125.
- Fig. 12. Ventral tube, partially extended, with its muscles. × 125.
- Fig. 13. Muscles of stomach of *Choreutes*, × 125.

PLATE XLVI.

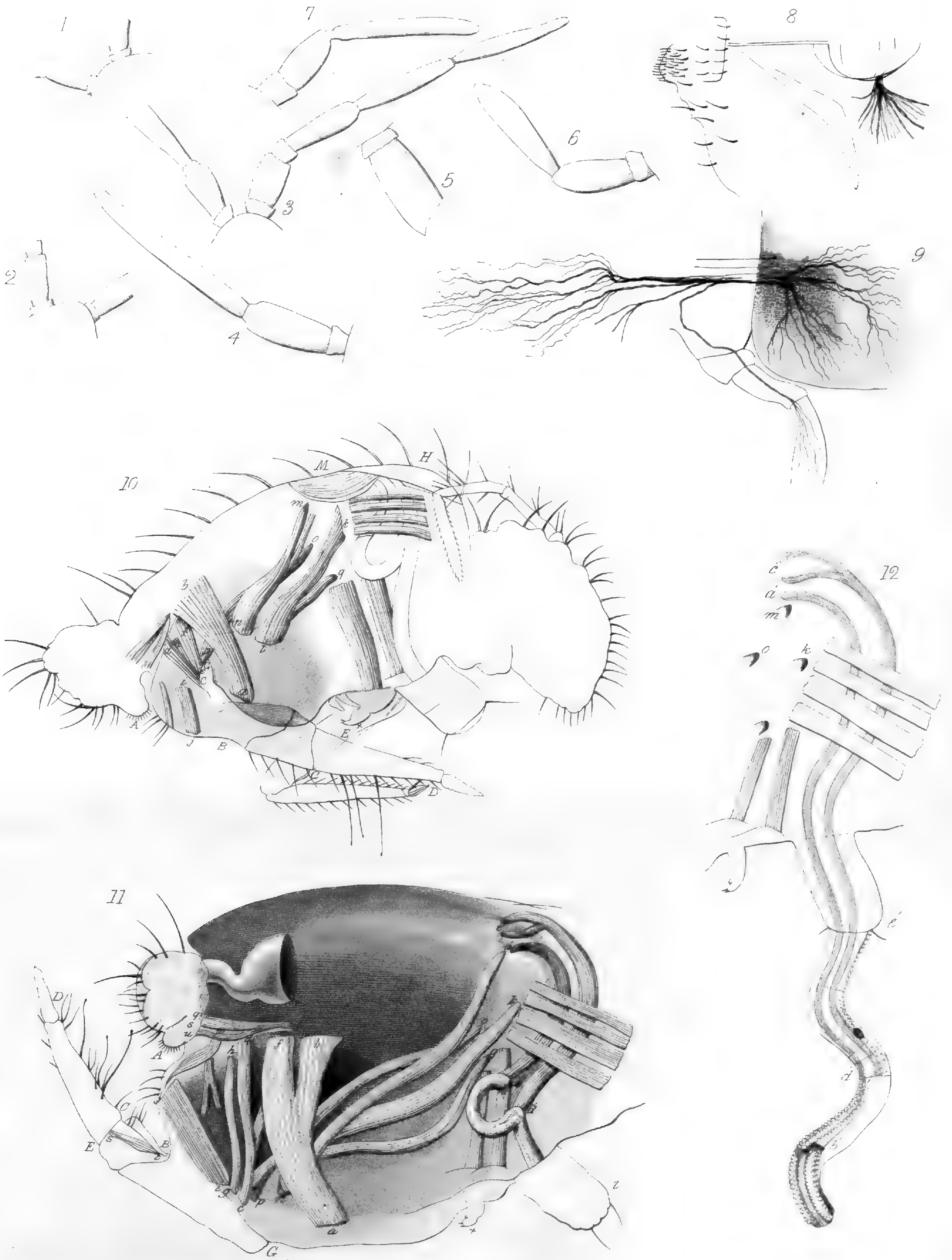
- Fig. 14. Muscles of stomach of *Choreutes*, × 125.
- Fig. 15. Underside of posterior end of abdomen of *Choreutes*, × 125.
- Fig. 16. Muscles of stomach of *Choreutes*, × 125.
- Fig. 17. Portion of skin of *Choreutes*, × 125.
- Fig. 18. Side view of abdomen of *Choreutes*, to show the muscles (inner layer), × 125.
- Fig. 19. Side view of abdomen of *Choreutes*, to show the muscles (outer layer), × 125.
- Fig. 20. Arrangement of muscles on the ventral surface of the posterior abdominal segments of *Choreutes*.



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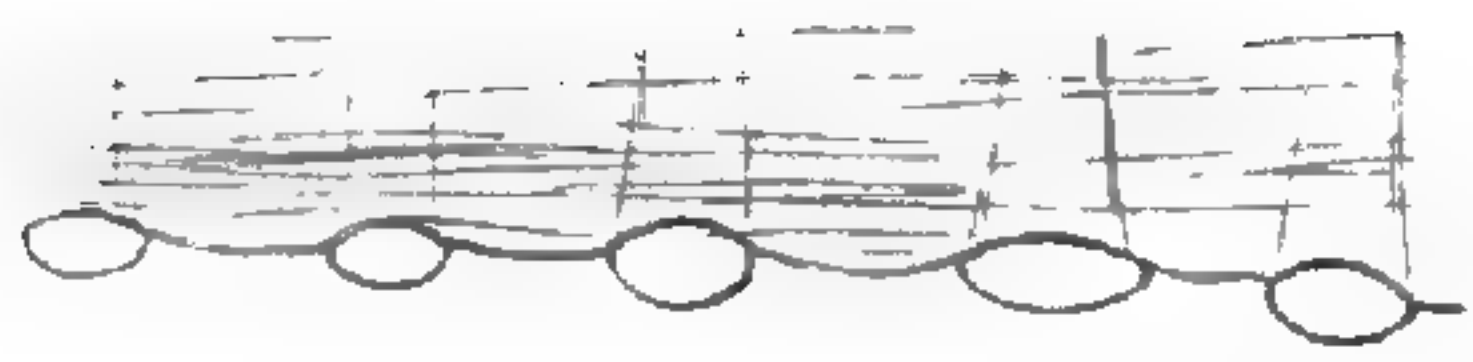




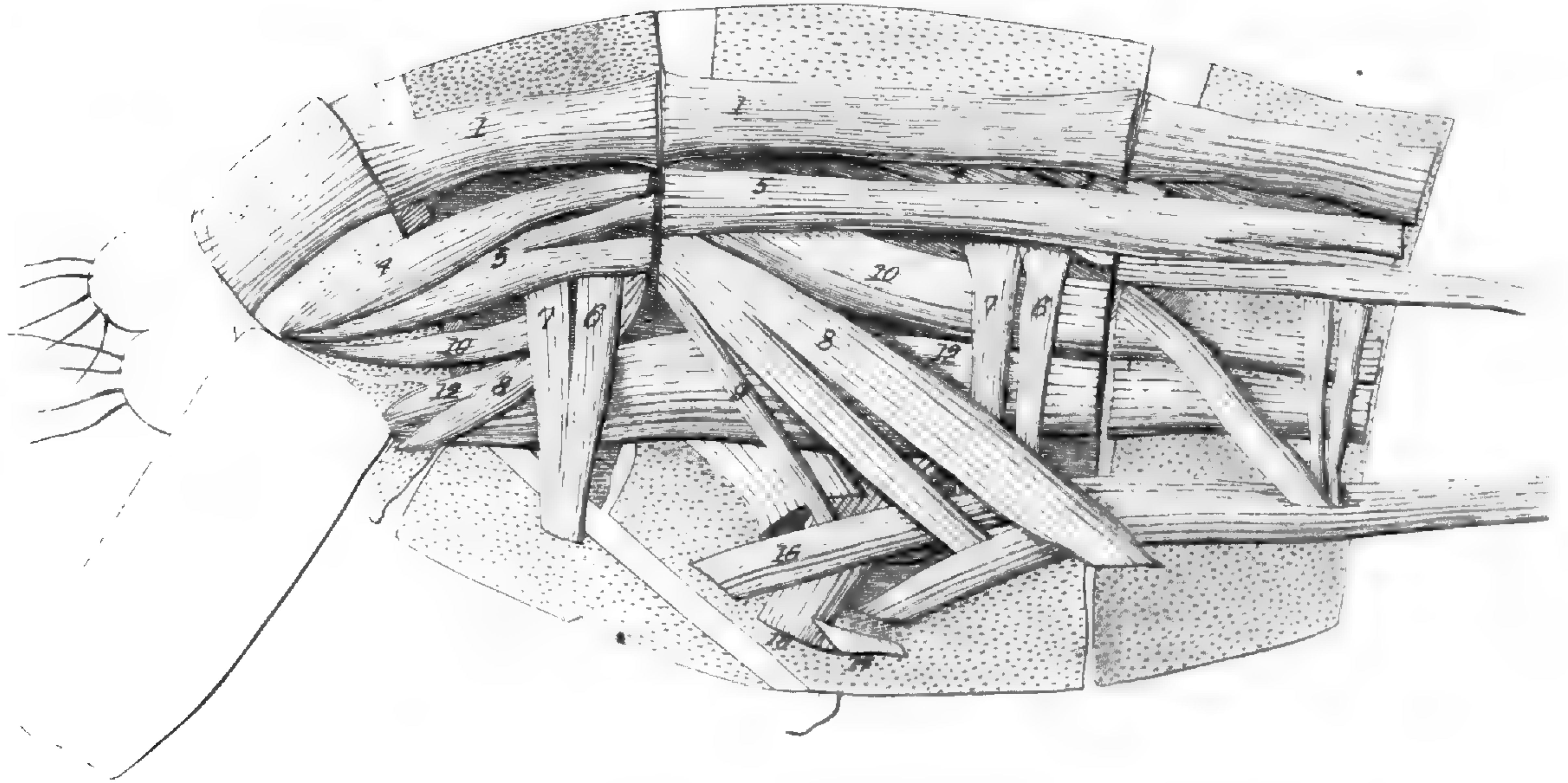




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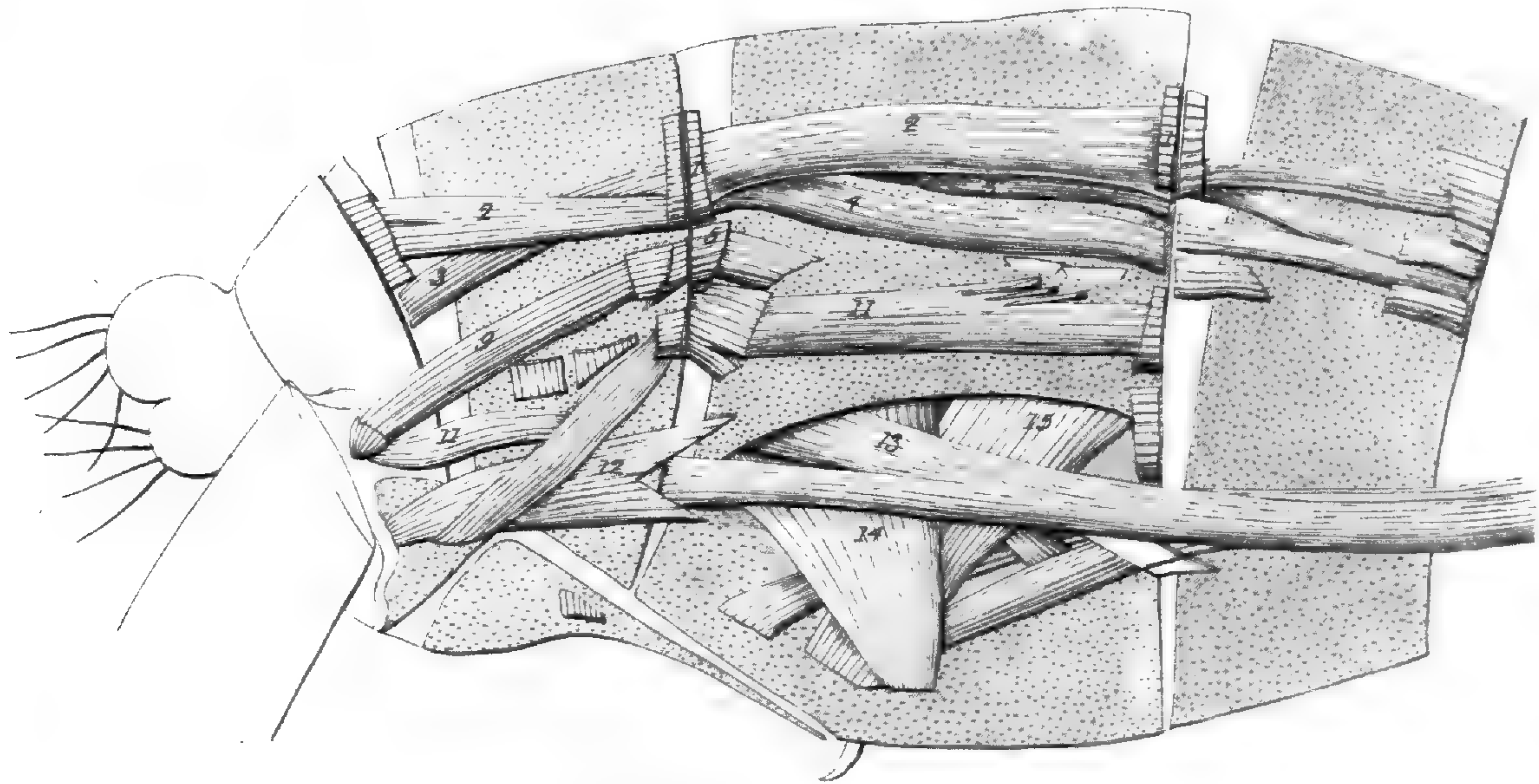
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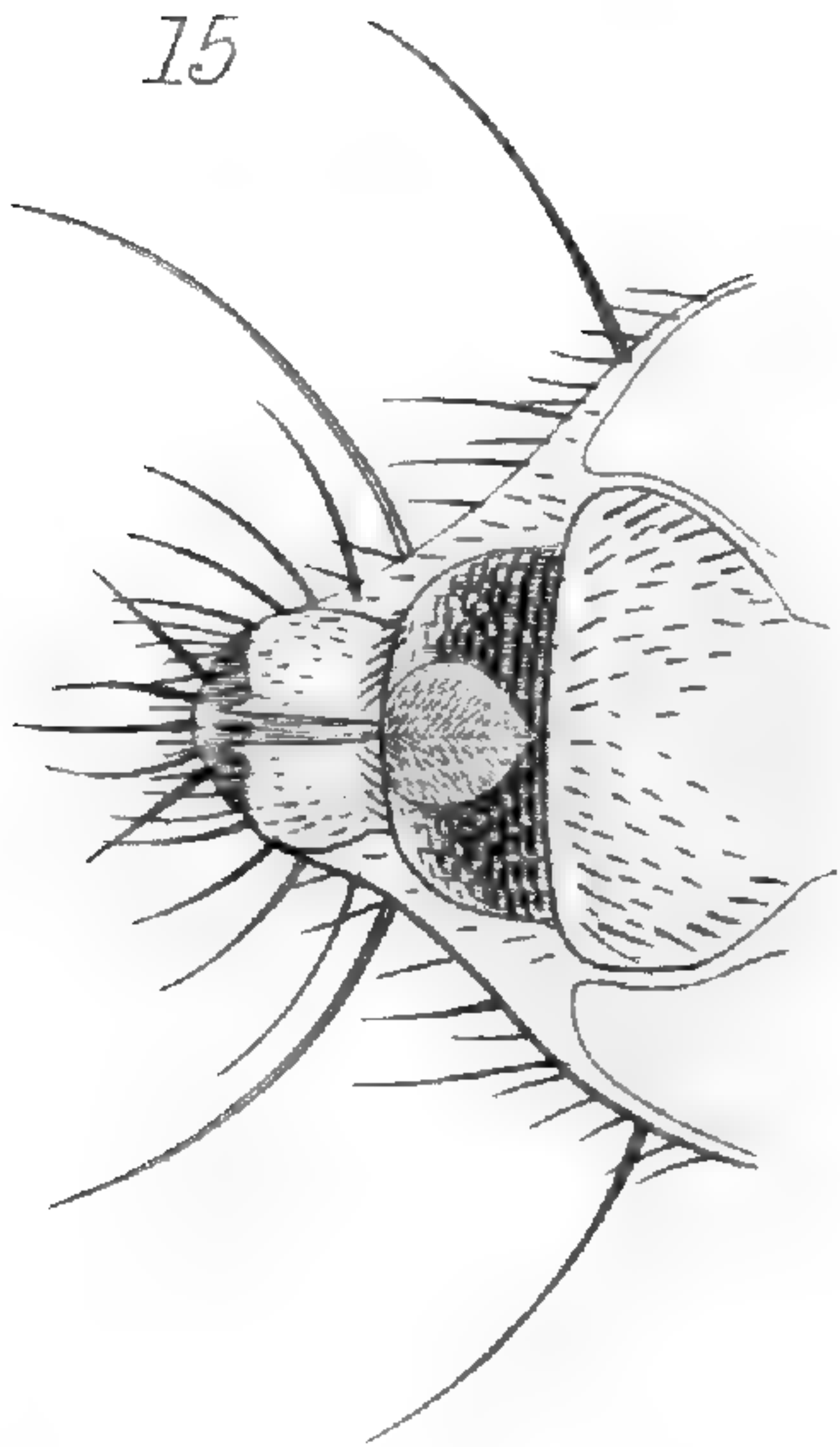
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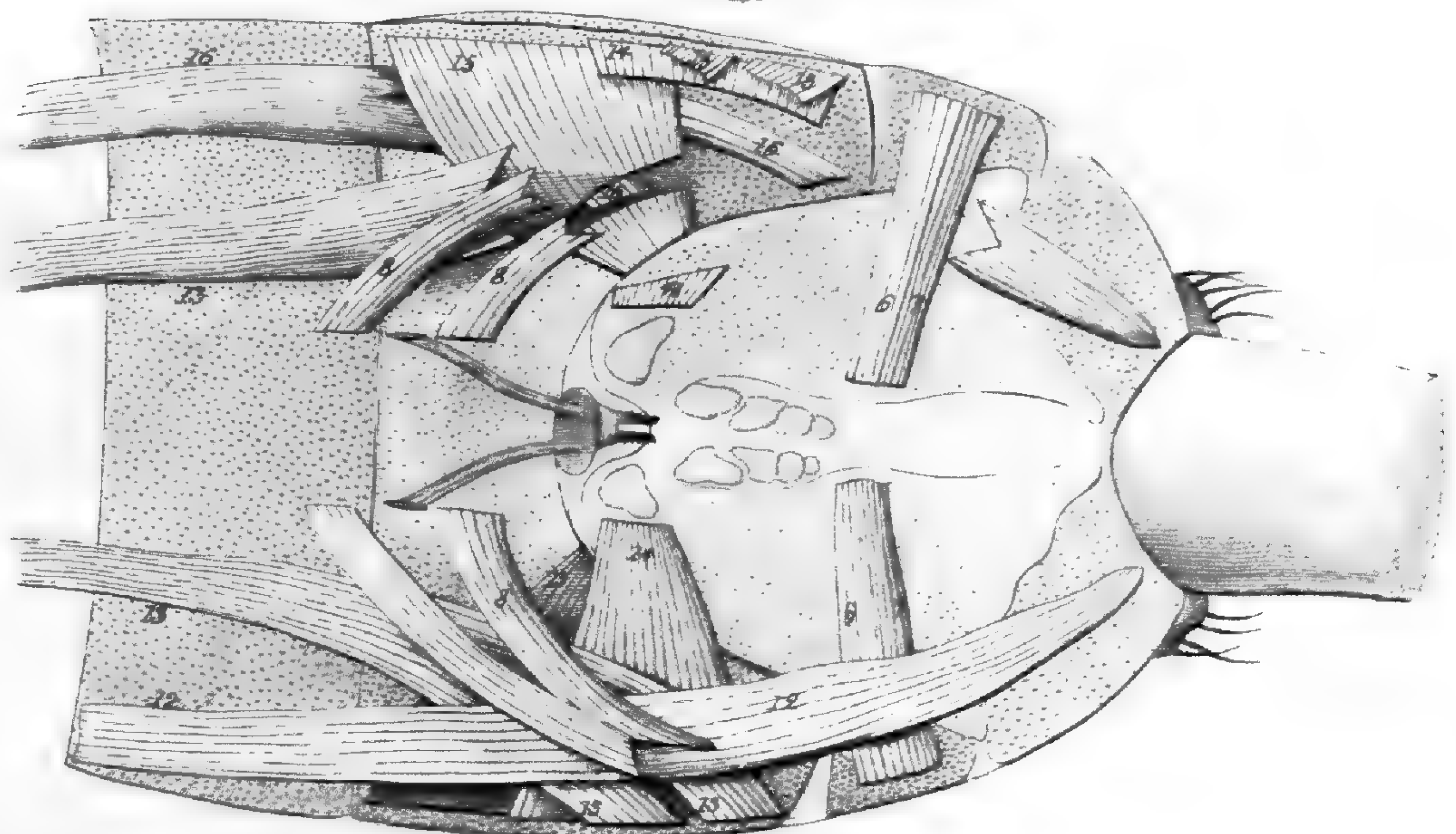
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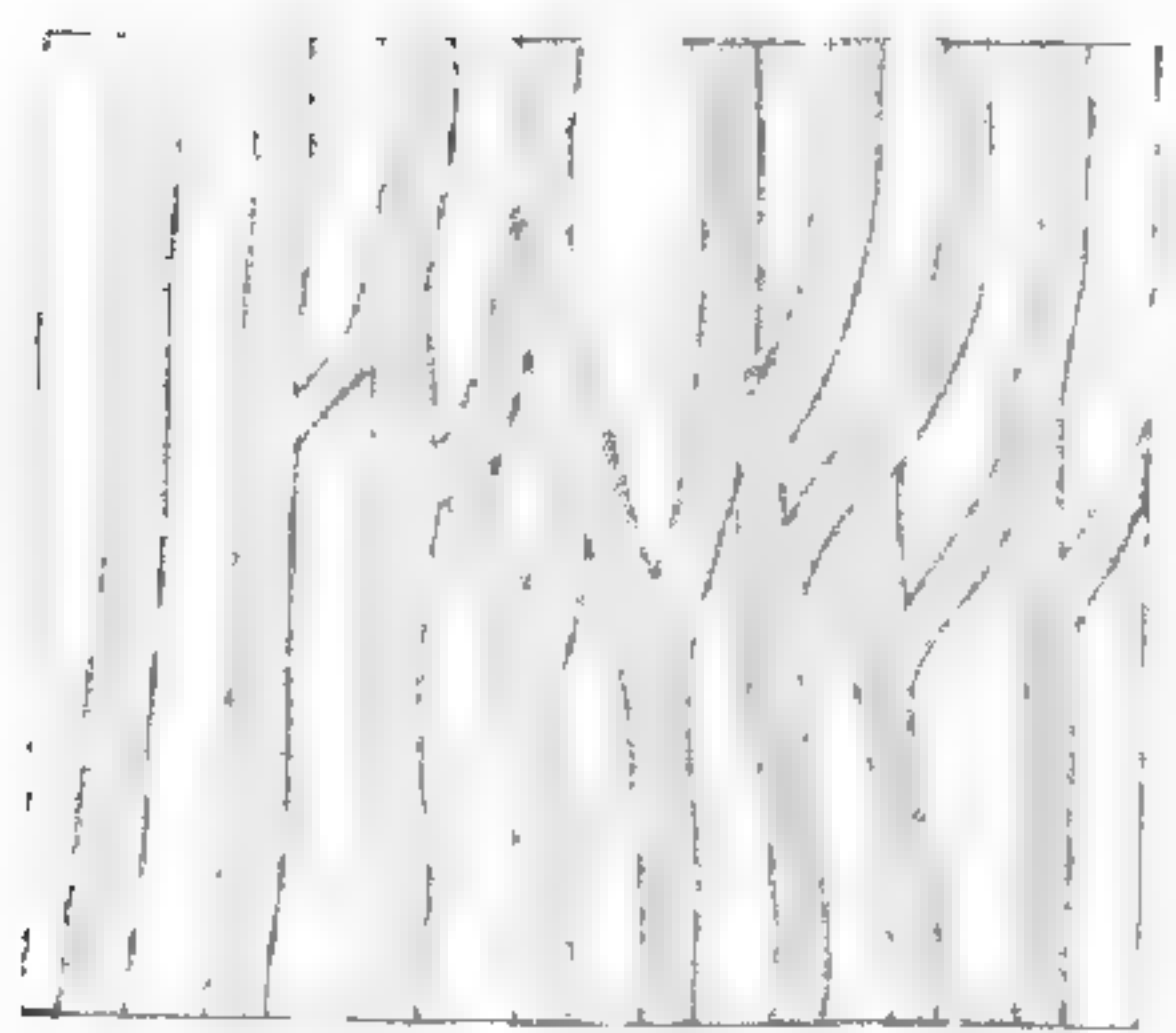
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XIII. *On the Anatomy of the Genus Appendicularia, with the Description of a new Form.*  
 By EDWARD L. MOSS, M.D., Assistant-Surgeon, R.N., H.M.S. Simoom. Communicated by Professor HUXLEY, F.L.S.

(Plate XLVII.)

Read December 3rd, 1868.

THE structure and habits of *Appendicularia* have for some time attracted the attention of biologists both at home and abroad; but few new facts bearing upon its anatomy have been added to English science since the observations of Professor Huxley, in the Philosophical Transactions of 1851.

My attention was first directed to these interesting little animals by the capture of a single specimen between Gibraltar and Malta; and the paper just alluded to was found of the greatest assistance in deciphering the particulars of its anatomy. As many specimens have since been from time to time obtained, some fresh points worthy of notice have presented themselves. The disjointed character of the following remarks must be accounted for by the peculiar difficulties of study at sea, the minute size and transparency of the *Appendiculariæ*, their extreme activity while alive, and the almost instantaneous disorganization of their delicate tissues in the moment of death. An average specimen carefully removed from a glass of sea-water, by the aid of a pipette, and placed in a cell a quarter of an inch wide and a line deep, will live about ten minutes. The rapid vertical undulations of its appendix, only intermitting for an instant, until the shrivelling of its external tunic, and occasionally the exfoliation of a layer of the same tunic from the body, immediately precede dissolution.

The forms of *Appendicularia* which have come under my notice may be conveniently divided into the short- and the long-bodied, which seem respectively to represent the Branchial and Intestinal groups of compound Tunicaries. The former presents an elliptically shaped body, especially when surrounded by an unshrunk external tunic, and an appendix formed on the plan common to all *Appendiculariæ*, but slightly varying in outline in different specimens, attached hæmally with its plane horizontal to that of the body.

The Atlantic and Mediterranean members of this group, which includes the *A. cophocerca* and *A. cærulescens* of Gegenbaur, as well as the new form described below, vary in length from the thirtieth to the third of an inch, and are therefore rather smaller than those described by Professor Huxley in the paper before referred to. The external tunic is always conspicuously developed; in some specimens it presents two tubular processes projecting from the body in the neighbourhood of the ciliated respiratory openings. When such processes exist, they, together with a delicate layer of the tunic, are invariably shed before the death of the animal. The posterior lip of the branchial orifice is occasionally furnished with minute tentacula; and imbedded in the substance of the lip, a short



distance below the orifice, two clear circular cells lie symmetrically on either side of the endostyle (figs. 3 and 4, H). The heart lies between the stomach and the base of the appendix, and, contracting vermicularly, propels the blood at the rate of about 250 pulsations a minute, in a broad stream over the surface of the testis, and in a still pulsating current through the appendix, down one side and up the other, in canals lying on either side of the muscular plane (figs. 1, 2, 3, and 5, A).

The nervous systems of both groups of *Appendiculariæ* present such similarities of structure and development, that a single description will suffice for both. The ganglion (figs. 1, 2, 3, 4, and 5, L) is imbedded in a depression in the anterior paries of the branchial sac; a horseshoe-shaped arc springs from its upper part, and gives origin to a pair of branches which encircle the orifice and supply its sphincter. Right and left, branches pass from the lower extremity of the ganglion obliquely round the branchial chamber to the ciliated respiratory openings. The main trunk descends anterior to the pharynx, curves round between the lobes of the stomach, and divides into two delicate nerves, which pass along the appendix on either side of the central axis inside the muscular bands, and exhibit alternate dilatations, increasing in size, at intervals which lessen, as they approach the tip (figs. 1, 2, 3, and 5, c). The muscular tissue supplied by these nerves is very finely and distinctly striated, with minute lacunæ between its fibres, its general appearance being not unlike the muscular structure of the human heart.

In the second group of *Appendiculariæ*, the length of the body is increased by the separation of the branchial chamber from the viscera by a stalk of considerable length.

At the oral extremity a jug-like dilatation of the internal tunic contains the branchial sac, with its two postero-lateral ciliated respiratory openings, a minute and shortened endostyle between and above these openings, and in the anterior wall a ganglion, with an otolithe attached to its left side.

The inhalant orifice possesses a broad sphincter, and is guarded by six active tentacula with bulbous bases.

A closely ciliated pharyngeal tube forms the greater part of the stalk, and leads from the lower part of the branchial sac to the stomach. A second dilatation of the inner tunic, occupying the centre of the body, contains the heart and intestinal apparatus. The rectum terminates posteriorly and rather on the right side, close above the point of attachment of the appendix. This organ projects from the centre of the body at a considerable angle, and is shaped like a cordate leaf, a peduncle and midrib being represented by the central axis, surrounded by muscular fibres spread out on either side in flat longitudinal bands. The lower half of the body is occupied by a globular mass of compressed yellow cells, and below them by a tapering ovary containing, in some specimens, upwards of 400 ova about  $\frac{1}{800}$  inch in diameter.

In addition to the otolithe and oral tentacula, all the varieties of *Appendicularia* possess an organ of sense analogous to that of *Salpa* and *Doliolum*, in the form of a pear-shaped ciliated sac (figs. 1, 2, 3, J) lying to the right of and attached to the ganglion in nearly the position in which Gegenbaur has figured the unsymmetrical ciliated opening in his *A. furcata*.

I have lately captured a new short-bodied form in the warm surface-water of the



Atlantic, near the Line, and occasionally as far north as off the coast of Portugal. It can be distinguished at first glance from any of its Appendiculate brethren by the peculiar scroll-like manner in which its slender lanceolate flabellum is rolled upon itself when the animal is at rest.

When examined under a magnifying-power of about 100 diameters, the internal economy of this form is seen to differ widely, as regards its respiratory arrangements, from any of the known species. The oval half of the globular body contains a large branchial sac, with a ganglion and otolithe in the usual positions in its anterior paries, but with its posterior lining-membrane folded into a gill-like structure (fig. 5, U), wide in the centre and tapering to either end, extending from the posterior lip of the branchial orifice to a point close to the insertion of the appendix, and presenting a double series of narrow transverse slits, which give the whole structure a general resemblance to the respiratory diaphragm of *Doliolum*, though on a lengthened and much more minute scale. The last curve of the intestine lies transversely across the centre of the body, above a globular ovary, and terminates on the right side in a papilla, through which the rectum opens.

The main nervous trunk, descending from the ganglion, curving round the stomach, and entering the appendix, presents no distinctive peculiarities.

In many specimens of *Appendicularia*, pear-shaped organisms have been found, attached by slender stems to various parts of the outer tunic, so like the pallio-vascular stolons of Compound Tunicaries as to suggest the existence of an ascidium at some developmental stage, and that possibly the "enigmatical 'Haus' of Mertens" might be in some way connected with such an ascidium; but further observation has convinced me that these pseudo-stolons, as well as an irregularly papillated condition of the outer coat sometimes met with, are merely parasitic growths, and that the "Haus" is an exfoliation of the tunics connected with a yet unknown vital process. Both groups of *Appendiculariæ* possess the power of forming the "Haus;" but that evolved by the long-bodied is small and so extremely delicate as only to be seen under the most favourable conditions. The following notes have therefore been principally gleaned from observations of the behaviour of members of the short-bodied group.

When the animal is about to form a "Haus," its rapid jerking movements cease, and after about a minute's rest, a transparent membrane is seen to project beyond the outline of the tunic over the upper part of the body; it soon after flexes its appendix until the tip touches the newly evolved structure, then, slowly extending it, draws the gossamer-like membranes completely over both body and appendix. If, however, the animal is disturbed during the process of evolution, it at once shakes itself free, and the structural details of the immature formation thus obtained are more distinct and compact than when fully extended; the annexed illustration (fig. 7) has therefore been sketched from a "Haus" thrown off when the tenant had just commenced to incurve its appendix. The general shape of the fully formed "Haus" may perhaps be described by comparing it to a thick-winged butterfly, the little Tunicate swimming, branchial orifice upwards, between the viscid alæ, and slowly propelling the whole mass by the undulations of its iridescent flabellum, which projects backwards between the wings. Even in a large aquarium the little animal seldom remains more than an hour in the "Haus;" a second one, as Mer-



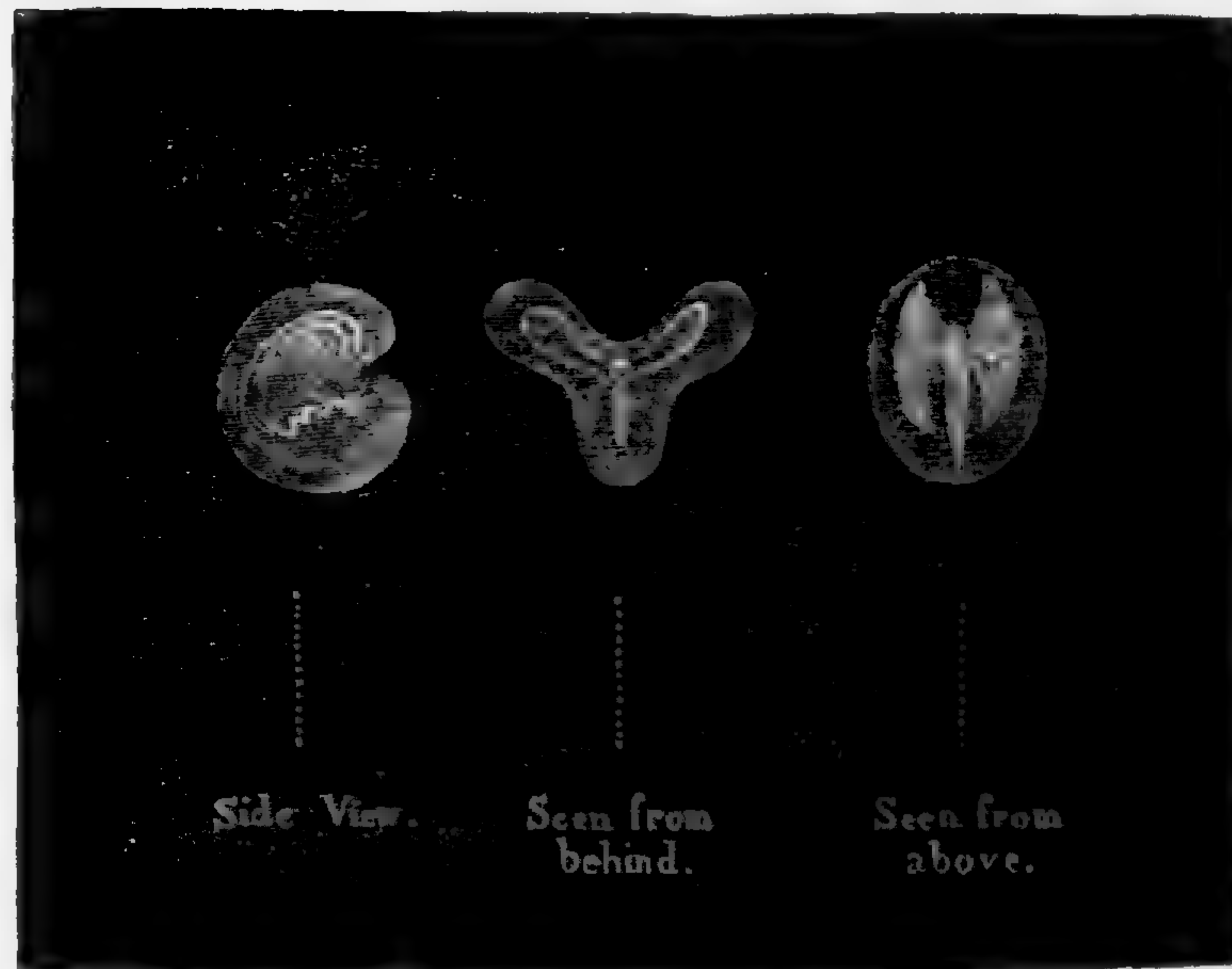
tens observed, is sometimes formed, but is invariably more transparent and delicate than its predecessor. When the *Appendicularia* has remained long in the structure, its upper part generally contains a few oval excrementitious masses, adhering to its viscid membrane; and as such masses are less frequently met with in the "Haus" formed under observation than in that found floating tenantless in the ocean, it is probable that the animal in its natural state makes a more lengthened residence in it than might otherwise be supposed. When microscopically examined, the "Haus" is found to be a sac of extreme tenuity, with a deep longitudinal groove ending above, where the animal was attached, in a torn fissure, and pierced below in the middle line by two small openings with projecting funnel-shaped lips. On either side the sac opens into a short tube of considerable diameter, marked with parallel longitudinal ridges. The membranes of the sides of the above-mentioned fissure are the most readily seen parts of the structure; in them two sets of parallel bars cross each other at right angles, and thus form a reticulation of great beauty and regularity—so regular, indeed, as closely to resemble the markings on a micrometer (fig. 7, c). In a large "Haus" in which this structure was first observed, the areolations measured  $\cdot 0018$  by  $\cdot 0037$  of an inch. During the process of evolution the terminations of the more finely marked bars are attached to the lips of the branchial orifice. The netted membranes are folded upon themselves in such a way as to look like a pair of lateral sacs, except when seen from above, when they present the fan-like appearance shown in the "Haus" figured by Professor Allman in the 'Journal of Microscopical Science for 1859.'

Some interest may perhaps attach to the chemical constitution of the "Haus." It gives no nitrogenous smell when burnt, and is insoluble in water, alcohol, ether, solution of potash, or the dilute mineral acids; in a word, it possesses the negative characters of Tunicin.

The geographical range of the *Appendiculariæ* is at least as extended as that of any of their pelagic brethren. Their discoverers found the first specimens in Behring's Straits and in the South Pacific; and those which gave materials for this paper were captured in the Mediterranean and the Gulf of Mexico, as well as over a large Atlantic area extending from the southern Tropics to the cold green waters of the Labrador current.

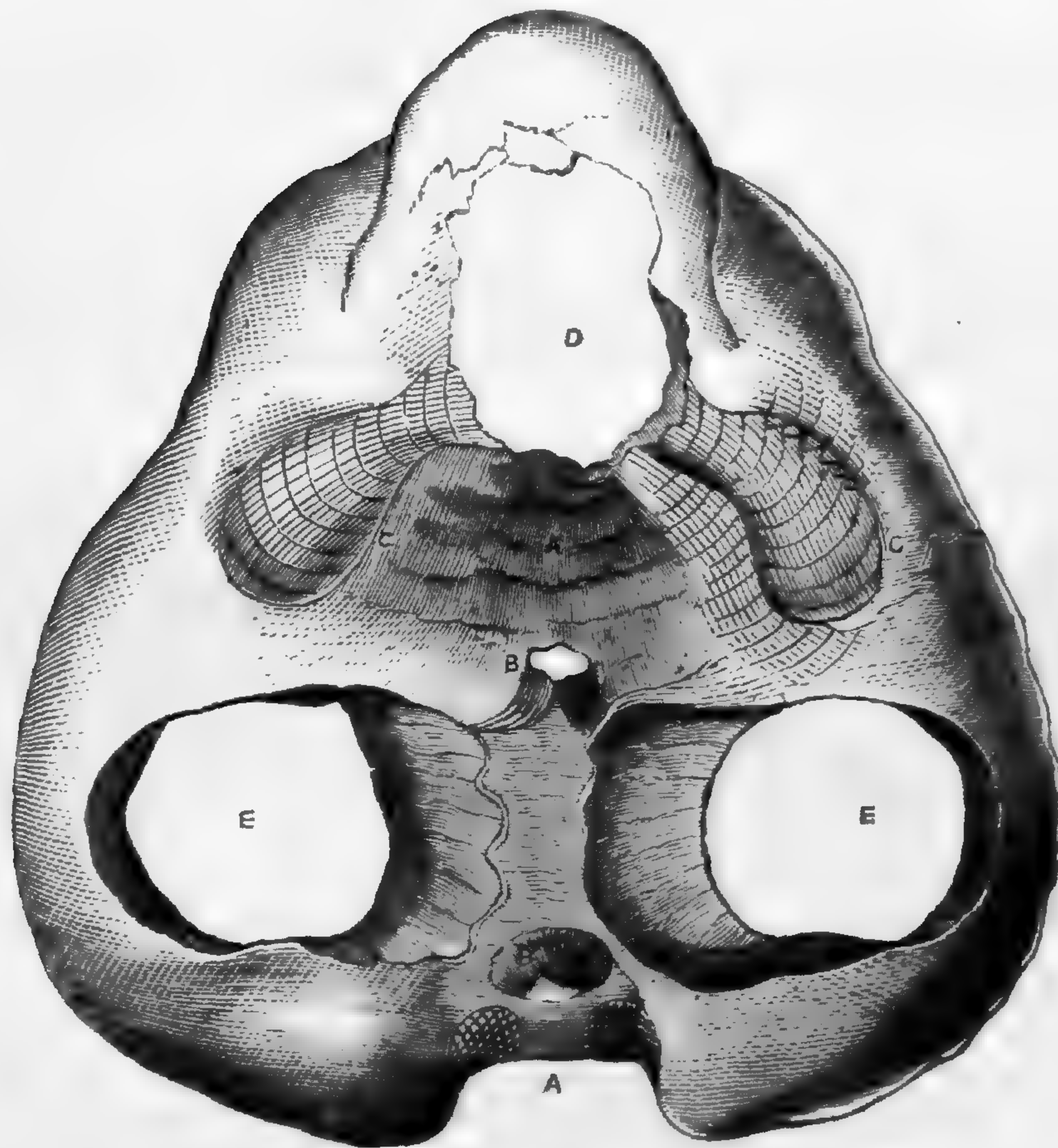


Fig. 6.



The "Haus," magnified three times.

Fig. 7.



Immature "Haus," magnified about 60 diameters.

A, median groove; B, small funnel-shaped opening; C, lateral reticulations; D, fissure where the *Appendicularia* was attached; E, lateral tubular openings.



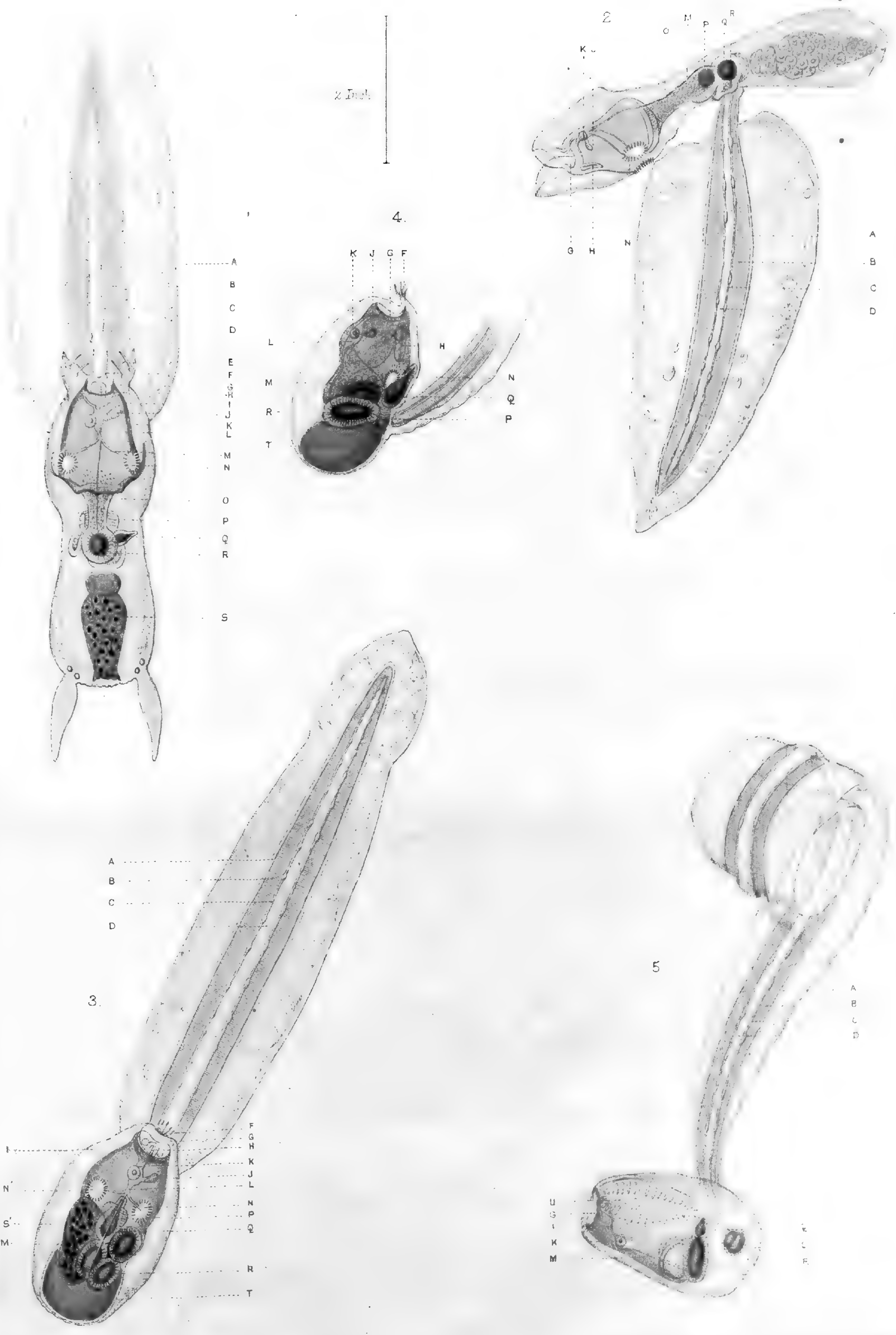
EXPLANATION OF PLATE XLVII.

- Fig. 1. *Appendicularia furcata*, front view.  
 Fig. 2. *Appendicularia acrocerca*, side view.  
 Fig. 3. Common short-bodied *Appendicularia*, front view.  
 Fig. 4. Side-view of fig. 3.  
 Fig. 5. New form, oblique view—the ganglion and otolithe (K) being in the middle line of the body anteriorly, the gill (U) and attachment of appendix posteriorly.

Significations of the letters the same in all.

- |  |  |
|--|--|
| <p>A, vascular canal of the appendix.<br/>                 B, muscular bands of the appendix.<br/>                 C, nervous cords of the appendix.<br/>                 D, central axis of the appendix.<br/>                 E, oral tentacula of lateral lips.<br/>                 F, oral tentacula of posterior lip.<br/>                 G, branchial orifice.<br/>                 H, endostyle and neighbouring symmetrical cells.<br/>                 I, nervous branches surrounding the branchial orifice.<br/>                 J, ciliated sac.<br/>                 K, otolithe and its sac.</p> | <p>L, ganglion.<br/>                 M, principal nervous trunk.<br/>                 N, ciliated branchial openings.<br/>                 O, ciliated pharynx.<br/>                 P, heart.<br/>                 Q, rectum.<br/>                 R, stomach.<br/>                 S, ovary. S', doubtful, in common short-bodied <i>Appendicularia</i>.<br/>                 T, testis.<br/>                 U, gill-like structure in the new form of <i>Appendicularia</i>.</p> |
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TRANSACTIONS  
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M.DCCC.LXXI.



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- XVI. *Descriptions of some British Spiders new to science; with a Notice of others, of which some are now for the first time recorded as British species. By the Rev. O. P. CAMBRIDGE. Communicated by JAMES SALTER, Esq., F.R.S., F.L.S. . 393*



*Errata in Prof. WILLIAMSON'S Memoir on Zamia Gigas, Lindl. & Hutt., published in Linn. Soc. Trans. vol. xxvi. pp. 663-674.*

From an accidental oversight on the part of Mr. Carruthers, a number of errors have found their way into the text of this memoir in referring to the plates. The references in the Explanation of the Plates are correct. The following corrections require to be made:—

Page 665, line	2, <i>for</i> fig. 6	<i>read</i> fig. 5
„ 666, „	32, „ Fig. 6	„ Fig. 7
„ „ „	39, „ figs. 5 & 7	„ figs. 3 & 6
„ 667, „	1, „ fig. 5	„ fig. 7
„ „ „	3, „ figs. 5 & 7	„ figs. 3 & 6
„ „ „	11, „ fig. 7	„ fig. 6
„ „ „	16, twice, <i>for</i> fig. 7	„ fig. 6
„ „ „	24, <i>for</i> Fig. 3	„ Fig. 5
„ „ „	28, „ Fig. 7	„ Fig. 6
„ 668, „	3, „ fig. 5	„ fig. 3
„ „ „	3, „ fig. 7	„ fig. 6
„ „ „	19 & 20 figs. 7, 8, and 9	„ figs. 6, 7, and 8
„ „ „	23, „ fig. 9	„ fig. 6
„ „ „	30, „ fig. 10	„ fig. 7
„ „ „	34, „ fig. 7	„ fig. 6
„ „ „	40, „ fig. 10	„ fig. 7
„ 669, „	7, „ fig. 5	„ Tab. LII. fig. 7
„ „ „	11, „ fig. 7	„ Tab. LII. fig. 7
„ „ „	16, „ figs. 10, 11, 12	„ figs. 6, 7, & 8
„ „ „	25, „ pyramidal	„ pyriform
„ „ „	30, „ fig. 7	„ fig. 6
„ 670, „	17, „ fig. 6	„ fig. 8
„ 672, „	15, „ fig. 13	„ figs. 12, 13



XIV. *Observations on the Lichens collected by Dr. ROBERT BROWN, M.A., F.R.G.S., in West Greenland in 1867. By W. LAUDER LINDSAY, M.D., F.R.S.E., F.L.S.*

(Plates XLVIII.–LII.)

Read February 4th, 1869.

I. *Introduction.*

THE lichens on which the following "Observations" were made were collected between June and September, 1867, by my friend Dr. Robert Brown, F.R.G.S.\* They were gathered mostly in the following localities, on, or in the neighbourhood of, Disco Island, between 67° and 70° N. lat., in an area of country not differing much in its different parts as respects its cryptogamic vegetation:—

1. Jakobshavn (in English, Jacob's Harbour or Haven), lat. 67° 13' 11" N., long. 50° 56' 30" W. †; period June to August.

This was the chief centre and locality of collection. Most of the muscicolous lichens, and of the common species (e. g.) of *Cladonia*, *Stereocaulon*, and *Collema*, from Jakobshavn, were specially labelled "shady places, north end of harbour near Mr. Fleischer's house;" July.

2. Egedesminde (English, Egede's Memory), lat. 68° 42' 39" N., long. 52° 43' 48" W.; June.

3. Godhavn ‡, the "Lievly" of British whalers (English, Good Harbour), on Disco Island, lat. 69° 14' 58" N., long. 53° 24' 40" W.; perhaps the best-known botanical locality in Greenland.

4. Illartlek; entrance to inlet, head of inlet, and at the glacier. About 69° 27' N. lat.; July.

5. Ounartok, lat. 70° 30" N., long. 52° W.; August.

6. Kudlesæt, lat. 70° 5' N., long. 52° 32' 35" W. (approx.); August.

7. Lyngemarken, on Disco, opposite Godhavn; September.

8. Atanakerdluk § (English, "the Rocky Promontory"), on Waigatz Strait (=Waj-

\* [We have been requested to state that the collection of lichens described in this paper is the property of Mr. Edward Whymper, and that the plants were collected by Dr. Robert Brown during a visit to Greenland, undertaken at the expense of Mr. Whymper, in 1867.—SECS. L. S.]

† "The longitudes and some of the latitudes which I have given for Greenland places, are only approximate" (says Mr. Brown, in writing me), "as I have not fully wrought out my astronomical observations for positions." Those cited are from Mr. Brown's "Florula Discöana," Trans. Botan. Society of Edinb., vol. ix. p. 435, where full descriptions of all the localities are given.

‡ Not to be confounded with Godthaab, a very different locality—a Danish "Colonie" in lat. 64° 8' N., and long. 51° 37' W.

§ Regarding the spelling of Greenland names of places, *vide* author's paper on the "Lichen-Flora of Greenland." Trans. Botan. Soc. Edinb., vol. x. p. 292.



gattet), lat. 70° 2' 30" N., long. 52° W. (approx.); the chief site of the fossil (Miocene) plant-beds.

The principal *rocks* on which the *saxicolous* lichens occur are granite, gneiss, and trap; while *terrícolas* forms affect a soil consisting of the débris of these rocks. *Corticulous* species were found mostly on twigs or stems of birch bushes\*; while *muscicolous* forms chiefly frequent *Rhacomitrium lanuginosum* †, a moss that appears to be abundant in all northern countries ‡.

In the examination of the present collection of Greenland lichens, I have made use of the *chemical tests* recommended of late years by Nylander and Leighton as a means of determining lichen-species. All the *positive* results—all instances of reaction of a marked kind—are hereinafter recorded. In the majority of cases, however, there was *no* reaction, or none of a kind meriting record; while in species in which a decided reaction was sometimes exhibited, at other times it was obscure or absent. In other words, reaction was, in these exceptional cases, capricious or inconstant. Hence the result of the present comparatively limited series of testings only confirms that of the more comprehensive series of experiments described in a former memoir to this Society §.

The present collection contains only one strictly arctic lichen, *Dactylina arctica*. But it contains several lichens that are apparently *new*, inasmuch as I cannot refer them to any of the species or varieties described in Th. M. Fries's 'Lichenes Arctoi Europæ Grœnlandiæque,' in his 'Lichenes Spitsbergenses,' in Nylander's 'Lichenes Scandinaviæ,' in the various monographs on arctic lichens scattered through botanical serials to which I have had access; or to the specimens contained in the various public or private herbaria I have examined ||.

These *new* forms are mostly referable to the genus *Lecidea*, viz.:—*L. Grœnlandica*, *L. Campsteriana*, *L. Friesiana*, *L. Egedeana*, *L. Discœensis*, *L. Vahlia*. But they represent also several other genera or pseudo-genera, viz.:—*Pertusaria paradoxa*, *Verrucaria tartaricola*, *V. Campsteriana*.

There are, moreover, various *parasites*—micro-fungi or micro-lichens, or their isolated pycnidia or spermogonia—to which I have not thought it proper at present to assign distinctive names.

The main interest of the collection attaches, however, not to the character or number of the apparently novel forms it contributes to science, but to the illustrations which it offers of the following, among other, characteristics or peculiarities of extreme northern, arctic, or alpine lichens, viz. the frequency of occurrence of:—

1. *Parasitic Micro-Fungi or Micro-Lichens*, or their separate pycnidia or spermogonia, affecting either the thallus or apothecia of the host, or both.

\* *Betula nana*, L.

† Or a moss closely resembling it.

‡ Thus I have pointed out its abundance in Iceland and Norway: 'Flora of Iceland,' p. 23, Edinb. New Philos. Journal, July 1861; 'Lichen-flora of Northern Europe,' p. 406, Journal of Linn. Society, Botany, vol. ix.

§ 'On Chemical Reaction as a Specific Character in Lichens,' Journal of Linn. Society, Botany, vol. xi. p. 36. Vide also Trans. Botan. Soc. Edinb., vol. x. p. 82.

|| There were (in 1858) few Greenland lichens in the Kew Herbarium; and none in the Herbaria of Linnæus in the Linnean Society, nor in that of the University of Edinburgh.



Such parasites are more or less common \* in species of the following genera:—*Cladonia*, *Ramalina*, *Cetraria*, *Thamnolia*, *Solorina*, *Peltigera*, *Stereocaulon*, *Parmelia*, *Physcia*, *Umbilicaria*, *Squamaria*, *Placodium*, *Lecanora*, *Lecidea*, *Endocarpon*, *Verrucaria*.

2. *More than one form*, in the same lichen-species, of apothecia, spermogonia or pycnidia, or of their contained reproductive corpuscles—sporidia, spermatia, or stylospores. Illustrations are to be found in *Lecanora subfusca*, *L. tartarea*, *L. varia*, *Squamaria chrysoleuca*, *Dactylia arctica*, and *Thamnolia vermicularis*. And I have entered more fully on the subject in my paper on “Polymorphism in the Fructification of Lichens” †.

3. *Sterility*.—Mere absence of apothecia, spermogonia, or pycnidia ‡; or their occurrence in an abortive or degenerate form.

Among the more marked illustrations are the following:—*Sphærophoron coralloides*, *Thamnolia vermicularis*, *Usnea melaxantha*, *Parmelia saxatilis* and *olivacea*, *Physcia pulverulenta* and *stellaris*, *Cetraria islandica*, *cucullata*, and *nivalis*, and *Nephroma arcticum*.

4. *Deformities of* (I.) the reproductive and (II.) the vegetative organs, the various results of:—

- (a) Hypertrophy or atrophy.
- (b) Degeneration or abortion.
- (c) Homologous or heterologous growths.

These deformities include, in regard to the

(I.) Reproductive system:—various monstrosities of the apothecia, spermogonia, or pycnidia, which are illustrated *e. g.* by the genus *Lecanora*.

(II.) Vegetative system:—

- (a) Disproportionate development, *e. g.* of the horizontal, foliaceous, or squamulose thallus in *Cladonia*, the podetia being absent or dwarfed.
- (b) Clothing of podetia with warts, granules, squamules, or folioles, *e. g.* in *Cladonia* and *Stereocaulon*.
- (c) Isidioid and Sphærophoroid growths, the former represented by the pseudo-genus *Isidium*, the latter by the var. *sphærophoroidea* of *Parmelia saxatilis*.

The development of *Isidia* is illustrated by *Lecanora glaucoma*, *tartarea*, and *parella*; by *L. spodophæa*, Whlnb., a Finmark and Nordland lichen; and by *L. aipospila*, Whlnb., a Spitsbergen one,—the two latter being figured in our own ‘English Botany’ (t. 2083). The isidioid states of these *Lecanora* constitute pseudo-species of the pseudo-genus *Isidium*, especially *I. corallinum* and *I. coccodes*. Mudd is wrong in referring all British forms of *Isidium* (save *oculatum*) to species of *Pertusaria*. *Isidium* cannot be referred to that genus in Green-

\* *Vide* “Enumeration of Micro-Lichens Parasitic on other Lichens,” Quart. Journal of Microscopical Science, January, April, and October, 1869.

† ‘Report of British Association,’ 1867, p. 89; and ‘Quart. Journal of Microscopical Science,’ January, 1868.

‡ This includes *rudimentary* conditions, *e. g.* those constituting the pseudo-genus *Lepraria*.



land, where none of its species have yet been found, save a parasite which I assign to it doubtfully\*. The truth is, that *Isidium* is a *condition* of several saxicolous species, both of *Pertusaria* and *Lecanora*, and probably also of *Lecidea* †.

- (d) Growth of warts or tumours, sometimes spherical, and ultimately detached or detachable, *e. g.* in *Lecanora ventosa* and *L. tartarea*.
- (e) Excessive development of the *gonidic* element in the form of *soredia*, constituting the pseudo-genus *Variolaria*.
- (f) Dwarf states, especially where the thallus is fruticulose, *e. g.* in *Stereocaulon* and *Cladonia*.
5. *Abnormalities of colour*, *e. g.* the colour-mottlings of the podetia of *Cladonia*.
6. *Unusual habitats*.
- (a) Other, generally higher, lichens, especially when old, decayed, and bleached by the weather, *e. g.* :—
- (I.) *Parmelia saxatilis* on the scyphi of *Cladonia pyxidata*, and on the thallus of *Umbilicaria vellea*.
- (II.) *Physcia pulverulenta* and *stellaris* on the thallus of the same *Umbilicaria*.
- (III.) *Lecanora sophodes* on *Umbilicariæ* and *Cladoniæ*.
- (IV.) *Lecidea myriocarpa* on *Umbilicariæ*.
- (b) On dried excrement of animals, *e. g.* *Lecanora polytropa* on that of birds.
- (c) On the bleached bones of dead animals, *e. g.* *Squamaria saxicola* on the vertebræ of Whales.
7. *Athalline conditions*: the apothecia constituting the entire plant, and growing parasitically or not, *e. g.* *Lecidea parasema*, *vernalis*, and *myriocarpa*.
8. *Variation in the character of the sporidia* in the same species, *e. g.* *Lecidea parasema*, *vernalis*, *petræa*, *atro-alba*, *geographica*, *alpicola*, *sanguineo-atra*, *Friesiana*, *insignis*.
9. Absence of any fixed or constant *anatomical distinction between spermogonia and pycnidia*, spermatia and stylospores, sterigmata and basidia, *e. g.* in *Peltigera canina*, *Nephroma arcticum*, *Lecidea cladoniaria*, *Lecanora subfusca*.

The organs known as *thecæ* and *spores* in *Lichens* being exactly what are called *asci* and *sporidia* in *Fungi*, it does not appear desirable to maintain different designations for the same organs in two groups so closely allied as *Fungi* and *Lichens* ‡. I have

\* Vide *Pertusaria paradoxa*, described under *Lecanora oculata*.

† Vide author's 'History of British Lichens,' pp. 326 & 341; and paper on "Parasitic Micro-Lichens," formerly quoted (p. 307).

‡ Some Ascomycetes (says Berkeley in the 'Treasury of Botany') approach Lichens so closely as to be scarcely distinguishable, *e. g.* in their spermogonia and pycnidia. *Fungi* and *Lichens* are "so closely allied that it is often difficult to tell to which division some given species may belong." Hence he includes both under the common designation "Fungals." I have pointed out in various papers (*e. g.* "New-Zealand Lichens and Fungi," Trans. Royal Society of Edinb., vol. xxiv. p. 434) that there is a large group, provisionally termed "Fungo-Lichens," which have the characters equally of *Fungi* and *Lichens*, and which it is at present impossible to assign preferentially or exclusively to either family.



therefore, in the present memoir, adopted Berkeley's suggestion that the terms *asci* and *sporidia* should be substituted for thecæ and spores. In his 'Outlines of British Fungology' (1860), he defines an *ascus* to be "a delicate sac containing sporidia," and *sporidia* as "reproductive cells produced within asci or sporangia from a transformation of their endochrome;" while *spores* are "reproductive cells borne freely on the sporophores"\*. In the 'Treasury of Botany' (1866), he describes *thecæ* as a now obsolete and unnecessary term. Whether or not it is unnecessary, it cannot be considered obsolete so long as it is used by so voluminous and original a lichenographer as Nylander. Körber and Th. Fries employ the term "asci," but not "sporidia," agreeing with Nylander in preferring the term "spores." There is thus considerable difference in the nomenclature by different authors of the same organs in lichens; and hence a confusion arises, which can only be remedied by the substitution of a *uniform nomenclature*, one applicable to the same organs in *both fungi and lichens*.

I have here also followed the German school of lichenologists in describing simple sporidia as monoblastic or *unilocular*, and compound ones as 2-, 3-, or poly-blastic or *multilocular*. Mudd has adopted this nomenclature in his 'British Lichens' (1861); but Nylander prefers to designate compound sporidia as *septate spores*. It does not appear to me that the one nomenclature has any marked superiority over the other. But it is most desirable here, as in the case of "asci" and "sporidia," that there should be *uniformity of nomenclature* for the same organs, not only among lichenologists, but common to fungologists and lichenologists.

## II. Enumeration of Lichens collected, with special Commentary thereupon.

### Genus 1. EPHEBE.

Sp. 1. *E. pubescens*, L. Egedesminde.

### Genus 2. COLLEMA.

1. *C. melænum*, Ach.—Associated with *Cladonia cervicornis*, Jakobshavn. In Europe the thallus is sometimes the seat of a parasitic *Sphæria* †.

2. *C. flaccidum*, Ach.—Jakobshavn. Agrees in characters with the English plant (E. Bot., t. 2197). I do not think the mere character of the sporidia sufficient to separate *Synechoblastus* as a *genus* from *Collema*.

The foregoing *Collemata* occur in Brown's collection as mere scraps, and not in fruit.

### Genus 3. CALICIUM.

1. *C. furfuraceum*, L.—On loose soil about the Illartlek glacier. Apothecia young, still green: contain no sporidia. Has the usual citrine-yellow thallus and other characters of the European plant (E. Bot., t. 1910 ‡, and Schærer's Exs. 14). Apparently the only representative in Greenland of the large European family Calicia. It grows also in

\* Glossary, pp. 411 & 414.

† *Vide* author's "Memoir on Spermogones and Pycnides," Trans. Royal Society of Edinb., vol. xxii. p. 272.

‡ The references to the plates of the 'English Botany' apply to the *second* edition (1843).



Spitzbergen\*. My herbarium contains a specimen similar to the Greenland plant, on moss from Branksdale, Yorkshire (*Mudd*); but in Britain it is more common on rotten tree-roots and trunks.

There is considerable variation in the size and colour of the *sporidia* in specimens from different localities. Thus in the type in Schærer's Exs. 14, they are colourless, spherical, with a diameter of  $\cdot 00013''$ . In var. *fulva*, L., Schær. Exs. 296, they are pale brown, spherical, with a diameter of  $\cdot 000083''$ . In var. *sulphurella*, Fr., Schær. Exs. 639, they are pale brown, simple, spherical, very abundant, with a diameter of  $\cdot 00010''$  to  $\cdot 00013''$ . In another specimen, in Nylander's Exs., they are pale brownish-yellow, sometimes granular, simple, spherical, with diameter of  $\cdot 000083''$ . The *spermogonia* would appear to be rare; and, so far as I am aware, they have not been described or observed by other authors. I met with them in Schærer's Exs. no. 14, and Hepp's Exs. 154 (=var. *sulphuretia*), as very minute, brown specks, scattered in great abundance, like grains of the finest dust, over the white pulverulent thallus. The envelope was of a deep brown, the spermatia atomic, and the sterigmata apparently very short and simple. There appears to be insufficient ground for separating *Coniocybe*, as a genus, from *Calicium*.

#### Genus 4. SPHÆROPHORON.

1. *S. coralloides*, Ach.—Illartlek glacier; Egedesminde. Several forms occur, none of them in fruit, but some of them spermogoniferous. *Spermogonia* exist, in the typical form of the plant, only in one fragment, as deep-brown papillæ or ring-like warts, crowning the under surface of the pale nodding tips of the branchlets. The thallus in these forms is always glossy; its surface frequently deformed by expansion and wart-growth; the colour black, or black-mottled, or rusty-red—or mottled rusty-red, brown, or lilac. The tips of the ramuscles are conspicuously white, contrasting well with the buff or reddish-brown colour of other portions of the plant.

Transition-forms between *coralloides* and *compressum* are common, possessing two distinct surfaces:—the one convex and deeply coloured; its opposite pale or white, and flattened, sometimes lacunose or fossulate. Spermogonia are more common on those forms which belong to *compressum* of authors. As they occur in this so-called species in other countries, they are figured in my 'Memoir on Spermogones'† (plate v. figs. 44 & 48, 49 & 52). Spermogonia, in the larger, laxer, more ramose forms of *coralloides*, occur on the nodding apices, just as in passage-forms to *compressum*.

There are various dwarf states of *coralloides* in Greenland, one of which forms a flat, isidioid, but tessellated surface, and might appropriately be designated form *isidioidea*, were we to follow the example of systematists and give names to such mere stages of growth. Here the branches are short, simple, and compactly arranged, sometimes assuming a Pycnothelioid character, sometimes resembling forms of *Lecanora tartarea* or *L. oculata*. In other cases, they become broadened and subfoliaceous, resembling certain states of some of the foliaceous *Cladoniæ*, e. g. *cervicornis*. Sometimes these subfolia-

\* Th. Fries, Lich. Spitsb., p. 47.

† The terms *Spermogones* and *Spermogonia* are synonymous, the former being simply the English representative of the Latin or Latinized word.



ceous states are associated with similar, very deformed, dwarf, ventricose or Pycnothelioid conditions of *Cladonia amaurocræa*.

A specimen in the Kew Herbarium from Disco (Lyall, 1852), labelled *fragile* by Nylander, is simply a short, cæspitose, sterile form of *coralloides*.

With *iodine* the white medullary tissue of passage-forms into *compressum* give, even in the same specimen, either no reaction, a pale violet, or a distinct blue. I have tried the effect of a diluted tincture of iodine on many specimens of *S. coralloides*, *fragile*, and *compressum*, from different parts of the world, collected at different times, and I am satisfied of its uselessness as a specific test. The reaction is both slow and difficult to obtain—where it occurs at all; for it is sometimes absent. It is quite capricious, therefore, being only sometimes violet or blue. With *bleaching solution* the medullary tissue of *coralloides* gives a brownish or blood-red colour like that of *Lecanora tartarea* under the same reagent; or this reaction is faint; or no reaction occurs; or colour is exhibited only in the dwarf, dense, subisidioid forms. For the development of reaction at all, the cortical layer must be bruised, and the medullary tissue exposed, by rubbing or breaking up the former, when moistened, with the stirrer.

#### Genus 5. CLADONIA.

1. *C. alcicornis*, Flk.—Jakobshavn, intermixed with various mosses; occurs sparingly. Under surface very white, with incurved margins. As in *cervicornis*, the folioles are sometimes very densely tufted, forming spherical masses. The podetia are very short, deformed, and inconspicuous, seated barrelwise on the folioles. The same black, punctiform parasite that infests *cervicornis* grows on the podetia, and sometimes on the under surface of the folioles, of *alcicornis*.

I regard *alcicornis*, as I do also *cervicornis*, as non-autonomous, but as mere conditions of *Cladoniae* in which the horizontal foliaceous thallus is developed disproportionately to the podetia. *Alcicornis* passes, on the one hand, into *cervicornis*, and on the other into *endiviæfolia*\*, these three so-called species differing only in the size of the thalline divisions. According to the latest (*chemical*) classification of Leighton and Nylander, *cervicornis* holds, however, position as a separate *species* †; while it has been hitherto generally assigned to *verticillata* as a *variety*. Coemans has shown that, even by so distinguished a lichenographer as Acharius, *alcicornis* was confounded not only with *cervicornis*, but with *pungens*, *degenerans*, and *pyxidata*. Some of its forms (*e. g.* in the Menziesian Herbarium ‡) I have been enabled to refer to *pyxidata*. In Leighton's Exs. no. 15, I found parasitic pycnidia on *alcicornis*—as described in my 'Mem. Spermog.' (p. 161).

2. *C. cervicornis*, Ach.—Jakobshavn, terricolous. Podetia and underside of folioles studded over with a black punctiform parasite. Upper surface of folioles becomes bright lemon-yellow with *Liquor potassæ*, while underside exhibits no reaction. The

\* Coemans makes *endiviæfolia* a var. of *alcicornis*, while other lichenologists have done just the reverse, regarding *alcicornis* as a var. of *endiviæfolia*!

† A position also assigned by them to *Cl. cornuta*, L., *degenerans*, Flk., *fimbriata*, Hffm., *crispata*, Ach., and *ecmocyna*, Ach., all of which I hold to be mere conditions or *forms* of other species.

‡ Contained in the Herbarium Hall of the Royal Botanic Garden, Edinburgh.



folioles are frequently very thick—and when moist, semi-cartilaginous—when dry, brittle. They are densely arranged, and form flat tufts. These brown microphylline states resemble the thallus of *Lecidea* (*Psora*) *ostreata*, Hffm. The lobes are fringed with dark brown or blackish-brown tubercles, resembling spermogonia in site and shape; sometimes these tubercles are seated on the surface of small digitate prolongations of the lobes. They are seen only under moisture, and even then with difficulty, by reason of their minuteness. Their envelope is of such tenuity that it nearly loses cohesion under pressure of the microscope glass: it is composed of brown irregular cells, normally spherical. The contents are myriads of corpuscles, resembling the stylospores of *Peltigera*, but pale green, and shaded, not distinctly granular, mostly spherical, varying little in size and form, with a diameter of  $\cdot 00015''$  to  $\cdot 00020''$ , sometimes adhering in twos and having then a resemblance to figure-8-shaped sporidia.

In the Kew Herbarium, certain specimens, labelled *cervicornis*, are really referable, I think, to *pyxidata*, *degenerans*, *gracilis*, and *verticillata* \*, while I refer no. 754 Mougeot and Nestler's Exs. to *pyxidata*.

3. *C. squamosa*, Hffm.—Jakobshavn. Various forms; sometimes corticolous (on birch). Its spermogonia are those typical of the genus, terminal, deep brown, barrel-shaped; the ostiole spherical and distinct under the lens. Spermata straight, in myriads, on digitate sterigmata.

Various forms of *squamosa* and *gracilis* are confounded with each other in the Kew Herbarium.

4. *C. gracilis*, L.—Jakobshavn; Illartlek glacier. Various states, mostly deformed. Colour varies from white or pale, through brown, to deep ash-grey or black. Bases of podetia, which are immersed in moss (apparently *Rhacomitrium lanuginosum*), are often or constantly quite black. Sometimes the podetia are black from base to apex, or the upper portion is dark brown. These dark forms are covered sparingly with white or very pale green, irregular, tumid phyllocladia, which are very conspicuous on the dark podetia. Deformed scyphi sometimes give off secondary podetia. The phyllocladia of the podetia (in some forms only) give the beautiful lemon-yellow of *cervicornis* with potash. A pale, white and green-spotted form, growing in the shade of *Cetraria cucullata*, shows no reaction. Sometimes the most deformed conditions are the most elegant. Podetia are sometimes studded over, about their tips, with a very minute, black, punctiform parasite, which has the structure of a *Torula* †, consisting of chains of oblong, brown, spore-like cellules. The parasite is seen with difficulty even under the lens; it is to be found equally on fertile and sterile podetia. On one of the podetia I also met with a brown, 2-locular sporidium, having the characters of the sporidia of *Buellia* or *Rinodina*; obviously it was a wanderer, and could have no relation to the *Cladonia* or its parasite. I have repeatedly met with such errant sporidia in different lichens ‡. Occasionally their presence may, to the student, be the source of considerable confusion.

\* Coemans regards *cervicornis* as a macrophylline var. of *C. verticillata*, Fr.

† The same *Torula* apparently, which is probably *T. lichenicola*, Linds., occurs also on *Lecanora tartarea* and *L. oculata* (q. v.).

‡ Vide *Lecidea petraea*, n. 5.



Forms of *gracilis* are, in the Kew Herbarium, confounded with *squamosa*, *amaurocræa*, *uncialis*, *pyxidata*, and *furcata*\*

5. *C. furcata*, Schreb.—Godhavn. In fruit. Some of its forms have been confounded with states of *gracilis* †, *uncialis*, and *rangiferina* ‡, in the Kew Herbarium.

6. *C. rangiferina*, L.—Egedesminde. Gives no reaction with potash. Rare and sterile in Spitzbergen, according to Th. Fries; but it would appear to be abundant in some parts, at least, of Greenland, where it ascends to 200 feet above the sea. *Cl. sylvatica* is commoner than the type in Spitzbergen, but nowhere plentiful, and always sterile (Th. Fries). The extent to which *C. rangiferina*, in some of its forms, grows in Greenland is of interest in connexion with the question of the *food of the Reindeer* in that country. Crantz, in his 'History of Greenland' § (1820, vol. i. p. 61), describes what is evidently *C. rangiferina* as "the food of the reindeer in winter; and might, in case of necessity, preserve the life of a hungry man." He assigns to this lichen, as well as to *Cetraria Islandica*, an unpleasant taste at first; "but when chewed and swallowed, they have" (he says) "a sweet flavour like rye." Hares also are said by Crantz (p. 66) to live partly on "White Moss" (*C. rangiferina*). There can be no doubt of the occurrence of the reindeer in Greenland; but it does not follow that there is a profusion of "Reindeer Moss," as it is well known that that animal can and does subsist on a considerable variety of *other* foods. Dr. Brown informs me that "The reindeer food does not consist to any great extent of *Cladonias* in Greenland, as they are rather scarce; but of other lichens, all species of grass, shoots of *Betula*, *Vaccinium*, *Empetrum*, &c." || He adds, "the reindeer of Greenland is, in my opinion . . . only a climatic variety of the Scandinavian species, and may be characterized as *Rangifer tarandus*, var. *Grænelandicus*, Kerr (Linn. 1792)." It is certainly a fact that *C. rangiferina* occurs very sparingly in the present collection, and equally rarely in the Greenland collections of lichens I have examined in Kew or other public herbaria.

In the Kew Herbarium forms of *rangiferina* are confounded with states of *uncialis* and *furcata*. Even Acharius confounded *rangiferina* with *furcata* (Coemans). But these errors, if errors they be, are quite excusable, and indeed are unavoidable; for *rangiferina* passes into *furcata* through *pungens* and *rangiformis*. No. 754 Mougeot and Nestler's Exs. is partly referable to *furcata* (= *Lichen pungens*, Ach., in fruit). The little value of the present unnecessarily elaborate classification of the *forms* of *rangiferina*—

\* *E. g.* in var. *surrecta*, Flk., according to Coemans, who points out that even Acharius confounded it with *crispata*, *amaurocræa*, &c.

† Especially var. *corymbosa*, Ach. (Coemans).

‡ Especially certain brown states thereof; the resemblance is sometimes so close that the two groups are confounded in the Kew Herbarium and all large herbaria.

§ English translation from the German.

|| In a paper "On the Mammalian Fauna of Greenland" (Proceed. of Zoolog. Soc. London, 1868, pp. 352 and 355, and Petermann's Geographische Mittheilungen, 1869, pp. 464 and 465), Dr. Brown points out that there has been a gradual decrease in the number of reindeer in Greenland, in consequence of their indiscriminate slaughter for the sake of the skin alone, of which the yearly production was at one time 10,000 to 20,000. "I can hardly think" (says he) "that . . . reindeer-moss . . . forms any great portion of its subsistence, as that lichen is nowhere found in Greenland in such quantity as to afford food for any animal." Compare certain remarks in my paper, "The Lichen-flora of Greenland," pp. 53–56, Trans. Botanical Society of Edinburgh, vol. x. 1869.



the non-necessity for the present redundancy of *names*, may be illustrated by the fact that the latest monographer of the genus *Cladonia* (Coemans) regards (and, I think, correctly) *gigantea* merely as the sterile, and *cymosa* as the spermogoniferous condition of the type. He also, quite as properly, merges *pumila* and *alpestris* [the latter not being necessarily an Alpine form] in the var. *sylvatica*, which, according to chemical testing, should stand as a separate species\*.

7. *C. uncialis*, L., form.—Godhavn; Egedesminde. Deformed. Passes apparently into

8. *C. amaurocræa*, Flk.—Godhavn; Egedesminde. A monstrous form, exhibiting the most singular deformities, which defy all efforts at description, as do also similar conditions of *C. deformis*, *cervicornis*, *gracilis*, *pyxidata*, and *cornucopioides*. Very frequently there are bulgings of the podetia as in *Pyncothelia*, such deformities being confined to, or commonest in, dwarf conditions of the plant. *Cl. uncialis*, var. *adunca*, in my herbarium, from the top of Ben Mac Dhui, so named by Mudd, is deformed like Greenland states of *C. amaurocræa*; and it is moreover undistinguishable from what Mudd calls, in my herb., *C. amaurocræa* †, var. *dicræa*, from the same Scottish locality. Coemans thinks *adunca* undeserving separate nomenclature; but he assigns it to *uncialis*.

9. *C. deformis*, L.—Jakobshavn. The eccentricities of this so-called species are endless; and it is useless attempting any further description than a general one of its *leading variation-forms*. It occurs with or without podetia. In the former case there are sometimes carious, sterile scyphi,  $\frac{3}{4}$ " to 1" in diameter. Sometimes the scyphi are margined by secondary podetia, crowned by the ordinary scarlet fringe. Sections of the podetia are sometimes gamboge-yellow, and exude a glutinous juice. The reaction with potash is bright lemon-yellow, or none. Podetia are frequently very granular, one of many characteristics of the northern *Cladoniæ*. At other times they are covered more or less copiously with squamules or folioles, their aspect being then completely altered. This change in character is assisted by occasional ramosity. These foliose or ramose states are sometimes brown, as in *furcata*. Sometimes the whole squamulose podetium is studded over with minute red warts. It is impossible to assign these warts to either abortive apothecia or spermogonia, inasmuch as they exhibit no normal reproductive structure. They are probably—as in other positions, in this and other *Cladoniæ*, in which they occur—sometimes the one, sometimes the other organ in an undeveloped state.

Occasionally the podetium is expanded into a single, irregular, thick, subcarious foliole, very granular, like the ordinary podetia. Sometimes the plant consists entirely of phyllocladia, ordinary podetia being absent. These folioles are tumid, irregular, densely arranged, forming a psoroid cæspitose thallus, as in similar forms of *cervicornis*. The colour is changed from the ordinary beautiful light green to a lurid brown. These folioles are frequently studded over with apothecia of a Lecidine character, flat, brown, irregular in form, though generally oblong-oval or elongate, girt with a thin exciple. They are seated directly on the thallus, or they constitute the terminations of very short, inconspicuous, terete, abortive podetia or stipes. They have the aspect of young, or degenerate, Lecidioid apothecia; but their structure is that of

\* It does so stand in the recently published 'Lichenes Britannici' of Crombie (1870).

† *C. stellata* and *amaurocræa* of Mudd's 'British Cladoniæ' do not appear to me to differ in any essential respect.



*Torula*, their contents consisting of myriads of spherical brown spores about  $\cdot 00010''$  in diameter. These apothecia or pseudo-apothecia sometimes resemble the apothecia of *Lecidea cornea*, Sm., but they never show the structure of a normal lichen-apothecium (the hymenial elements).

The folioles of the *Cladonia* are also studded over or fringed with what appear to be various forms of spermogonia, barrel-shaped, like those typical in the genus, or verrucæ-form.

There are two series of Greenland forms of *deformis*—one with scarlet fruit-warts, which I refer to the *cornucopioides* type, the other with brown fruit-warts, referable to *pyxidata*. I do not, however, admit the distinction between erythrocarpous and phæocarpous *Cladoniæ* to be other than one of convenience. I have elsewhere pointed out that, both naturally and artificially, the scarlet apothecia in *Cladonia* became brown\*; and I have to add that, where this colour-distinction is abolished, there is no other good distinction between (*e. g.*) *pyxidata* and *cornucopioides* and their respective forms and allies.

In the Kew Herbarium I found *deformis* confounded with *carneola* and *fimbriata*. Its apothecia are described by Nylander and other authors as scarlet; but they are also occasionally of a brown colour. And accordingly as these apothecia or pseudo-apothecia, with their spermogonia, whether normal, abortive, or degenerate, are red or brown, the plant is, I think, referable, as a mere *state*, to the *cornucopioides* † group on the one hand, or the *pyxidata* series on the other. The phyllocladia of *deformis*, as well as of *gracilis* and *pyxidata*, especially in certain sterile, degenerate conditions, are the common site in Greenland, as in other northern or Alpine countries, of black, punctiform, parasitic Micro-fungi, referable apparently to different species and genera. Thus in Schærrer's Exs., No. 49, I met with parasitic pycnidia, which have been described in my Mem. Spermog. (p. 164).

10. *C. bellidiflora*, Ach.—Egedesminde : a peculiar dwarf form, resembling a *Bæomyces*. Apothecia very large and deformed, seated amidst the horizontal folioles. Podetia very carious, and so short and deformed as to appear absent. The plant agrees in general aspect, save as to the phæocarpous apothecia, with *C. cæspititia* and *syncephala* of Mudd's *Cladoniæ*, (Exs.) Nos. 29 and 44. The Greenland plant may equally appropriately be referred to *cornucopioides*, as I believe the latter and *bellidiflora* are merely different forms of the same type. In the Kew Herbarium I met with specimens having brown\* apothecia, the colour having probably altered by desiccation, the plant in this case being undistinguishable from *pyxidata*.

In the Menziesian Herbarium some specimens, labelled *cornucopioides* (or *coccifera*), are also referable to the protean *pyxidata*. In the Kew Herbarium *bellidiflora* and *cornucopioides* are frequently confounded,—a circumstance that merely shows their close

\* *Vide* the author's 'British Lichens' (1856, p. 268).—The earlier lichenologists state that the red apothecia of *Cladoniæ* become naturally brown in moist situations, or with age; while the same change may be artificially induced by steeping in water, or exposure to ammonia. In nature the colour appears to vary with locality or conditions of growth and decay,—*e. g.* shade and moisture, age or desiccation producing the same effect as chemical reagents.

† Most of the forms I saw in the Kew Herbarium were referable to the fimbriate conditions of *bellidiflora*.



relationship. If they *are* to be separated, even as varieties or forms, it is convenient to refer all the major states of growth to *bellidiflora*, and the minor to *cornucopioides*. Sometimes the podetia of *bellidiflora* are as copiously squamulose as in *deformis*.

11. *C. pyxidata*, L.—Jakobshavn; Illartlek glacier.—Scyphiferous, but sterile. To this species I refer *degenerans* and *fimbriata*, with all their forms. In the Kew Herbarium, I met with several forms identical with states of *bellidiflora* and *cornucopioides*, save as to the colour of the apothecia—a character which is inconstant in the *Cladonia*, as it is in many other Lichen-genera, *e. g.* *Lecidea*. In the same Herbarium, some forms of *pyxidata* (*e. g.* *tubæformis*) are confounded with *uncialis*. Coemans also points out that *pyxidata* is confounded with *carneola*, Fr., by var. *carneo-pallida*; as well as with *cenotea*, *macilenta*, *cariosa*, and *deformis*.

12. *C. degenerans*, Flk.—Godhavn; Jakobshavn. Podetia blackish-brown, having a dirty or sooty aspect. No apothecia occur; but spermogonia abound, as deep-brown little barrel-shaped bodies, distinct under the lens, fringing the closed scyphi, or studded irregularly over the surface of their diaphragm, or of the podetia. Ostiole large and patent. In the Kew Herbarium *degenerans* is confounded with *uncialis*, and is partly referable to *furcata* and *squamosa*, as well as to *pyxidata*. Coemans shows that Acharius confounded it with *pungens* [by var. *nivea*, Ach.]—and with *turgida*, *cenotea* and *glauca*, Flk., as well as with *pyxidata*, *furcata*, and *squamosa*. In truth it must be regarded, like not a few other so-called species in the genus *Cladonia*, as a mere *condition* of other types.

13. *C. coralloidea*, Ach.—Jakobshavn. To this may be referred some specimens destitute of podetia, in which the horizontal thallus consists of densely aggregated phyllocladia, with tumid margins, brown and psoroid, like the thallus of *Lecidea lurida*. It is not, however, an easy matter to refer every specimen in the genus *Cladonia* to a particular “species.” The variation-forms are so extreme, the deformities so remarkable, abortive and degenerate as well as sterile conditions so frequent, passage-forms so puzzling and numerous, that all that can be properly attempted in most cases is to select the *types* of form and growth, and classify them in a general way. To “determine,” in the sense of *naming*, every specimen met with is as absurd as it is unnecessary and impossible! It is sheer waste of effort on the part of the student. Certain forms of the psoroid (horizontal) thallus of *coralloidea* appeared referable to *cervicornis*; while, on the other hand, one form of what seems to be *pyxidata*, has a parmelioid (horizontal) thallus only; that is, it consists of rounded, large-lobed folioles, either sterile or studded over with subsessile or sessile apothecia or spermogonia—variously degenerate—none fertile. According to Coemans, *coralloidea* is partly referable to *degenerans*, partly to *crispata* and *decorticata*.

14. *C. fimbriata*, Hffm.—Jakobshavn. The podetia are studded over with irregular, black papillæ, which are pycnidia. Their envelope is very deep brown; the cavity is occupied by myriads of stylospores, spherical, oval, or pyriform, about ‘00009’ in diameter, pale olive, generally granular, seated on short, thick, simple basidia. The same parasite apparently occurs also on *C. deformis* and other species—on the scyphi, podetia and squamules alike.

The specimens of *fimbriata* in the Kew Herbarium are referable mostly to *pyxidata*,



but also to *gracilis*, *cornucopioides*, and *deformis*. Coemans regards it as a var. of *pyxidata*, including as subvarieties or subforms, *glauca*, Flk., *ochrochlora*, Flk., and other pseudo-species. He describes *fimbriata* as passing into *pityrea* and *cæspititia* (other varieties of *pyxidata*). The varieties or forms *chlorophæa* and *simplex* of *pyxidata* in Mudd's *Cladoniæ* (Exsicc.) are referable to *fimbriata*. In the Kew Herbarium I found specimens labelled *fimbriata*, though generally with brown, sometimes with scarlet, fruit-warts\*. The plant is therefore partly referable to the erythrocarpous† group, of which the type is *cornucopioides*; and it would appear that it is to be properly regarded, like *degenerans*, as a mere condition of several different species!

As a group the Greenland *Cladoniæ* exhibit the following peculiarities—many of which are common, not only to the lichens of Greenland in general, but to those of Arctic and Alpine countries or districts—viz., the frequency of:—

- (a) *Sterility*—both as to apothecia and spermogonia.
- (b) *Monstrosity*, or deformity, abortion or degeneration, equally of the vegetative and reproductive organs.
- (c) Growth of *parasitic Micro-fungi*.
- (d) *Discoloration* or mottling (black or other), especially of podetia.
- (e) Absence of podetia, and increased *development of the horizontal foliose thallus*, which acquires a psoroid or parmelioid character.
- (f) Clothing of podetia with *granulosities, warts, squamules, or folioles*.

The podetia are frequently very black, e.g. in *degenerans* and *gracilis*. The pulviniform warts or squamules, which are scattered over their whole length, are often chestnut-coloured, becoming olive-green under moisture. The foliose condition, without podetia, of the character of *alcicornis* and *cervicornis*, is common; sometimes microphylline, the folioles densely imbricated; sometimes broad and parmelioid, the folioles less numerous and more laxly arranged; generally of a brown tinge above, sometimes very white below.

Occasionally the *Cladoniæ* occur in a rudimentary or *Leprarioid* state. At least, from Godhavn, there are masses of a green *Lepraria* overspreading large areas of decayed vegetation, granular, mealy, and sterile, which resemble what in this country is referred to a *Leprarioid* condition of *Cladoniæ*, and especially of *C. pyxidata*‡. The nature of the pseudo-genus *Lepraria* has not, I think, been satisfactorily determined. If it is, as lichenologists assert, a mere rudimentary condition of various *Cladoniæ*, *Parmeliæ*, and other lichens, it ought to be easy artificially to develop a *Lepraria* into the genus or species to which it properly belongs. But I am not aware of the existence on record of any experiments to this effect. Nor do I know that the natural development has been observed and its various steps or phases recorded.

\* I use this term to denote those most irregular warts which sometimes fringe the scyphi, sometimes are studded over the podetia or squamules, in *Cladonia*, which show no normal reproductive structure under the microscope, and which may be either abortive or degenerate apothecia or spermogonia.

† The earlier lichenologists speak of its *purple* apothecia; whence it would appear that they too recognized some of the erythrocarpous *Cladoniæ* under the name *fimbriata*.

‡ *Vide Lepraria* (or *Lepra*) in the author's 'British Lichens' (1856, pp. 266, 327, and 341).



The reaction of potash with the Greenland *Cladoniæ* is most capricious. Frequently it was lemon-yellow. Equally frequently no reaction was exhibited. Never was it of any significance, and still less of any use, in classification.

As the result of his examination of the *Cladoniæ* in the Acharian and Florkean Herbaria, Coemans points out\*, as I have elsewhere done†, how useless, and mischievous to science, is excessive elaboration in the nomenclature of *varieties* and *forms*. Acharius himself admits the impropriety of attaching *names* to trivial forms, when he says ('Synopsis,' p. 258), "vix sub nominibus singularibus denotari merentur." Coemans therefore proposes, as I have done, the abolition of a large number of names of varieties or forms—names that indicate only trivial and inconstant conditions of growth!

Of the Greenland *Cladoniæ*, the following are the only types that have good claims to the position of species:—1. *C. rangiferina*, 2. *C. uncialis*, 3. *C. furcata*, 4. *C. gracilis*, 5. *C. squamosa*, 6. *C. pyxidata*, 7. *C. cornucopioides*. All the others are to be regarded as mere varieties, forms, or conditions, more or less of inconstant character, not unfrequently referable to two or more species or types. To this category belong also the pseudo-species *cæspititia*, *cornuta*, *digitata*, *polydactyla*, and many others.

The genus *Cladonia* may be regarded as the equivalent or representative among lichens of the phænogamous genera *Rubus*, *Hieracium*, and *Salix*—with no very clearly isolated types, but with hosts of crosses or intermediates, having characters so changeable as to defy definition!

#### Gen. 6. STEREOCAULON.

1. *S. tomentosum*, Fr.—Egedesminde; Jakobshavn. Never in fruit. Frequently occurs in a subsidioid condition, muscicolous, or growing among moss, apparently young or rudimentary, as well as sterile, no podetia being developed. The thallus is very white, very irregularly granular or tuberculate, apt to be confounded with states of various *Lecanoræ*, e.g. *tartarea* and *oculata*. The pulvinuli forming this white isidioid crust are frequently large and sparsely scattered. Were a *name* necessary for such a mere condition of development, *coralloidea* would be most appropriate. With potash, the terminal white phyllocladia, or the young, rudimentary, coralloid thallus, give a greenish (lemon) yellow reaction, which may be vivid or very faint; or there is no reaction. There is great confusion in herbaria, as well as in systematic works, between *tomentosum*, *alpinum*, *denudatum*, and other so-called species. Thus a specimen of *alpinum* from the Pyrenees, Nylander refers (in Kew Herbarium) to *denudatum*. It is unnecessary and a waste of time to endeavour to reconcile these differences in opinion between systematists, seeing that there appears no better ground for dividing the genus *Stereocaulon* into a number of species than what can be found to support similarly elaborate classification among the *Cladoniæ*.

*S. alpinum*, in Spitzbergen, is the seat of the parasitic *Biatorina stereocaulorum*, Th. Fries (L. Arct. p. 188), which occurs on its phyllocladia also on the Alps of Eastern

\* "Cladoniæ Acharianæ:" Bulletin de l'Académie Royale de Belgique, sér. 2, t. xix; or translated by Leighton, in Ann. Nat. Hist. vol. xviii. 1866, p. 313 *et seq.*

† "The Arctic Cladoniæ," Trans. Botanical Society of Edinb. vol. ix. 1867, p. 175.



Finmark,—as well as of a parasitic *Sphæria*, which may appropriately bear the provisional name, *S. stereocaulorum*, Th. Fries (L. Spits. p. 36). The *Biatorina* occurs also in Spitzbergen on *S. denudatum*, Flk.

Gen. 7. THAMNOLIA.

1. *T. vermicularis*, Sw.—Jakobshavn. Erect forms : terminate frequently in a curling horn. Podetia also marked by various horn-like offshoots, especially towards their tips, which are sometimes ramose. Warts are also numerous, but show no special structure ; they appear to be merely rudimentary offshoots. There are numerous short, thick, or broad deformed conditions, comparable with Hepp's Exs. no. 298. All are hollow and very white, much whiter than any *Cladonia*, resembling somewhat macaroni. With potash, the thallus gives a lemon-yellow reaction. Some specimens show distinctly circumscribed, discoloured patches, which are copiously studded over with very minute, black, immersed, sporidiiferous perithecia. The asci, when isolated, are very beautiful microscopic objects ; 8-spored,  $\cdot 0024''$  long and  $\cdot 0006''$  broad, giving no blue with iodine. Paraphyses filiform, wavy, very delicate, tips not knobbed nor coloured, but as in *Verrucaria*. Sporidia, when mature, are brown or olive, bilocular and soleiform :  $\cdot 00045''$  to  $\cdot 00060''$  long and  $\cdot 00020''$  broad. In the young state they are ellipsoid, olive, and simple ; sometimes, while in the asci, they are 1-septate (or 2-locular) and colourless. They are usually associated with much oily matter, in the form of globules. The perithecia in question appear to be parasitic. They agree with what I have already elsewhere described and figured as *Microthelia vermicularia*\*.

Scattered on some of the podetia, but not on special portions of the cortical layer, are similar black punctiform perithecia, considerably larger than those of the *Microthelia*. They are *spermogonia*, probably, like the *microthelia*, parasitic, and perhaps referable to it. Their envelope is composed of dark brown, cellular tissue ; and they contain hosts of straight, rod-shaped spermatia,  $\cdot 00015''$  long. They do not correspond in characters either with the *spermogonia* formerly described by myself as occurring in *T. vermicularis* †, or with those described by Nylander ‡.

There is the utmost difference of opinion as to the true character and affinities of the genus *Thamnolia*, and as to the relation to it of the sporidiiferous and spermatiferous perithecia which occur on its surface. Th. Fries (L. Arct.) classes *T. vermicularis* with *Dufourea arctica* as a *Cladonia* of which, he says, the apothecia have not yet been discovered. Some authors separate *Lichen tauricus*, Wulf., as a species. It is said to have been found fertile by Floderus, in Oeland, in 1853, the apothecia having been terminal and those of a *Cladonia* (teste Th. Fries, L. Arct. p. 161). The apothecia of *vermicularis* itself, however, are described by Massalongo in the 'Flora' (1866) as belonging to the *Cladonia* group ; and Körber also describes them in his 'Parerga' (p. 14), appa-

\* Memoir on Spermogones, p. 528, pl. v. figs. 19, 24 ; and "Otago Lichens and Fungi," Trans. Royal Society of Edinburgh, vol. xxiv. p. 441.

† Mem. Spermog. p. 143, pl. v. figs. 20-23. Compare the *spermogonia* of *Bæomyces*, 'Mem. spermog.' pp. 143-145.

‡ Th. Fries describes its *spermogonia* in his 'Lich. Spitsberg.' p. 31.



rently following Massalongo. *Taurica* passes into *Cladonia gracilis*, var. *macroceras*, in Oeland, says Th. Fries (L. Arct. p. 162), and is therefore not autonomous, according to him, but a monstrosity of that *Cladonia*. Mudd includes *vermicularis* in *Cladonia*, in his 'British Cladoniæ,' though not in his 'Manual.' He refers the spermogonia, described by Nylander (in his 'Lich. Scand.' p. 68), to *Endocarpon Crombii*, Mudd (Brit. Clad., p. 36), evidently another to be added to the several *parasites* that infest this puzzling lichen. My *Microthelia vermicularia* is apparently what Th. Fries refers to as a parasitic *Buellia*; it is given in Rabenhorst's Exsiccati, No. 253, and was mentioned by the late Robert Brown (*teste* Th. Fries. L. Arct. p. 161).

#### Gen. 8. ALECTORIA.

1. *A. jubata*, L., var. *chalybeiformis*, L. — Jakobshavn. *Chalybeiformis* does not deserve a separate name; it is a mere saxicolous form, sometimes as long as corticolous states, though generally blacker and more glossy. Sometimes pruinose or white, largish, sorediiferous warts, mostly oblong-ellipsoid, are seated at the angles of the filaments. Through *bicolor*\*, it appears to pass into *ochroleuca* (*rigida* and *nigricans*) and *thulensis*.

2. *A. ochroleuca*, Ehrh.—Godhavn; Jakobshavn; Illartlek Glacier. Varies considerably in colour, height, degree of ramosity, and size of its divisions. Its normal colour is beautiful lemon-yellow. In this condition it gives no reaction with potash. But it is also variously buff-coloured, grey, white, brown, or black; or it exhibits various combinations of these colours; or the thallus is variously mottled. The grey forms give a lemon-yellow reaction with potash. The black forms †, which are abundant about Godhavn, do not differ in other respects from the typical plant. There seems to be a series of forms connecting *ochroleuca*, through *thulensis* and *divergens*, with *Cetraria aculeata*. *Ochroleuca*, in Greenland, is sometimes short and cæspitose; or long and simple, corresponding to some of the simple states of *Usnea barbata*.

Var. *rigida*, Vill. (Th. Fries, L. Arct. p. 27), with black apices, is common, but is undeserving separate nomenclature.

3. *A. thulensis*, Th. Fr., does not appear to me to be autonomous. In his 'L. Arctoi,' Fries makes a separate subspecies of it, arranging it under *A. ochroleuca*; while in his 'L. Spitsbergenses,' he makes it a synonym of *A. nigricans*.

4. *A. divergens*, Ach., is sometimes, at least, confounded with, and probably belongs to, *Cetraria aculeata* ‡. It bears white sorediiferous warts, which are minute, compared with those in *chalybeiformis*.

\* In specimens of var. *bicolor* in the Edinburgh University Herbarium, from Scotland, Switzerland, and the Arctic regions, the plant does not differ much from var. *nigricans* of *A. ochroleuca*. It is a mere condition or form, referable partly to *jubata* and partly to *ochroleuca*.

† In specimens of var. *nigricans*, determined by Leighton, from Great Bear Lake, in the Edinburgh University Herbarium, the thallus is black only at the tips of the ramuscles; and the plant deserves no separate name, even as a form.

‡ In the Edinburgh University Herbarium I found specimens from Great Bear Lake, Richardson, 1826, determined by Leighton; Newfoundland, Despréaux, 1833, and Lenormand, 1830; 'Arctic Regions,' Parry's Second Voyage, Edwards, and 'Overland Canadian Expedition' of 1823, Richardson; in which the plant might be referred in its various forms, partly to *C. aculeata*, and partly to *A. jubata* and *A. ochroleuca* (*nigricans*).



## Gen. 9. CETRARIA.

1. *C. aculeata*, Ehrh.—Jakobshavn. Always sterile. Sometimes corticolous; on bark of birch (as are also *Lecanora tartarea*, var. *frigida*, and *Cetraria Islandica*, var. *leucomeloides*). Not mentioned by Th. Fries as a Greenland lichen at all. In the present collection, however, I met with various forms, which I cannot but refer to this type. Some states, exasperate with bristles, agree with French specimens (in Nylander's Exs.) of var. *acanthella*. *Aculeata* is not very rare in Spitzbergen, though only found sterile, says Th. Fries (L. Spitsb., p. 10); and it would be singular if it were not to occur also in Greenland. Fries has probably referred its puzzling Greenland forms to *Alectoria divergens* (= *Thulensis*, p. 29) or *ochroleuca* (e. g. var. *nigricans*), with which it is frequently associated and intermixed, and from which it scarcely differs sometimes save in colour. With forms of these *Alectoriæ* it is very apt, in certain conditions of growth, to be confounded. This being the case, it is a very artificial and arbitrary classification that separates *aculeata* from *ochroleuca*, placing it in a different *genus*. The old genus *Cornicularia* was much more natural and convenient than its modern substitutes: and anomalous as some of its species were, they were not more so than are those of many genera of the present day; while it was better for the student's purposes to find them grouped together than scattered, as they now are, through various genera such as *Parmelia* (e. g. *stygia*, *tristis*, and *lanata*). Equally artificial is the separation of *Platysma* from *Cetraria*. *Glauca* is a Parmelioid form, and stands appropriately enough in a separate section (not genus); but *cucullata* and *nivalis* are too closely allied to *Islandica* to permit of such severation.

2. *C. Islandica*, L.—Godhavn, Egedesminde, Lyngemarken, Jakobshavn, Illartlek Glacier. Various forms occur, always sterile; including *crispa*, and several states intermediate between it and *C. Délisei*, *C. nigricans*, and *C. odontella*, as well as those so-called "species" themselves. It is generally terricolous; but one form, with margins as fibrillose as *Physcia leucomela*, and otherwise resembling that plant, occurs on twigs (probably of birch) near Jakobshavn. This state, with laciniaë as long and flexuous as in *P. leucomela*, might appropriately bear the name (if name is required) of form or variety *leucomeloides*. The form from Lyngemarken is decayed, and as white as *P. leucomela*, with a black, Verrucarioid parasite, very conspicuous on these whitened laciniaë, resembling externally that which occurs on the young thallus or prothallus of *Lecanora tartarea*, var. *frigida*.

The thallus of *Islandica* is sometimes of a beautiful vermilion colour, or is red-mottled, about the base (e. g. in Egedesminde specimens). None of its forms give any reaction with potash. Fibrilosity of the margin of the laciniaë is sometimes a very marked character. The fibrillæ are sometimes very long, and are split at their ends into tufts of secondary fibrillulæ. The *crispa* forms are sometimes also very denticulate, with narrow laciniaë, closely tufted, and of a very deep glossy brown colour.

Some forms closely resemble, save in colour, *C. cucullata*. The laciniaë are broader, much curled\*; the margins smooth, destitute of fibrillæ, cilia, or spermogonia; the

\* In the Edinb. University Herb. what is called *C. Grænlandica* by Despréaux, collected in Labrador in 1833, is this form of *C. Islandica*, with the thallus as much curled as in *C. cucullata*.



extremities of the laciniaë rounded; the whole plant more foliaceous and membranous; the colour more of a uniform dark olive or chestnut, becoming greener under moisture. The plant grows in dense, cæspitose, dwarf masses, exactly like *cucullata*. This is probably the *C. Délisei*, Bory\*, which, regarded as a separate species by Th. Fries (Arct. p. 11), is by other lichenologists referred as a mere "variety" to *Islandica*. It has, however, an equal title to belong to *cucullata*, and is, in truth, a passage-form between it and *Islandica*.

It is significant, in regard to its non-use as food or fodder, in medicine or the domestic arts, in Greenland, that Crantz, in mentioning *Islandica*, speaks of it as a lichen which, in *Iceland*, where it is the "Fjallagras," is "eaten instead of bread, or boiled with milk, like oatmeal"†.

3. What appears from Fries's description to be *C. odontella*, Ach. (Th. Fr. Arct. p. 35) occurs in the present collection as mere fragments, associated with *cucullata* from Jakobshavn and about Egedesminde. Its colour is pale chestnut; the laciniaë bristle with spermogonia. It agrees with French specimens (in Nylander's Exs.‡). Just as *Délisei* appears to connect *Islandica* with *cucullata*, *odontella* seems to associate it with *aculeata*.

4. *C. cucullata*, Bell.—Jakobshavn, Egedesminde, Illartlek Glacier. Apparently very abundant, but always sterile as to apothecia; sometimes, however, beautifully spermogoniferous (*e. g.* about the base of the Illartlek Glacier). Generally dwarf and cæspitose; never so tall and beautiful as in Norway. The fine purple mottling of the base, so common in Norway, occurs also here. In Swiss forms, the base is tinged of the same deep purple, which is found to penetrate and pervade both cortical and medullary tissues (in Schærer's Exs.). Thallus in Greenland plants gives no reaction with potash. Passage-forms into *nivalis* abound and are frequently very puzzling.

5. *C. nivalis*, L.—Jakobshavn. Intermixed with *cucullata*, from which it is generally difficult to distinguish it, by reason of the abundance of puzzling passage-forms. In the present collection it occurs very sparingly, and never in fruit, though sometimes spermogoniferous. But it would appear to occur fertile, and in quantity in some parts of Greenland. Thus Professor Dickie, of Aberdeen, sent to me (in Decem. 1859) a specimen in fruit§; and he remarks, in reference to it and its collector (the Surgeon to an Aberdeen whaler), "Covering square acres or rather miles . . . in Greenland; he only got about a dozen *in fruit*." I doubt, however, whether the Surgeon in question was right in supposing that the plant referred to was *nivalis* and not *cucullata*? In some forms of *nivalis* in Greenland, the spermogonia are of the usual (marginal) or typical kind (as described and figured in my 'Mem. Spermog.' p. 302, pl. ix. figs. 42-5), *e. g.* about the Illartlek Glacier, where the thallus is beautifully black-denticulate with spermogonia. But sometimes they are black, barrel-shaped, or rod-shaped columns, seated on the surface, as well as on the edges, of the laciniaë. These elongated and large

\* Nylander's *C. nigricans* may perhaps with propriety be referred to *Délisei*.

† *Vide* reference to Crantz, under head of *C. rangiferina*.

‡ Th. Fries, however, gives it only as a Central-Lapland plant.

§ In the Kew Herb. I found a specimen of *nivalis*, from Davis Straits (Lyall, 1852), but sterile.



forms resemble the spermogonia in some states of *Islandica*; and this is an additional reason for not dissociating *nivalis* and *cucullata* from *Islandica* in a separate genus. Potash develops no reaction on the cortical, nor iodine on the white medullary, tissue. The natural colour of *nivalis*, as in *cucullata*, is a beautiful lemon-yellow; but it is seldom so brilliant or pure as in the handsomer Norwegian plant. Passage-forms into *cucullata* lose their lacunosity; while the tips of the laciniae become rounded. Wherever both lichens occur in the same district or country, they are generally intermixed, and are apt to be confounded. Hence, in the Kew Herbarium (*e. g.* some Swiss specimens) and all large herbaria, forms of the one are commonly mistaken for conditions of the other.

#### Genus 10. DACTYLINA.

1. *D. arctica*, Br.—On a dry mossy slope, near the Illartlek Glacier, in considerable abundance. I did not see the specimens in this collection, which Brown says (Trans. Botan. Society of Edinb., vol. ix. 1868, p. 453) were “accidentally packed in the *Fungi* parcels.” Specimens in my herbarium from the Kikerton Islands\* (Taylor) sent me by Prof. Dickie have the characters partly of *Dufourea madreporiformis* (Schær. Exs. 85):—of *Dactylina arctica*, var. *madreporiformis*, Ach.; of *Thamnolia vermicularis*, var. *subuliformis* (Schær. Exs. 86); and of *Dactylina ramulosa*, Hook., a plant of Arctic America, the Rocky Mountains, and Behring’s Straits. *Dufourea muricata*, Laur., which I have not seen, is probably a transition-form between *arctica* and *madreporiformis*. I have no hesitation in referring *arctica*, *madreporiformis*, and *ramulosa* to one genus, and, indeed, to a single species, discarding the genus *Dufourea* as unnecessary. What Dickie labels *Dufourea madreporiformis* is *Dactylina arctica*, sterile, but quite agreeing with specimens of *arctica* in my Herbarium from Arctic America (Great Bear Lake, Richardson).

The Kikerton form of *arctica* bears both apothecia † and spermogonia in abundance. The thallus is quite as ramose as *madreporiformis*, whose branches, however, are narrower in general. It is very different from that of the usual sterile forms of *arctica* in my herbarium, from Arctic America and Cape Adair, which exhibit simple, ventricose, finger-and-thumb-like offshoots from a general, horizontal, hollow, podetium-like thallus, frequently 1" long and nearly  $\frac{1}{2}$ " broad. In the latter case, hollowness is visible by reason of the greater size or dilatation of the podetia and their offsets. *Madreporiformis* of equal size would be equally hollow. In the latter species (if a species) the podetia are sometimes hollow, though generally filled with a spongy, white medulla, which gives no reaction with iodine. Nor does the cortical layer show any colour-change

\* In Arctic plant-collections, I find three places of similar name, that are apt to be confounded, if they are different localities, viz.:—

1. *Kikerton*, or *Kikkerton* Islands, which Mr. Brown tells me are in Cumberland Sound, near Frobisher’s Straits, and are therefore unconnected with Greenland.

2. *Kikertait* (=“The place of Islands”) mentioned by Hayes, in his ‘Open Polar Sea’ (London, 1867, p. 68).

3. *Kikertak*, in Greenland (*teste* Th. Fries, ‘L. Arctoi’).

† It is noteworthy that, though apparently abundant in Greenland, *D. arctica* is always there sterile—according to Fries (Arct. p. 160).



under potash. In Kikerton *arctica*, potash and iodine develop no colour-reaction on either cortical or medullary tissues. A few octahedral crystals of oxalate of lime were met with in the thallus.

In the Kikerton plant, the sporidia are simple, spherical, colourless, about  $\cdot 00015''$  in diameter, with double contour, or granular, or marked with a central nuclear point. Asci blue with iodine. The *spermogonia* are distinct under the lens, scattered sparingly about the angles of the podetia, as in *madreporiformis*. Spermata straight rods on delicate arthro-sterigmata, resembling those of many *Parmeliæ*\* (*e. g. P. perlata, physodes, and encausta*), the sterigmata being associated with hypertrophied, sterile filaments, similar to those that also occur in the genus *Parmelia*\* (*e. g. P. tiliacea, acetabulum, and perforata*). Basal cellular tissue brown. Nylander says that the spermogonia of *arctica* have not yet been seen (Synopsis, p. 286); and Tuckerman † also describes them as "unknown." Nevertheless I figured and described them in my 'Memoir on Spermogonia' ‡ published in 1859, the date of Tuckerman's paper being 1862, and of Nylander's 'Synopsis' (vol. i.) 1858-1860.

What I figure differ, however, from those since figured by Leighton§. It does not follow that the plants examined in this case by Leighton and myself were different species or genera; for not only may the same object appear under different aspects to different observers, but I have already pointed out that the same species of lichens not unfrequently possess *two or more forms of spermogonia*, spermata, and sterigmata ||. The spermogonial contents would appear to be equally variable in *madreporiformis*; for the sterigmata and spermata figured by Nylander (Synopsis pl. viii. fig. 23) are very different from those figured by myself (Mem. Spermog. pl. vi. fig. 22).

*Dufourea madreporiformis*, in Schæerer's Exs. 85, bears spermogonia only. They are more frequently irregular, and confluent or deformed, than those of *arctica*; otherwise they are alike. Tuckerman admits the "obvious affinity" of *D. madreporiformis* and *Dactylina arctica*, though he also refers to their "equally obvious differences" (p. 397). He regards the two as "mediated" by *Dactylina ramulosa*, Hook., which is evidently quite our Kikerton plant. He refers *madreporiformis* (and properly, I think) to the genus *Dactylina* (p. 398). The Kikerton *Dactylina* and Schæerer's *Dufourea* (Exs. 85) appear to me to be the same plant.

## Genus 11. NEPHROMA.

1. *N. arcticum*, L.—Godhavn. Abundant; in large masses, but without apothecia. In West Greenland, where it ascends to 300 feet above the sea, Vahl says it is always sterile. Thallus not tomentose; frequently white below, especially peripherally. At one

\* *Vide* the Author's 'Mem. Spermog.' pp. 291-3, plates xi. & xii. and Explanations thereof.

† "Observations on North-American Lichens," Proceed. of American Academy of Arts and Sciences for April 22, 1862, p. 396.

‡ Page 133, plate vi. fig. 23.

§ "On the Lichens collected by Sir John Richardson in Arctic America," Journal of Linnean Society, vol. ix. Botany, p. 192, plate ii. figs. 16, 17.

|| "On Polymorphism in the Fructification of Lichens," Quart. Journal of Microscopical Science, Jan. 1868; or Report of the British Association, 1867, p. 89.



point, in one of the Godhavn specimens, *spermogonia* occur. They have the aspect of young apothecia, with the colour of the disk of *Lecanora tartarea*. They are evident under the lens only when the thallus is moistened. They then appear as marginal, irregular, buff-coloured tubercles, isolated or grouped, becoming subgelatinous under moisture. Sometimes they are confluent, in large compound, irregular masses, having quite an apothecioid character. In all their forms the spermatia are the same—simple, spherical atomic, in myriads, about  $\cdot 00015''$  to  $\cdot 00020''$  long and  $\cdot 00060''$  to  $\cdot 00075''$  broad. The sterigmata are indistinct.

*N. arcticum* is sometimes confounded with forms of certain of the *Peltideæ*: e. g. in the Kew Herbarium, one of two specimens labelled *P. horizontalis*, from Canada (Shepherd), is this *Nephroma*. The distinction of *Nephroma* and *Nephromium* as separate genera appears to me a most artificial and unnecessary one.

#### Gen. 12. PELTIGERA\*.

1. *P. apthosa*, Ach.—Egedesminde. Sterile, as it generally is. In Herb. Kew. it occurs from Disco (Lyall, 1854).

2. *P. canina*, Hffm.—Lyngemarken. In fruit and pycnidiferous. The thallus is that of *canina*; but the sporidia exhibit greater variety of form and size than is common in that or any other species of the genus; the upper surface of the thallus is sometimes lurid-grey (dark lead-colour), becoming darker when moistened, and covered with a sparing white pruina; the under surface is very fibrillose-rhizinose, of the usual whitish colour, with buff or cream-coloured veinlets and rootlets. The upper surface is occasionally the site of a black, papillæform, very minute, semiimmersed parasite, which shows, however, no specific structure.

The sporidia of the *Peltigera* are (apparently) normally 4-locular: but in the young state they are simple, or 2-locular, in the former case frequently granular. They are usually fusiform or broadly ellipsoid, but sometimes pyriform, oval, or even linear-oblong. Though generally straight, they are sometimes curved. Their character varies greatly, even in the same section of one apothecium, under the field of the microscope, at the same moment—the variations relating equally to form, size, and structure. They are invariably colourless; usually about  $\cdot 0009''$  to  $\cdot 0012''$  long and  $\cdot 0003''$  broad, associated with large numbers of oil globules of all sizes. Sometimes, instead of distinct loculi, they contain one or more large cellular nuclei. Hymenial gelatine pale blue with iodine. Tips of paraphyses pale brown.

*Pycnidia* occur as marginal brown buttons or warts, filled with myriads of stylospores, all very delicately muco-granular or shaded, very variable in size, the average about  $\cdot 00027''$  to  $\cdot 00030''$  long and  $\cdot 00009''$  to  $\cdot 00015''$  broad; their diameter, when subspherical,  $\cdot 00022''$ . Their form is oblong-oval, pyriform, or irregularly angular, many of them resembling pus or tubercle corpuscles; their outline is rendered more distinct by iodine,

\* The old Acharian genus *Peltidea* is now generally known (for what reason I am not aware) as *Peltigera*. In a letter to me, of date February 1866, Nylander speaks of the "genre *Peltidea* qui diffère par ses gonidies (qui rendent leur thalle à l'état humide d'un beau vert) des *Peltigera* (dont le thalle à l'état humide devient foncé)". To *Peltidea* he refers *venosa*, Ach.



which gives them a yellow colour and a corrugated, bolder margin. In some cases the basidia remain attached. These basidia are very indistinct, and the connexion between them and the stylospores cannot be well made out with the powers of my microscope (which magnifies from 90 up to 600 diameters linear). But they appear to be thick-walled arthro-sterigmata somewhat like those of *Endocarpon* and *Umbilicaria*; and if they are so, the secondary reproductive organs of this *Peltigera* may be regarded either as spermogonia or pycnidia, having the sterigmata of the former, and the stylospores of the latter, forming, in truth, a link of connexion between these two great groups of complementary reproductive organs\*. The present instance is the first in which I have succeeded in detecting fertile pycnidia in *Peltigera*, though I have searched for them carefully in numberless specimens, a circumstance that illustrates the undue proportion that negative bear to positive results in spermogonological research. In Britain, *Illosporium corneum*, Fr., occurs as a parasite on *P. canina* (Berk. 'Brit. Fungology,' p. 341), as does also *Scutula Wallrothii*, Tul.

3. *P. scabrosa*, Th. Fries, does not occur in the present collection, but is apparently a Greenland lichen. Specimens in my herbarium from the Kikerton Islands—collected by Taylor, named and given me by Prof. Dickie—appear to be merely an arctic form of what would, in more southern countries, probably be referred to *horizontalis*. The genus *Peltigera* is very much in the position of *Usnea*, *Ramalina*, *Cladonia*, and many others, as to the difficulty of dividing the many puzzling forms composing it into scientific "species." I see no difficulty in regarding *all* the British *Peltideæ* as referable to a single type—*canina*. That which stands out most distinctly from the rest is *venosa* †.

In the Kikerton *scabrosa*, the asci are blue with iodine,  $\cdot 0024''$  long and  $\cdot 00040''$  broad, 8-spored. The filaments of the paraphyses are thick and simple; the tips conglutinate and pale brown. The sporidia are very narrowly (or linear) fusiform, multilocular,  $\cdot 0012''$  to  $\cdot 0018''$  long and  $\cdot 00009''$  broad, straight or curved, so delicate, long, and narrow as to be apt to be confounded with the paraphyses.

### Gen. 13. SOLORINA.

1. *S. crocea*, L. On loose soil about the Illartlek glacier; apothecia abundant.—Lyngemarken. Central portions of the thallus in some specimens have lost colour and become whitish or ashy grey; and these decolorized patches are plentifully studded over with a black, punctiform or papillæform parasite, which is conspicuous by reason of the contrast of colour. The hymenial gelatine and the constituent parts or tissues of the hymenium give no blue with iodine. Paraphyses are very delicate and not knobbed at tips, their characters being those of *Verrucaria* and *Endocarpon*. Asci in tufts, 8-spored,  $\cdot 0015''$  long and  $\cdot 00045''$  broad. Sporidia 4-locular, fusiform, colourless,  $\cdot 0006''$  long and  $\cdot 00015''$  broad.

\* Compare the contrasted characters of Spermogonia and Pycnidia, given in my Papers on "Polymorphism in the Fructification of Lichens," before quoted; also the description of the spermogonia, or pycnidia, of *Peltigera* and their contents, in my 'Mem. Spermog.' pp. 173-4, and in Tulasne's "Mémoire" in the Ann. des Sciences Nat. Sér. iii. Botanique, vol. xvii. 1852, pl. ix. figs. 7-17.

† *Vide* footnote on preceding page.



This parasite does not correspond in character with any of the following parasitic Lichens, which affect species of *Solorina* or *Peltigera*, viz. :—

1. *Rhagadostoma corrugatum*, Körb. ('Parerga,' p. 472), which is parasitic on *S. crocea*. Sporidia 2 to 4, large, hyaline, simple or 2-locular, clavate.

2. *Scutula Krempelhuberi*, Körb. ('Parerga,' p. 455), which is parasitic on *S. saccata*. Sporidia 8, minute, ellipsoid, simple or 2-locular, hyaline.

3. *Xenosphæria Engeliana*, Saut. (Körb. 'Parerga,' pp. 466 & 307; and 'Systema,' p. 376), also parasitic on *S. saccata*. Sporidia 6 to 8, arcuate-ellipsoid, 4-locular, brown.

4. *Biatorina tuberculosa*, Th. Fries. (L. Arctoi, p. 188), a parasite on *Peltigera*. Sporidia fusiform-oblong, 2-locular, colourless\*.

Nor is the parasite on the Greenland plant what I have described as infesting Irish specimens† of *S. crocea*, where it consists of mere pycnidia; while it does not agree with the *Sphæria urceolata* of *Solorina saccata*‡, which has brown sporidia.

In sterile specimens of *S. crocea*, in Herb. Kew., from Lachen, Sikkim-Himalaya, alt. 12,000 feet, collected by Dr. Hooker, the thallus, especially about its periphery, is studded over with a parasite in the form of crowded, black papillæ or points, sometimes semi-immersed. It contains deep brown, soleæform (2-locular) sporidia .0010" long and .00025" broad. This, again, differs in character from all the other parasites above mentioned on *Solorina* or *Peltigera*.

On *S. crocea*, which I collected on the top of Ben Lawers, in June 1856, a black papillæ-form parasite occurs, occupying cushion-like elevations of the thallus, closely studded over these pulvinuli, rendering them very rugged and black-warted. These cushion-like deformities are usually seated at the division-angles of the lobes. The individual conceptacles are semi-immersed in the thallus. No distinct structure can be detected: no blue reaction is developed with iodine; no asci were seen; but a large number of oil-globules of all sizes covered the field of the microscope. Externally the parasite differs from that on *S. saccata*, assigned to *Sphæria urceolata*, in the crowding or agglomeration of the perithecia into warts. The Ben-Lawers parasite has the same external characters as that from Brandon Mountain, Kerry (Carroll), in which the stylospores are oblong or oblong-ellipsoid, colourless, simple, or 2-locular, muco-granular in the young state; .00133" to .00166" long and .00033" broad. But the want of structure in the Ben-Lawers plant leaves us at a loss as to the species or genus, lichen or fungus, to which it is to be assigned. Possibly the parasitic pycnidia of the Irish plant are referable to some of the sporidiiferous lichens or fungi already mentioned as affecting *S. crocea* or *S. saccata*.

#### Gen. 14. STICTA.

1. *S. pulmonaria*, L. Not in the present collection, and not given at all by Th. Fries as a Greenland lichen. But in the Kew Herb. I saw specimens of the ordinary form labelled "Davis Straits." The labels, however, unfortunately did not inform us on which coast

\* I have no means of judging whether any of the parasites I have met with on *S. crocea*, in Greenland or other specimens, bear any relation to *Bertia lichenicola*, De Not., a parasitic fungus, according to Rabenhorst ('Fungi Europ.' Exs. Cent. x.), that affects its thallus.

† Mem. Spermog. p. 175.

‡ *Ibid.* p. 175, and pl. ix. fig. 35.



the plant was collected, east or west—nor whether it was corticolous or saxicolous\*. The corticolous form occurs in Lapland, Nordland, and the Samoyede country, on *Betula*, *Populus*, and *Salix caprea*—rarely fertile, but bearing sometimes the parasitic *Celidium Stictarum*, Tul., which is regarded as a *fungus* by Th. Fries (Arct. p. 50) †. The saxicolous forms, which are frequently dissociated as *S. linita*, Ach. (*e. g.* in Th. Fries's 'Arct.' p. 50), from corticolous states, occur in various parts of North America, and may also be met with on the Greenland side of Davis's Straits. Neither is this form or pseudo-species, however, recorded by Th. Fries as a Greenland lichen, while he describes it as very rare in Northern Scandinavia.

#### Gen. 15. PARMELIA.

1. *P. saxatilis*, L.—Jakobshavn, on granitic rocks, close to the sea; Egedesminde; Illartlek glacier.—“Very common everywhere” in the districts visited by Dr. Brown. Many and frequently puzzling forms occur, always sterile, often deformed, and occasionally the seat of parasitic Micro-lichens or Micro-fungi. All the ordinary European varieties occur (*leucochroa*, Wallr.; *omphalodes*, L.; and *panniformis*, Ach.), with innumerable passage-forms or intermediates. But that form which is both the commonest and the most remarkable, is what may be appropriately distinguished as

*Sphærophoroidea*—in which the greater portion of the thallus (the periphery being generally excepted) is covered and concealed by a dense compound-isidioid growth, which resembles a series, densely aggregated, of specimens of *Sphærophoron coralloides* in miniature. These anamorphoses of the thallus—these Sphærophoroid growths—convert a foliaceous thallus into the semblance of a crustaceous or fruticulose one. While generally constituting a surface which is nearly level or uniform, these growths are sometimes also developed as subspherical masses, easily detached and quite comparable with the concentric and erratic forms of *P. sinuosa* ‡, and with the spherical warts of *Lecanora tartarea* and *L. ventosa*, though they are on a smaller scale than the former, and on a larger scale than the latter, tumour-like deformities. Every gradation exists between the simply isidioid and the compound isidioid or sphærophoroid conditions, the colour of the central deformed portions of the thallus being usually deep bronze.

The sphærophoroid forms of *saxatilis* have apparently certain characters in common with *Parmelia isidiocera*, Nyl. (Syn., p. 382), collected at Cape Krusenstern, W. Arctic America, lat. 67°, by Beechey. Its thallus has the facies of *lævigata*, is smooth peripherally, white within; the apothecial exciple and isidia yellow within; the latter mostly ramulose. The plant is fertile, and is allied to *P. aurulenta*, Tuck. §, a North American species. I have not seen a specimen of *P. isidiocera*. But I doubt its being a good

\* Compare remarks in paper on the “Greenland Lichen Flora,” formerly quoted, (p. 305).

† *Vide* Papers on “*Arthonia melaspermella*,” Journal of Linnean Society, Botany, vol. ix. p. 278; and ‘Otago Lichens and Fungi,’ p. 449.

‡ *Vide* the author's “Monograph of *Abrothallus*,” Quart. Journal of Microscopical Science, vol. v. 1857 (sub nom. *P. saxatilis*); or Mudd's ‘British Lichens’ (p. 96, sub *P. sinuosa*).

§ Compare also *P. crinita*, Ach. (Tuckerman, ‘Synopsis of North-American Lichens,’ 1848, p. 25).



species, as I regard what is apparently its distinctive character (the clothing with sphærophoroid isidia) as a mere *condition* common to, or in, *various Parmeliæ* and other foliaceous lichens in Arctic or northern countries. Similar states of *omphalodes* occur in the present collection, mostly in microphylline forms, the isidia compound or ramulose, aggregated sometimes in spherical detachable masses, as in the type. The same sphærophoroid conditions of *P. saxatilis* and other species occur in the present collection from the Vancouver-Island area of N. W. America.

Greenland varieties of *saxatilis* occasionally exhibit other forms of abnormal growths on the thallus, *e. g.* granulations, warts, squamules, or minute secondary laciniaë. All forms of the plant, including those which are most sphærophoroid, and all parts of the thallus, including the smooth peripheral laciniaë, as well as all colours of the thallus, including the whitish *leucochroa* forms, exhibit the same reactions, or their absence, with chemical tests, the reaction-colour being most vivid (where developed at all) in forms with the palest thallus. Bleaching-solution gives no reaction. Potash gives a lemon-yellow, generally very vivid and beautiful—developed at once—sometimes quickly passing into a rich orange-red. *Omphalodes*, and the passage-forms into the type, give the same reaction with potash as *saxatilis*, that is, a vivid green or lemon-yellow. Lemon-yellow however, is, sometimes equally produced by the application of water; and in no case has the reaction any significance or value.

The thallus of *saxatilis* has, in the natural state, sometimes as distinctly a saffron colour as *Solorina crocea*. Its surface is occasionally smooth, free from the usual reticulations or fossulations, approaching *perlata*. In the same forms, which are usually macrophylline, the colour is frequently glaucous or bluish. These characteristics of colour and smoothness are always more visible on the peripheral laciniaë, which are simpler in all respects than those which are more central.

There are various passage-forms between the type and *omphalodes*, the only difference being one affecting *colour*. The normal thallus of *saxatilis* is sometimes peripherally olive. Microphylline forms of *omphalodes* sometimes bear, to a slighter extent, the same subspherical, but more minute, sphærophoroid growths that occur in the type—the isidia being very narrow or slender, branching considerably, closely aggregated, sometimes constituting (when isolated) small balls. Some forms (mostly microphylline) of *omphalodes* closely resemble certain conditions of *P. olivacea*, *P. fahlunensis*, and *P. arctica*. It passes into *panniformis*, which is sometimes jet-black and glossy. Sometimes a single specimen exhibits the characters, in different parts, of *saxatilis*, *omphalodes*, and *panniformis*, with a normally smooth, or an isidioid, thallus. Another abnormal or unusual condition of *saxatilis* (about Jakobshavn) resembles the *vittata* var. of *P. physodes*.

All the Greenland forms of *saxatilis* examined by me were sterile as to apothecia; but in some cases the peripheral laciniaë were copiously black-punctate with spermogonia\*. The thallus, moreover, was frequently the site of various parasitic growths.

\* The ordinary spermogonia of *P. saxatilis* and their contents are figured and described in my 'Monograph of *Abrothallus*,' p. 61, and pl. v. figs. 3, 4; and 'Mem. Spermog.' p. 226, and pl. xii. figs. 17-19. They may be contrasted with the pycnidia on var. *sulcata*, Tayl., from Connemara (Moore), which contain stylospores '00016" long and '00012" broad (Mem. Spermog. p. 228, and pl. xii. figs. 20, 21).



dothideoid mottling was sometimes so copious as to give the appearance of *panniformis* or *vittata*. This mottling is probably attributable to *Dothidea homostegia*, Nyl., which generally occurs in a sterile, abortive, or degenerate condition, as is too frequently the case with lichenicolous Micro-fungi in general\*. In this sterile condition, I have very often met with this fungus on *P. saxatilis*, affecting generally the peripheral, and smooth or normal, laciniae. In its fertile state I have found it only in one or two instances, *e. g.* on *P. saxatilis* from Barmouth, North Wales, collected by Mr. Leighton in June 1856. The parasite here occurs on the microphylline thallus, as black, sublecodeoid glomeruli, surrounded by a black discoloration or shading of the thallus of the *Parmelia*. This shading often connects two or more groups of glomeruli, forming large, black, irregular mottlings of the thallus. The individual fruit-clusters or perithecia vary in size accordingly as they are young and comparatively simple, or old and compound or confluent; in the former case being verrucarioid papillae, in the latter, convex, apothecioid, superficial bodies, like the apothecia of a *Lecidea* (*e. g. parasema*).

Regarding this parasite, my friend M. C. Cooke wrote me in 1866 as follows:—"On it" (the *Parmelia saxatilis*) "are two or three clumps of *Sphaeria*, in fruit, almost the only truly mature one which I have found amongst your *Sphaeriae* on Lichens. This is certainly a *Dothidea*, with 3-septate spores, and agrees with specimens sent me from Germany, under the name of *Sphaeria homostegia*, Nyl. (Prodr. p. 56). I call it therefore *Dothidea homostegia*, and hope you will find it again, as it is a good *Dothidea*."

On some degenerate conditions of the thallus of *P. saxatilis*, what appears to be a *Torula* studs the surface, as numerous, minute, irregular, black papillae. This structure, however, is indistinct; and the parasite may therefore really be some of the other lichenicolous Micro-fungi, which infest the thallus of many of the *Umbilicariae*, *Cladoniae*, *Lecanorae*, and other genera.

But the most important *parasite* on Greenland forms of *P. saxatilis* is what I propose to distinguish by the name of the pioneer of Greenland colonization (Hans Egede) as

*Lecidea Egedeana*.

It occurs plentifully on some forms, on the central portions of the thallus, on old cracked laciniae. The apothecia have the colour and appearance of those of *L. cornea*, Sm., than which they are smaller; they are flat, margined, crowded, with difficulty seen even under the lens. Fertile asci are very delicate; 8-spored. Hymenial gelatine very faint lilac or blue with iodine. Paraphyses with pale brown, agglutinated tips. Sporidia brown, 2-locular, broadly ellipsoid; .0006" to .0009" long, and .0003" to .00045" broad. Their general appearance is that of the sporidia of *Physcia stellaris* and its allies, rather than those of *Lecanora sophodes* or *Lecidea disciformis*. As is frequently the case in alpine, arctic, and even old, specimens or species of lichens, *degenerate* asci are common, having the aspect of brown, ribbon-like masses.

Some of the Greenland forms of *P. saxatilis* examined by me occupied unusual positions: thus, I met with it on some large scyphi of *Cladonia pyxidata*, and on the lower surface of the old thallus of *Umbilicaria vellea*, just as I have found *Physcia pulverulenta*

\* What is probably this parasite is figured in my 'Mem. Spermog.' pl. xii. fig. 2, on *P. physodes*. It also occurs on the thallus of saxicolous forms of *P. Borreri*, Ach., in Bolivia (Nyl. Lich. Exot. p. 215).



and *P. stellaris* on the old thallus of various *Umbilicariæ*. The forms of *saxatilis* growing on *U. vellea* are microphylline, sterile, but dotted over with a black papillæform parasite, which exhibits no distinct (or normal) structure. Curiously, I met with no traces of *Abrothallus*\* in Greenland. But the spherophoroid deformities (before-mentioned) of *saxatilis* frequently resemble, in their globularity, the anamorphoses of thallus associated with the growth of that peculiar pseudo-genus.

2. *P. arctica*, Nyl.—Jakobshavn. On granitic or gneissöse rocks; sterile. When moistened, the thallus assumes an olive colour, like that of *olivacea*, some of whose forms the plant otherwise closely resembles. It has the character, so far, of a Norwegian specimen of *arctica*, collected by me on the top of Sneehätten, Norway, in August, 1857, and determined by Nylander. But the Norwegian plant is blacker, especially centrally. In both the Greenland and Norwegian plant there are, especially centrally, erosions of the superficial or cortical layer of the thallus, exposing the white medullary tissue. I have seen no fertile specimen of Nylander's *arctica* (Synopsis, p. 394); but I doubt the propriety of its classification as a distinct species. It certainly does not belong to *encausta*, or *alpicola* † Th. Fries (Arct. p. 57), but probably to some of the puzzling broad-lobed or macrophylline forms of *olivacea* or *fahlunensis*.

3. *P. olivacea*, L. All its forms are sterile. Sometimes there is a tendency to an isidioid condition of the centre of the thallus and margins of the laciniaë, its character then approaching *exasperata*. But the isidia are generally large and discrete warts. Sometimes the thallus is curled up into spherical masses, resembling the similar anamorphoses of *P. saxatilis* and *P. sinuosa*. Some of its macrophylline forms resemble certain conditions of *P. saxatilis* and its var. *omphalodes*. The laciniaë, in such states of the plant, are fossulate, with subretuse ends; the colour is light olive, rendered much greener by moisture; the surface smooth and glossy. Microphylline forms, on the other hand, resemble *fahlunensis*.

4. *P. fahlunensis*, L. Like *olivacea*, *saxatilis*, *arctica*, and the majority at least of the Greenland *Parmeliæ*, I found it only sterile, occurring in various puzzling forms, differing in colour and in the size and flatness of the laciniaë. Some of these forms resemble conditions, or possess certain characters, of *saxatilis*, *omphalodes*, and *olivacea*. Thus the plant is sometimes macrophylline, of lighter colour than usual, becoming greener when moistened; the surface dull or glossy; the laciniaë terminating retusely, as in *saxatilis*, and similarly fossulate. There are several sterile Greenland *Parmeliæ*, which I am puzzled to refer either to *omphalodes*, *olivacea*, *arctica*, or *fahlunensis*, combining, as they do, some of the characters of all these species or varieties. All the species or pseudo-species referred to frequently form very handsome, round, dark, conspicuous patches on quartzose, granitic, or gneissöse rocks and stones. Macrophylline and microphylline conditions of the same species are sometimes curiously associated.

5. *P. stygia*, L.—Jakobshavn, in fruit; Illartlek Glacier. Thallus becomes deep olive-

\* *A. Smithii* occurs in Europe, both on *P. saxatilis* and var. *omphalodes*; and *A. oxysporus* on the type (Monograph of *Abrothallus*, pp. 35–38).

† The name *P. arctica*, Th. Fries, in my "Lichen-Flora of Northern Europe" (Journal of Linnean Society, Botany, vol. ix. p. 409) is an error, as I find no such *Parmelia* in his 'Lich. Arctoi.'



green under moisture. Some of its forms apparently pass into *fahlunensis*. In the hymenium a blue colour is indistinctly elicited under iodine. Sporidia simple, colourless, oval or oval-oblong, 0006" long, and 00025" to 0003" broad.

6. *P. lanata*, L.—Jakobshavn, on granite, sterile; Illartlek Glacier, in fruit. Thallus sometimes as brown as that of *olivacea*—or paler, a fine chestnut colour,—a variation in character that is important in connexion with the close interresemblances already referred to of forms of *omphalodes*, *olivacea*, *arctica*, *fahlunensis*, and *stygia*.

7. *P. encausta*, Sm.—Jakobshavn. Colour of thallus sometimes green, especially when moistened, or buff or brown. Young and pale (etiolated) states occur on the under, shaded and moist surfaces of rocks. These states give a greenish-yellow reaction with potash. In the specimens examined by me, the thallus is mostly white and decayed. It is studded over with a parasite in the form of minute, subspherical or very convex, crowded, black apothecia or perithecia, resembling the apothecia of *Abrothallus Smithii*. They exhibit, however, no structure.

#### Gen. 14. PHYSCIA.

1. *P. pulverulenta*, Schreb.—Jakobshavn. A few fragments only occur, sterile, of olive-green colour, some terricolous, others growing on the underside of *Umbilicaria vellea*. Th. Fries does not give *pulverulenta* as a Greenland lichen, though he describes *muscigena*, Ach., as fruiting and as common throughout the area of his 'Lichenes Arctoi' (p. 63). In the Kew Herbarium I saw the ordinary form (the type) in fruit, with the thalline edges or periphery much eroded, labelled as from the "North Pole" (Parry\*); and in that herbarium it appeared to be a very Arctic species. It passes into, and is apt to be confounded with *obscura* and *stellaris*. Var. *pityrea*, Nyl., is just a white-pruinose form, in which the pruinosity is so abundant as to cover the whole thallus. Th. Fries (L. Spitsberg. p. 13) mentions another form with the thallus densely white-pruinose, giving it the facies of *stellaris* or *cæsia*. In Europe *Karschia pulverulenta*, Anzi (Körb. Parerga, p. 460), is sometimes parasitic on the upper surface of the thallus.

2. *P. cæsia*, Hffm.—Kudlesæt: sterile, with a dark lead-coloured thallus. Jakobshavn, on granite and gneiss; microphylline, with both apothecia and spermogonia. The apothecia are wholly black and lecideoid, exciple and disk alike; flat and regularly round in outline. The spermogonia are very minute black papillæ, conspicuous under the lens when the thallus is moistened. The laciniae are sorediferous, and of the usual lead-grey colour. Some macrophylline forms approach *stellaris*. In Scandinavia, the thallus of *cæsia* is the site of the parasitic *Buellia convexa*, Th. Fries (Arct. p. 234).

3. *P. stellaris*, L.—Jakobshavn. Associated with *Placodium elegans*; a fragment merely, but bearing both apothecia and spermogonia. Disk of apothecia cæsio-pruinose. Sporidia 2-locular, ellipsoid, brown or olive, straight or slightly curved, 00040" to 00060" long, and 00020" broad. The spermogonia are black papillæ; the sterigmata 0006" long, sometimes comparatively simple, or composed of few articulations. Spermatia straight rods 00015" long. Various microphylline, sterile forms of the plant grow both on the under and upper surfaces of the thallus of *Umbilicaria vellea*.

\* Vide author's "Lichen-Flora of Greenland," Trans. Botan. Society of Edinburgh, vol. x. pp. 52 & 33.



## Gen. 15. UMBILICARIA.

1. *U. cylindrica*, L.—Jakobshavn, fruit abundant; Egedesminde, on granite and gneiss, without apothecia, but spermogoniferous. Thallus sometimes very thick and coriaceous, dwarf and complicate; colour of upper surface sometimes ashy grey, becoming olive-green on moisture, sometimes very white, these white or grey conditions apparently being accompaniments of age. The white forms are sometimes also sparingly white-pruinose. Under surface sometimes beautifully peach, pink or buff-coloured. The cortical or medullary tissues give no reaction either with bleaching-solution or potash. Marginal fibrillæ of thallus seldom very prominent or long. Sometimes, however, they are long, tufted, and as pale as the under surface of the thallus. This under surface is sometimes very fibrillose or densely rhizinose, at other times almost nude. Apothecia frequently deformed or degenerate, most irregular or angulose; sometimes in form resembling those of *anthracina*, save as to gyri; compound from the opening up of these gyri; sometimes, when degenerate, white in all their parts, like the thallus; frequently stipitate (in age) to various degrees. Sporidia of same size and form as in *arctica*. Spermogonia frequently, or generally, only peripheral; sometimes large and verrucarioid, conspicuous on the ash-grey thallus; more generally punctiform, frequently immersed and inconspicuous compared with those of *arctica*; become more prominent and brown under moisture; vary in size; frequently clustered. Spermata in myriads; oblong corpuscles, atomic in size, shorter and broader than those of *arctica*.

2. *U. arctica*, Ach.—Jakobshavn, on granitic stones; fruit abundant, with characters of the Scotch plant. Passes into *proboscidea* on the one hand, and *hyperborea* on the other, if the latter is not to be associated with *arctica* under a single type. The thallus gives no reaction either with bleaching-solution or potash. In Greenland specimens in the Kew Herbarium, the thallus is sometimes complicate; and these forms are generally the most plentifully spermogoniferous. Spermogonia occur as conspicuous, minute, black papillæ, perched on the rugosities of the thallus, chiefly about the periphery, semiimmersed. Spermata rod-shaped, in myriads. Sporidia simple, oval, colourless; 00040" long, and 00022" broad. Some specimens of *arctica* are copiously studded over with a minute, black, papillæform parasite, which may be confounded externally with the spermogonia. Unfortunately it exhibits no structure, so that it is impossible to refer it to *Dothidea lichenum*, Smrf. (Th. Fries, L. Arct. p. 165), or *Tichothecium grossum*, Körb. (Parerga, pp. 40 & 469), which have been described as parasites on *arctica*, the one as a fungus, the other as a lichen.

3. *U. hyperborea*, Ach.—Jakobshavn, in fruit; Illartlek Glacier, about its base, also in fruit; Egedesminde, a few sterile fragments. Thallus only once gave a faint red colour with bleaching-solution. In the British-Museum Herbarium I found a large patch of *hyperborea* from Greenland. In that of Kew, in a specimen of the same species, from Walden Island, the sporidia are simple, oval-oblong, and 00050" long by 00020" broad. It seems to me to be a very arbitrary and unphilosophical classification which separates *hyperborea* and *arctica*. In truth, among the European *Umbilicariæ* there are very few types that stand clearly forth by easily distinguishable characters, while not a



few of the so-called "species" are to be regarded as mere *conditions*, e. g. *erosa*, *cylindrica*, and *proboscidea*.

4. *U. vellea*, L.—Egedesminde, sterile. The natural grey of the thallus is changed into deep olive-green by potash,—a reaction which, however, is equally produced by bleaching-solution and by water—one which is common in the foliaceous lichen-thallus, and one that has no significance or value. Various forms of *Parmelia saxatilis* and *Physcia stellaris* grow on its old thallus, sometimes on its upper grey cracked surface, sometimes on the lower, copiously fibrillose, black or brown one. In the Kew Herbarium, apothecia are rare in this so-called "species," while Greenland specimens are sterile.

My herbarium contains two specimens apparently of *vellea*, collected by the late Henry Paul, of Edinburgh, in or before 1851, the one labelled "Norway," the other "Dunoon" (Argyleshire). I examined both in 1852, and found them to possess 2-locular sporidia, a condition apparently not previously observed, or recorded as occurring, in the genus *Umbilicaria*, none of the British species, as then described, having sporidia of other character than simple. I found, however, that in several European species of *Umbilicaria* there is a tendency, not only to bilocularity of the sporidia, but to muriform division, as well as to the acquisition of colour (e. g. *spodochroa*). These conditions of the sporidia have been, long subsequent to my observations, found by other authors in various foreign *Umbilicariæ* (e. g. *flavovirescens* and *haplocarpa*). In the Dunoon *vellea* the sporidia are large and distinct, generally 2-locular, sometimes simple; loculi pale yellow or colourless, granular or not, according to age; generally broadly oval, frequently pyriform, variable in size and form, having sometimes a projection at one end, indicating the commencement of germination. Asci sometimes 1-spored; that is (as is common in the genus), only one sporidium reaches maturity. In other cases there are 4 to 8 sporidia in each ascus.

Possibly there may have been some transposition of the labels in Paul's 'Dunoon' plant, both suites of his specimens being really Norwegian. But not necessarily; for Mudd (Brit. Lichens, p. 120) gives *vellea* as a British species, he having seen specimens from Lancashire. My own Dovrefjeldt specimens, collected in 1857, are sterile.

*U. flavo-virescens*, Leight. (Journal of Linn. Soc. vol. x. Botany, p. 33), a South-African species (if it is an *Umbilicaria* at all), has 2-locular, brown sporidia, as has also *U. haplocarpa*, Nyl., a Peruvian species, in which there are 6 sporidia in each ascus. Such irregularities in the number of sporidia in each ascus would now appear to be common. The spermatia and sterigmata of *U. flavo-virescens*, as figured by Leighton (Pl. iv.), are not those usual in *Umbilicaria*, while the apothecia are flat, simple and lecidine, a condition, however, less unusual.

Paul's Norwegian specimens bear a white parasite—possibly a fungus—which grows on and about the apothecia. It possesses, however, the structure of the apothecia already described in the Dunoon plant; and though Mr. Leighton, who kindly examined the specimens, refers the 2-locular sporidia "indubitably" to the said fungus, I believe they really belong to the normal apothecia of the *Umbilicaria*. The asci give a pale blue with iodine, a circumstance which is at least suspicious in any reference of them to a parasitic fungus. The paraphyses cohere at the apices, which are brown; their filaments are very delicate. The asci are large, 8-spored; one or more



sporidia sometimes become abortive. The mature sporidia are 2-locular, the loculi pale yellow, oval, sometimes pyriform, ellipsoid or figure-8-shaped. The young sporidia are colourless and simple; their contents muco-granular; their shape within the asci more or less spherical.

I can make out no good distinction between *U. vellea*, *U. spodochoa*, *U. hirsuta*, and *U. murina*. All of them, with the exception of *spodochoa*, are sterile or nearly so in my herbarium. The under surface of the thallus in all may be naked or hirsute, pale or black. *U. vellea* of Hepp's Exs. No. 117 is what Nylander calls, in my herbarium, both *spodochoa* and *vellea*. Schærer's Exs. No. 137-140 (= *U. depressa*, var. *hirsuta*, in fruit) are also what Nylander calls *spodochoa*; while Schærer's Exs. Nos. 141-142 (= *U. depressa*, var. *spodochoa*) represent what he designates, in my Norwegian specimens *U. vellea*!

5. *U. spodochoa*, Hoffm.—Norwegian specimens, collected by myself in 1857, bear a few, mostly degenerate, apothecia. In those which are degenerate, all the elements of the hymenium are fused into an obscure, brown, striated mass, giving no reaction with iodine. The asci and sporidia are undistinguishable. This degenerate condition of the apothecia and their contents is common to all the Arctic or Northern *Umbilicariæ*. When the apothecia are normal in *spodochoa*, the asci give a pale blue with iodine, as does the whole hymenium. Asci 2-4-spored. Sporidia, in the normal and mature state, oval, simple, colourless, finely granular or not, .0006" to .0009" long and .00045" to .0006" broad. In age they are occasionally deep brown, and muriform as in *Urceolaria scruposa*, .0009" long and .0006" broad.

6. *U. anthracina*, Wulf. In 1857 I collected two distinct suites of specimens on Sneehätten (Dovrefjeldt mountains, Norway), which Nylander refers to this species (or *atro-pruinosa*, Schær.). Both forms have simple lecidine apothecia. The larger form has a thallus somewhat like that of *arctica*. Its upper surface is grey, whitish, or mouse-coloured; the under pale and rhizino-fibrillose. There is none of the tessellated character to be found in the smaller black form. In the grey, larger forms, the apothecia are larger, flatter, rounder, more scattered over the surface, and more sessile than in the other. The hymenium becomes beautifully blue with iodine. Sporidia simple, oblong-oval, with generally a thick margin or double contour, .0003" long and .00022" broad. This major form is perhaps *U. stipitata*, Nyl. (L. Scand. p. 289), a species that is not mentioned by Th. Fries as a Greenland or Spitzbergen lichen (either in his 'L. Arctoi' or 'L. Spitsberg.'). In my list of Northern Lichens *U. vellea* and *U. anthracina* have probably been confounded, as they are occasionally in all herbaria.

In the smaller form with black tessellated thallus, the apothecia are angular, stipitate, and subperipheral; the normal sporidia ellipsoid-oblong, simple, generally slightly curved; .00040" to .00050" long and .00010" to .00015" broad. Hymenium becomes deep blue with iodine. In the same hymenium the sporidia are sometimes only (exceptionally) normal, the majority being old or degenerate, both within and without the asci deep brown, longer than the normal ones, and sometimes obscurely 2-locular.

7. *U. Pennsylvanica*, Hoffm., represents, in Greenland and Arctic regions generally, the very common *U. pustulata* of Scandinavia. A specimen of *Pennsylvanica* in the Kew Herb., collected during Franklin's first journey in the Arctic Regions, has lecideine, large,



flat apothecia, somewhat like those of *pustulata*, but larger and flatter. There is a distinct black border (exciple), lighter in colour than the deep-black, sooty, or subpulverulent disk.

#### Genus 16. PANNARIA.

1. *P. brunnea*, Sw.—Jakobshavn; Illartlek glacier, abundant; Lyngemarken, abundant; Ounartok; Godhavn. One of the most abundant (musci-coloured) lichens in the area examined by Brown. Several forms occur, exhibiting some of the characters of *Pannaria hypnorum*, Vahl. (E. Bot. t. 2119, or Th. Fries's L. Arct. p. 78); and of var. *coronata*, Hffm., of *P. brunnea* (= *Biatora coronata*, Fr., Leight. Exs. No. 235; *Lecidea coronata*, E. Bot. t. 2110). The plant is, I believe, one of those species or types which may be made properly to include *several* of the so-called "species" of authors. Sometimes it is athalline, only its large apothecia being scattered over the surface of decaying or dead mosses (*e. g.* about Jakobshavn). In age, the apothecia sometimes become very large, and black, or black-mottled, the disk expanding and becoming flattened, the margin thin and cracked, and the whole outline variously irregular or deformed. The plant has then quite the character of the British *Squamaria isidioides*, Borr. (E. Bot. t. 2130). The paraphyses are agglutinated at their tips, which are very pale brown. The asci, and hymenial gelatine generally, usually become blue under iodine. Sometimes, however, there is no reaction in either. The asci are 8-spored; the sporidia are arranged in single or double series, the shape and size of the asci varying accordingly. Asci usually  $\cdot 0021''$  to  $\cdot 0024''$  long,  $\cdot 0006''$  to  $\cdot 0009''$  broad. The sporidia vary considerably in size, shape, and contents. They are always simple, and generally colourless, their contained nuclei being sometimes lemon-yellow. Their shape varies from narrowly ellipsoid to oval or subspherical, exhibiting occasionally various irregularities in outline (*e. g.* becoming subpyriform). Their size is usually about  $\cdot 0006''$  long and  $\cdot 00022''$  to  $00040''$  broad. Within the asci, as well as when mature and free, they are frequently granular. Sometimes, apparently in the young state, they contain one, two, or more large, prominent, spherical, button-like nuclei, conspicuous even within the asci. These nuclei become more distinct under iodine. In the old state the sporidia frequently show double contour.

In var. *coronata* (Leight. Exs. no. 235) the paraphyses and asci are shortish, the latter faint blue with iodine. The sporidia are colourless or very faint yellow, broadly ellipsoid and simple. Var. *coronata* Auct., and *Pannaria nebulosa* of Nylander's Exs., do not deserve rank even as separately named *varieties*.

In the present collection I met with a few sterile fragments of what appears to be *P. muscorum*, Ach. (= *Massalongia carnosa*, Dicks.), according to Schærer's Exs. No. 482, and Nylander's description (Scand. p. 128). But it is not mentioned in the 'L. Arctoi' as a Greenland lichen, though common in Scandinavia. Nylander objects to the name *carnosa*, and Fries to that of *muscorum* (Arct. p. 80)!

#### Genus 17. SQUAMARIA.

1. *S. chrysoleuca*, Sm.—Kudlesæt. The thallus varies in colour; usually straw-yellow or greenish, with black-mottled margins. Medullary tissue white. The colour and mottling resemble those of *Usnea melaxantha*. Apothecia abundant and crowded; disk black.



Tips of paraphyses deep brown and granular, their outline irregular. Asci and hymenial gelatine deep blue with iodine. Asci 8-spored,  $\cdot 0018''$  long and  $\cdot 0006''$  broad. Sporidia simple, oblong-ellipsoid (as in *Lecanora subfusca*),  $\cdot 0003''$  long and  $\cdot 00022''$  broad. Several forms of the plant occur, including *opaca*, Ach., and *feracissima*, Th. Fries. The *Placodium chrysoleucum* of Dickie, from Davis Straits, east side, collected by Taylor, is quite the Greenland *S. chrysoleuca*, growing apparently in larger and compound patches. The spermogonia of *chrysoleuca* have already been described and figured in my 'Mem. Spermog.' (pp. 259, 260, plate xv. figs. 15-17).

In *S. chrysoleuca* and its var. *opaca* (= *Parmelia rubina*, vars. *chrysoleuca* and *opaca*) of Schærer, Exs. nos. 345, 346, the sporidia are the same as in the Greenland plant, ellipsoid, simple, colourless,  $\cdot 00033''$  to  $\cdot 00041''$  long and  $\cdot 00016''$  to  $\cdot 00020''$  broad. The asci are 8-spored,  $\cdot 00013''$  to  $\cdot 00016''$  long, and  $\cdot 0005''$  to  $\cdot 0006''$  broad. The paraphyses are discrete, their tips yellow or brownish-green.

In var. *peltata*, Fr.\* (Nyl. Scand. p. 131, and Exs.), the sporidia are simple, ellipsoid to oval, colourless,  $\cdot 00033''$  long and  $\cdot 00020''$  broad. Asci blue with iodine,  $\cdot 0013''$  to  $\cdot 0016''$  long and  $0005''$  broad. The epithecium is black-mottled with *Phacopsis clemens*, Tul. †; while the thallus is the site of other black, punctiform or papillæform verrucarioid parasites, associated with and externally resembling the spermogonia of *chrysoleuca*. These parasites include the *Sphæria* described by Nylander (Scand. p. 133) as parasitic on the thallus of *S. saxicola*, which consists of minute, black, punctiform, immersed conceptacles containing fusiform colourless sporidia, associated with spermogonia, also black and punctiform, containing minute, straight spermatia. The thallus of *chrysoleuca* appears also to be the site of a parasitic *Celidium* (Tul. Mém. p. 125), by which it is rendered black-maculate.

2. *S. saxicola*, Poll. Jakobshavn; Godhavn. Some of its forms (*e. g.* on Disco Island) are athalline, or nearly so, and are undistinguishable from *Lecanora polytropa*. The apothecia, asci, and sporidia are the same in the *Squamaria* and *Lecanora*. The apothecia are frequently very large, from being compound or confluent, irregular in outline and surface, immarginate, generally more or less convex and pulvinate. The sporidia, asci, and paraphyses are also identical with those of *S. chrysoleuca*. The normal apothecia are small, crowded, with a thalline, thin exciple. A variety in the Kew Herbarium, from Cape York (Lyall, 1852), occurs on the old weathered vertebræ of whales.

The apothecia of Norwegian specimens collected by myself about Jerkin (Dovrefjeld, 4600 feet, in August 1857) are the site of a parasite, which unfortunately exhibits no structure. In the young state the disk is mottled over with very minute, round, blackish-brown spots. These gradually increase in size, coalesce, and cover the whole disk. The margin also becomes involved; and finally the whole apothecium (disk and exciple) become black and granular, resembling the black degenerate apothecium of some *Lecideæ* (*e. g.* *L. parasema*). The parasite destroys at length not only the exciple but the disk, and thereby the whole general form of the apothecium; the disk becomes

\* This and certain other forms, Nylander appears (Scand. p. 131) to refer to *S. melanophthalma*, Ram.,—probably one of the many instances that abound in Nylander's works of excessive and unnecessary elaboration!

† Referred to the genus *Arthonia* by Th. Fries (L. Spitsberg. p. 46); and to *Conida* by Körber (Parerga, p. 458).



convex instead of flat; and ultimately a black, irregular, verrucæform, shapeless mass is the result.

Various parasites, mostly hitherto considered Lichens\*, have been described as occurring either on the apothecia or the thallus of *S. saxicola*, or on both, *e. g.* :—

(1.) *Conida clemens*, Tul. (Körb. Parerga, p. 458). On the apothecia. Sporidia 8, small, unequally oblong, 2-locular, hyaline.

(2.) *Cercidospora Ulothii*, Körb. (Par. p. 466). On thallus. Sporidia 4, fusiform or cymbiform, equally 2-locular, hyaline.

(3.) *Thelidium epipolytropum*, Mudd (Brit. Lich. p. 298). On thallus. Sporidia 4–8, oblong or subfusiform, 2-locular, hyaline.

(4.) *Lecidea episema*, Nyl. (Prodr. p. 125). On thallus. Sporidia ellipsoid or oblong, and simple; or oblong, cylindrical, and 2–4-locular.

(5.) *Sphæria Squamariæ* (Nyl. Scand. p. 133), already described under *S. chrysoleuca*. On thallus. I have given it the provisional specific name *Squamariæ*, as it is desirable, if not necessary, for convenience in reference, that it should bear some short distinctive appellation.

3. *S. elegans*, Link. Jakobshavn, in fruit. Many forms or conditions occur—some of them passing into *Physcia parietina*, or undistinguishable from certain of its states. The colour of the thallus varies greatly with locality—from the brilliant vermilion of the type to the dull green of certain forms of *parietina*. It is a pale dirty green (*e. g.*) in shady places, on portions of the thallus shaded by stones, or on revoluted portions of the thallus. Sometimes the thallus is covered with sorediiferous spots, which become quite green under moisture. The cortical layer is frequently eroded in patches, as in *P. parietina*, exposing the white medullary tissue, and thus producing white-mottling of the thallus. This erosion sometimes involves large patches of the thallus. Potash struck a deep vermilion-red only in one specimen, while in many cases there was no reaction: thus there was none where the thallus was pale-green; but in other cases there was every gradation of colour-development between none and a distinct reaction. The apothecia exhibit similar changes of colour to those of the thallus. The disk, however, is sometimes deep vermilion where the thallus is very pale. Sometimes on a white (eroded) thallus the disk of the apothecia is black, the exciple thick and involute. The disk is also occasionally, in part or in whole, eroded similarly to the thallus, the hymenium being more or less destroyed. The paraphyses are very beautiful and distinct microscopic objects, discrete, hyaline, with thick filaments, resembling the medullary tubes of many lichens. Hence *S. elegans* is one of the best lichens in which to study the structure of their paraphyses and their connexion with the tubular tissue constituting the medullary layer. They are distinctly articulated, the last two or three terminal cells being subspherical, frequently granular, or containing prominent nuclei. The terminal cells, or joints, which constitute the tips of the paraphyses, are much larger than the others; the seat of greenish

\* A detailed list of the *Parasitic Micro-lichens*, that affect species which occur in Greenland in common with other countries, will be found in my "Enumeration of Micro-Lichens parasitic on other Lichens:" Quart. Journal of Microscopical Science, January, April, and October, 1869.



colouring-matter; generally subovate or subpyriform. They are more granular, and more frequently contain nuclei than the other articulations. Hence, when detached, they have the aspect of many sporidia or stylospores. Their colouring-matter is sometimes distinctly limited, *e. g.* to the terminal cellule, or to a portion only thereof\*. The sporidia are very variable in size and form, hyaline, very delicate, generally oval, sometimes slightly curved, sometimes simple; or polari-bilocular and physcioid; or equally 2-locular, with a median septum, and with (or without) a central constriction, giving a figure-8 character; about  $\cdot 00040''$  long and  $\cdot 00020''$  broad.

The thallus, as well as the apothecia (disk and exciple alike) are the seat of a parasite, which occurs in the form of scattered or crowded, sometimes confluent, black papillæ, containing sporidia, that are about  $\cdot 00020''$  long and  $\cdot 00009''$  broad, oblong-ellipsoid, 2-locular, brown in maturity, olive in the young state. These sporidia are very different from those of the *Squamaria*, and cannot be confounded therewith. Nor can the parasite be mistaken for the spermogonia of *S. elegans*, which are described and figured in my 'Mem. Spermog.' (p. 300, plate xv. figs. 27-29). The Greenland parasite has the characters of some species of the genus *Ticothecium*, Fw., emend., as they are described by Körber (in his 'Parerga,' p. 467). But none of the said species are represented as infesting the *apothecia* of the Lichens on which they occur.

In the Kew Herbarium several specimens of *S. elegans* occur from Greenland and different parts of the Arctic regions (*e. g.* Igloolik, Sir Edward Parry), all of them saxicolous, and in fruit. In Spitzbergen, they sometimes occupy unusual habitats, *e. g.* the old weathered horns of Reindeer (Th. Fries, 'L. Spitsberg.' p. 14).

In some districts of Greenland, *S. elegans* would appear to occur in such abundance as to give a character to the rock-scenery. Thus Hayes, speaking of Port Foulke, says that the rocks are almost everywhere covered with a lichen of an orange-red colour, growing in "immense patches," imparting "a cheerful hue to the rocks;" while "Tripe de roche," which was still more plentiful, gave them, on the other hand, "a mournful look" ('Open Polar Sea,' p. 398) †.

I see no good ground for separating *Placodium* and *Squamaria* as genera. On the contrary, it would be much more convenient, and quite as scientific, to arrange in a single group all the Lichens, having a subfoliaceous thallus intermediate between *Parmelia* or *Physcia* and *Lecanora*, with sections founded perhaps on the character of the thallus, on the one hand, or of the sporidia, on the other. The character of the sporidia, however, is unsafe even for the establishment of sections, inasmuch as there are (*e. g.* among the *Lecanoræ* and *Lecideæ*) many Lichens whose sporidia are, at different stages or in different states of growth, both simple and compound. This difficulty meets the student in connexion with the numerous subgenera into which Continental lichenologists have divided the heterogeneous genera *Lecanora*, *Lecidea*, and *Verrucaria*.

#### Genus 18. LECANORA.

The subdivision of this great genus into the numerous genera quoted by Th. Fries (*e. g.*

\* This limitation is even more distinct in *Lecidea Grænlandica* (*q. v.*).

† Compare remarks on the physiognomy of the Greenland Lichen-flora in my paper on "the Lichen-Flora of Greenland" (pp. 36-39 & 65).



in his 'L. Arctoi') and other Continental authors, such as Körber, Stizenberger, and Massalongo, appears to me to be unscientific, inasmuch as their characters are not constant—and unnecessary, inasmuch as it is sufficient for the purposes of classification to give them place (if separate place they ought to have) as *sections* only. The following subgenera, however, made use of by Th. Fries, in his 'L. Arctoi,' being those only that are represented in Greenland, suffice to illustrate their very arbitrary definitions:—

- (1.) *Caloplaca*, Th. Fries. Sporidia ellipsoid, colourless, polari-bilocular.
- (2.) *Dimerospora*, Th. Fries. Sporidia oblong, 2-locular, colourless.
- (3.) *Rinodina*, Mass. Sporidia 2-locular, brown.
- (4.) *Dimelæna*, Norm., emend. Sporidia 8, 2-locular, biscoctiform, brown.
- (5.) *Hæmatomma*, Mass. Sporidia acicular, 5- to poly-locular, hyaline.
- (6.) *Gyalecta*, Ach., emend. Sporidia ovoid-oblong, or fusiform, 4- or multi-locular, colourless.
- (7.) *Aspicilia*, Mass. Sporidia simple, colourless, ellipsoid.
- (8.) *Acarospora*, Mass. Sporidia myriad, very minute, simple, hyaline. His true genus
- (9.) *Lecanora*, includes species referable to the following genera or subgenera:—  
*Ochrolechia*, *Cryptolechia*, and *Lecanidium* of Massalongo; *Polyzosia* and *Zeora* of Körber.

1. *L. tartarea*, L.—Jakobshavn; Godhavn, fruit abundant; Lyngemarken, apothecia compound; Illartlek Glacier, in fruit. One of the most abundant lichens in the area examined by Brown. Especially common in its muscicolous forms, which include *frigida*, Sw.; *gonatodes*, Ach.; *grandinosa*, Ach.\*; and *thelephoroides*, Th. Fries (L. Spitsberg. p. 21). Though frequently fertile as to apothecia, it is more generally sterile, the thallus occurring in an abortive or degenerate condition. This sterile thallus is very common, covering large patches of dry, decayed vegetation, mostly mosses. In its earliest stage of development, the thallus appears as a thin, very white, effuse, smooth coating. Next, wartlets gradually become developed here and there; these gradually multiply and coalesce into a tartareous thallus; and lastly the spicula (which are typical in *gonatodes*) are exhibited. Sometimes the thallus forms large loose crusts on mosses, having little hold, and being therefore easily detachable in patches, which have the appearance of rough plaster moulds of the subjacent decayed vegetation. Frequently the sterile thallus is sorediiferous, less often isidioid. Though generally white, especially in the young state, the colour varies to tawny yellow. These cream- or buff-coloured forms are more frequently uniformly granular than verrucæform, and are very different from the ordinary verrucose thallus of the type. They give, however, the same beautiful blood-red reaction with bleaching-solution, and are so frequently and intimately associated with the more usual conditions of *tartarea*, that they too appear to be referable to it. Sorediiferous forms have frequently a greenish tint, probably from growing in the shade. Occasionally there is apparently no filmy or rudimentary stage, or prothallus—the earliest form of thallus consisting of a series of smooth subspherical warts, scattered irregularly over the surface of herbage, varying greatly in size, frequently agglomerated

\* Not mentioned as a Greenland form by Th. Fries in his 'L. Arct.' p. 100.



into groups, often also becoming on their surface very irregular, soreidiferous, or granular. Sometimes the thallus is inconspicuous, or appears to be altogether absent, the apothecia being scattered directly over the surface of various mosses, especially *Racomitrium lanuginosum*. In other cases the moss is coated only with an obscure thin white film; or there are only a few isolated verrucæ. The spicula, which are the characteristic feature of the forms known as *gonatodes* and its allies, are thus developed:—The leaves of mosses become first covered with the thin, white crust of the lichen. In course of growth, this crust assumes the form of nodules or warts on the surface, spicula being protruded at its margins. The ends of the primary spicula are frequently the seat of minuter, secondary, divergent ones. Occasionally the spicula are so long and vermiform, that the states of thallus bearing them might appropriately claim the designation *vermicularia*, resembling, as they do, moreover, certain conditions of *Thamnolia vermicularis*.

With potash, the young white smoothish thallus gives a beautiful lemon-yellow, becoming orange. With bleaching-solution, the same condition of thallus gives a bright blood-red reaction; as a general rule, all forms of thallus, including the muscicolous ones, developed a beautiful blood-red, or more brilliant crimson, or vermilion colour, slight attrition being required. The colour was most easily developed, and proved richest, on the denser, verrucæform states of thallus. In other cases, however, there was either no reaction, or it was very faint. Thus there was none with the young apothecia scattered, without thallus, over *Racomitrium lanuginosum*. With *gonatodes*, it was frequently very feeble, though at other times very brilliant; while with the verrucæform sterile young thallus, there was sometimes no reaction, either with potash or bleaching-solution. Greenland forms of the type and of its varieties *frigida* and *gonatodes* yielded at once, under ammoniacal maceration, a port-wine-red colour—a result which I obtained also in Icelandic, Norwegian, and Faroese forms\*.

The apothecia are frequently very large, irregular in outline, and as if composed of a series of confluent individuals. They are also variously deformed by erosions or otherwise. I measured one old apothecium, which was nearly  $\frac{1}{2}$ " across. Sometimes new and smaller apothecia are developed on the surface of the old ones. Occasionally eroded portions of the hymenium are replaced by new tissue. Sometimes there is central erosion through all the tissues, or to various degrees, as in the apothecia of *Parmelia perforata*, the edges being generally very irregular, becoming thickened, and assuming the pale colour and characters of the thalline exciple. Where the hymenium disappears, the excipular subjacent tissue, which is of a whitish or cream-colour, becomes exposed. Where only part of the hymenium decays, the brownish red of the remainder contrasts curiously with the paler colour of the denuded exciple. The central parts of the disk, where not eroded, are frequently much areolate or fissured. The thalline margin (exciple) is sometimes very thin and inconspicuous, or it disappears, or is concealed by the swelling subconvex disk; in other cases it becomes greatly swollen and involute on the hymenium. Apothecia, both old and young, normal and deformed, occur sometimes, apparently or really, by themselves, the thallus being either obscure or absent.

\* "Northern Lichen-flora," Journal of Linnean Society, vol. ix. Botany, p. 415.



In corticolous forms, occurring on *Betula*- and willow-stems, the asci are 8-spored, the sporidia oval, colourless, simple, granular; sometimes, in the young state,  $\cdot 0009''$  to  $\cdot 0012''$  long, and  $\cdot 0006''$  broad.

On various forms of *tartarea*, I met with a black verrucarioid parasite, possessing both sporidiiferous perithecia and spermogonia. It occurred (*e. g.*) on the verrucæform thallus of the *Lecanora*, about Godhavn, seated, like *Abrothallus*, apparently on special growths of, or from, the said thallus. The parasite is punctiform or papillæform, the perithecia being seated on the irregularities of the thalline warts. When occurring as large papillæ, these perithecia resemble in external character the smaller apothecia of *Abrothallus Smithii*. The asci are 1- to 4-, never 8-spored, their size about  $\cdot 0024''$  long, and  $\cdot 0004''$  broad. The sporidia vary considerably, equally in length and breadth; their length ranges from  $\cdot 0006''$  to  $\cdot 0009''$ ; their breadth from  $\cdot 00015''$  to  $\cdot 00030''$ . In form they are oval, sometimes fusiform, generally straight, sometimes slightly curved. In maturity they are 3- to 8-locular, the number of septa varying considerably, 2 or 3 being common, while there are sometimes 4 or upwards. The epispore frequently bulges in maturity opposite the loculi of the endospore. In the young state, within the asci, the sporidia are sometimes simple and very granular, or they exhibit only rudimentary divisions into loculi. Their colour, according to age, varies from hyaline or pale olive (within the asci) to deep or blackish brown. The sporidia are frequently abortive or degenerate, and are then of a deep brown colour. Even in this condition they are also sometimes simple, or show only traces of division. Sometimes only one sporidium is developed in an ascus, acquiring in that position a brown colour, though the remaining protoplasm of the ascus is hyaline. Occasionally chains of 4 sporidia occur, the wall of the ascus having disappeared; or 2 sporidia adhere, and carry as a sort of caudal appendage the degenerate protoplasm, or the pedicle of the ascus. In young asci, the protoplasm (as it generally is in lichen-asci) is granular, usually colourless, sometimes becoming pale olive.

This parasite has not, so far as I can discover, been previously detected or described. As an apparently new form, therefore, I give it the appropriate name *VERRUCARIA TARTARICOLA*.

What appear to be its spermogonia occur on similar, but separate, thalline warts, studding more copiously their verrucosities, much more numerous, minute, and crowded than the sporidiiferous perithecia.

Parasitic perithecia, externally resembling those of *Verrucaria tartaricola*, occur on the thallus of var. *gonatodes*, which, about the Illartlek glacier, coats grass, leaves, stems, twigs, and mosses. Here the black parasite is very conspicuous on the beautiful white, thin, papery thallus, being dotted copiously over its periphery. But the internal structure differs from that of *V. tartaricola* in the asci being always 8-spored, and the sporidia colourless. The paraphyses are filiform and very delicate, hyaline throughout, flexuous and interwoven, sometimes indistinct. The asci are subsaccate and subarthonioid, with a very short, inconspicuous pedicle. They occur in tufts amidst the web of the paraphyses. They exhibit a brownish-red reaction under iodine,



which develops a blue colour in the hymenial gelatine. The sporidia are fusiform or ellipsoid, varying considerably in all dimensions; usually about  $\cdot 0006''$  long, and  $00015''$  broad, 3- to 6-locular. Within the asci the loculi of the sporidia sometimes resemble rows of button-like nuclei, subspherical or transversely oblong. According to prevalent rules or customs as to botanical nomenclature and classification, this parasite appears to require a separate place or name, at least provisionally. I therefore distinguish it from *V. tartaricola* as *VERRUCARIA CAMPSTERIANA*\*.

On some Greenland forms of var. *frigida* occurs still another parasite, as very minute, black, punctiform, crowded perithecia, full of round, brown or olive, simple, usually granular spores, varying from  $\cdot 00009''$  to  $\cdot 00022''$  in diameter, partly cohering in large irregular masses, partly having the appearance of *Torula* spores.

2. *L. parella*, L. Kudlesæt, on willow- and *Betula*-stems and leaves, decayed and dry; also muscicolous. Some of its forms have the characters of *upsaliensis*, others of var. *frigida* of *L. tartarea*. It is obvious that the one variety passes into the other, just as do the types†. I have long been of opinion that *tartarea* and *parella* belong properly to a single type, and cannot be specifically separated. I have met with innumerable passage-forms from very different parts of the world, but especially from alpine and arctic regions. In many cases I have found it impossible to refer individual specimens to the one plant or variety rather than to the other. But such difficulties are obviated by uniting *tartarea* and *parella* and abolishing *separate names for varieties*, which are mere inconstant states of growth, depending on the nature of the habitat (*e.g.* whether rock or stone, wood, leaves, or moss). *Upsaliensis* gives no reaction with bleaching-solution. But after all I have elsewhere said‡ of the capriciousness of this reaction in lichens, and particularly in *L. tartarea*, it would be obviously absurd to make its presence or absence a character for separating or establishing *species*.

3. *L. oculata*, Dicks. Illartlek glacier, terricolous, with quite the characters of the British *Isidium oculatum*, Dicks. (E. Bot. t. 2267). It also occurs corticolous on birch-bark, associated with *L. tartarea*. The young thallus is exactly like that of *L. tartarea*, coating leaves and mosses with a very vividly white crust. The mature state exhibits a series of beautiful tall, white, thick pillars, resembling greatly magnified *isidia*, digitately branching below their tips, which are subdiscoid. These pseudo-disks have a darker shade of colour than their thalline margin. An intermediate condition between these two states of thallus, the typical young and the typical old ones, resembles the dwarf, compact form of *Spherophoron coralloides*, with which it is apt at first sight to be confounded. Here the podetia-like columns are very short and stunted, closely arranged, producing a subtartareous thallus. But the columns are always very fragile and spongy, occupied by a light, soft, cottony tissue; whereas the branchlets of *Spherophoron* are always comparatively tough. The plant appears to be generally sterile in Greenland, as it is also

\* Vide *Lecidea Campsteriana* for origin of the *specific name*.

† In Hepp's Exs. No. 673, *L. pallescens*, var. *upsaliensis* is quite the *frigida* var. of *tartarea*, except as to the colour of the disk.

‡ "On Chemical Reaction as a Specific Character in Lichens," Journal of Linnean Society, vol. xi. Botany, p. 36; and Trans. Botanical Society of Edinburgh, vol. x. p. 82.



in Spitzbergen, and generally throughout the arctic lands and islands. The asci and sporidia are those of a *Pertusaria*, or Pertusarioid *Lecanora*, such as *L. bryontha*. The hymenium gives a blue reaction with iodine. The thallus, especially when young, gives a lemon-yellow with potash. No reaction occurs with bleaching-solution. Water has the same effect as potash, in a minor degree—a circumstance that renders this greenish-yellow coloration under potash of little or no significance in the lichens in which it occurs.

I met with two or three different *Parasites* on Greenland forms of *L. oculata*. Of these the following is of an unusual character. It occupies small wartlets of the horizontal thallus of the *Lecanora*, clustered at the base of the columns. These wartlets are crowned with an irregular, stellate-fissured, ostiolar disk of the same obscure brownish-green colour as the apothecia of the *Lecanora*. The disk expands under moisture. The wartlets in question might be supposed at first sight to be the spermogonia of the *Lecanora*. But they contain hymenial tissue and sporidia, not sterigmata and spermatia. The hymenium gives a yellow (no trace of a blue) colour with iodine. The asci are 8-spored, sublinear,  $\cdot 0012''$  to  $\cdot 0015''$  long, and  $\cdot 00022''$  broad. The young protoplasm is, as usual, granular. Neither the paraphyses, which are very delicate and indistinct, as in *Verrucaria*, nor the hypothecial tissue is coloured as is usual in the higher lichens. The sporidia are arranged in a single series in each ascus, about  $\cdot 00015''$  to  $\cdot 00020''$  in diameter, being spherical, like those of *Lecidea lugubris*\*, than which they are smaller. This parasite has the external aspect of a verrucæform or papillar *Pertusaria*, and I therefore assign to it the name

*Pertusaria paradoxa*†.

Its sporidia are very different from those of *Pertusaria*; but I know of no better provisional position than in that somewhat heterogeneous genus. The colour of the disk and hymenium, and their occupation of the ordinary wartlets of the thallus of the host, are also striking peculiarities.

While examining the lichens of the Kew Herbarium in 1858, I met with a plant having very similar characters to *Pertusaria paradoxa*. The specimen was labelled by Borrer, 1805, was apparently referred to *Lecidea luteola*, Ach., and was no doubt English, though no locality was given. The apothecia or perithecia were precisely of the character of those of *P. paradoxa*, being subconical warts, with a radiate disk having a very torn, irregular margin. The sporidia were simple, colourless, oval, resembling those of *Lecanora subfusca*, but much smaller. Both this lichen and *Pertusaria paradoxa* are apparently closely allied to *Lecanora protuberans*, Smrf. (Th. Fries, L. Arct. p. 102).

\* *Vide* author's paper on *L. lugubris*, Quart. Journal of Microscop. Science, vol. v. 1857, pl. xi. The sporidia of the *Lecidea* are more regularly spherical, and usually exhibit a distinct double contour. Somewhat similar; also, are the sporidia of *Lecidea fuscescens*, Smrf., in Nylander's Exs. No. 135, which I found spherical, not ellipsoid, as described by Th. Fries (L. Arct. p. 197).

† A somewhat similar lichen Th. Fries has apparently described as var. *pertusarioides* of *L. tartarea* (L. Arct. p. 100). But, unless we admit *L. oculata* to have two forms of apothecia on the same thallus, the pertusarioid apothecia in our Greenland plant must be considered *parasitic*.



Both the columns, and horizontal, verrucose thallus of the Greenland *L. oculata* are studded over with a very minute, black, punctiform parasite, which is partly of the nature of *pycnidia*, containing myriads of stylospores, resembling those of similar pycnidia in *Cladonia fimbriata*; brown or olive, spherical to pyriform; when spherical, about  $\cdot 00015''$  in diameter; sometimes oblong and cohering in chains, like the spores of *Torula*; then deep brown,  $\cdot 0003''$  long and  $\cdot 00022''$  broad. The envelope is deep brown and cellular. The constituent tissues give no reaction with iodine. It is extremely unlikely that these pycnidia are referable, as a secondary form of fructification, either to the *Lecanora* or *Pertusaria*. It is possible, however, that the perithecia, which contain the deep-brown, concatenate, oblong spores are referable to a different parasite from that, which contains the much smaller, more delicate, isolated or free stylospores. In this case, the first-mentioned group of perithecia may belong to *Torula lichenicola*\*

On a specimen of *L. oculata* (sub nom. *Lichen dactyliferus*, Whlnb.) in the Kew Herb., I find a parasite of a very different kind from any of those which occur on the Greenland plant. Seated on and partially immersed in some of the thalline warts are apothecia, black, flat, rough on the surface, slightly urceolate sometimes, which appear to be developed in, and ultimately to burst through, though they do not project above, the thalline warts. The asci and sporidia resemble those of certain *Calicia*, the sporidia being brown, 2-locular, oval, or figure-8-shaped (having a constriction at, or opposite to, the central septum),  $\cdot 00050''$  to  $\cdot 00066''$  long and  $\cdot 00025''$  broad.

4. *L. bryontha*, Ach.—Illartlek. A most interesting lichen, having certain characters both of *Lecanora* and *Pertusaria*, and forming a connecting link between these genera. The apothecia are those of *Lecanora*. There is an open, convex disk, concealing the thalline exciple. The sporidia and asci are those of *Pertusaria*. The sporidia are very large,  $\cdot 0060''$  long and  $\cdot 0024''$  broad, simple, oblong-oval; double contour distinct; protoplasmic contents finely granular or muco-granular, intermixed with much oil-globules, as is common in *Pertusaria*. The asci are also very large,  $\cdot 0075''$  long and  $\cdot 0024''$  broad, 1-spored, blue with iodine; none of them seen in their entire length on the field of the microscope. Both asci and sporidia resemble those of *Pertusaria communis*.

The Greenland plant is quite the *Pertusaria macrospora*, Næg., of Hepp's Exs. No. 424, and of Mudd's 'Brit. Lichens,' p. 277, with certain trivial modifications. The disk has the same dull greenish-brown colour as in Hepp's Swiss specimens; but the apothecial verrucæ in the Greenland plant are more elongated, more like the columns of *L. oculata*, more isidioid or stipitate; while the disk is so convex and tumid as to conceal the usual thalline margin.

It would be equally proper to class this lichen as a *Lecanora* or a *Pertusaria*. Inasmuch as the external (morphological) characters should always, if possible, take precedence of internal (structural) ones, I prefer arranging it, on account of its apothecia, as a *Lecanora*, beside *L. oculata*. Th. Fries (L. Arct. p. 117) gets over the difficulty of the Pertusarioid sporidia by creating specially for this single lichen a separate (sub-)genus, *Pionospora*, characterized by large single sporidia, and which he conveniently considers

\* A new species described in "Observations on new Lichenicolous Micro-Fungi," Trans. Royal Society of Edinburgh, vol. xxv. pp. 515 & 530; and Proceedings, vol. vi. p. 534.



intermediate between the true *Lecanora* and the *Pertusaria*. Whatever its position in classification, the plant illustrates the close affinity between these two great genera.

5. *L. ventosa*, Ach.—On granitic rocks about Jakobshavn; not common. Apothecia and spermogonia abundant, as well as the parasitic *Sphæria ventosaria*, Linds.\* The thallus is of an unusually vivid green, a character, however, which is common to all northern or arctic lichens with a greenish thallus. The spermogonia and the *Sphæria* are externally alike, the perithecia of both consisting of black, irregular warts; but their contents at once distinguish them. The Greenland *Sphæria* has polysporous asci,  $\cdot 0015''$  long and  $\cdot 00045''$  broad, the sporidia being ellipsoid, olive or brown, 2-locular, sometimes figure-8-shaped, and very minute,  $\cdot 00022''$  long and  $\cdot 00009''$  broad.

In specimens of *L. ventosa*, collected in the Braemar Highlands, in August 1856, I very frequently met with the *Sphæria*, but rarely with the spermogonia, which are usually externally undistinguishable from the parasite. The spermogonia, however, were abundant in a specimen from Morchone, as irregular, flattish, longish, conspicuous, elevated warts, seated on individual areolæ of the thallus, their surface black, or bluish-black, pierced by several irregular blacker openings or ostioles. The spermatia were numerous, as straight rods, about  $\cdot 00025''$  long, arising from the apices of delicate, linear, irregularly digitate, and sometimes bulging sterigmata, subsimple or consisting of only a few articulations. Interspersed with these spermogonia were a number of black, papillæform perithecia, much more like ordinary spermogonia, but which really belonged to the parasitic *S. ventosaria*.

On another specimen, bearing normal apothecia (from the summit of Lochnagar), I found spermogonia abundant, external to the region of the thallus occupied by the apothecia. Here, again, they occurred as large, irregular, prominent warts, of a darker green than the thalline verrucæ upon which they were seated, their apices covered with irregular, black, or bluish-black ostioles, indicating compound perithecia. These ostioles are the only external distinguishing feature, as they are never seen in the *Sphæria*.

6. *L. subfusca*, L.—Jakobshavn, on twigs of birch; a form with very small apothecia, very sparingly distributed. Muscicolous forms (= *epibrya*, Ach.) are more common. In Britain, *L. subfusca* is very frequently the seat of various parasitic Fungi or Lichen†. Of these by far the most common I have met with is, especially in Irish specimens, *Torula lichenicola*, Linds., which occurs both on its apothecia and thallus.

7. *L. frustulosa*, Dicks.—Jakobshavn. Its white, tartareous thallus, of pulviniform areolæ, gives a beautiful lemon-yellow reaction with potash, a reaction that is common, however, on white, tartareous thalli, both in *Lecanora* and *Lecidea*. Hymenial gelatine beautiful pale blue with iodine. Tips of paraphyses agglutinate and pale brown. Sporidia simple, oval, or broadly ellipsoid, about  $\cdot 0006''$  long and  $\cdot 00022''$  broad; sometimes with granular or muco-granular contents; frequently exhibiting 1, 2, or 3 large, prominent nuclei.

\* Described in the author's "New Zealand Lichens and Fungi," Trans. Royal Society of Edinburgh, vol. xxiv. p. 439.

† E. g.:—1. *Sphæria apotheciorum*, Mass.; 2. *S. epicymatia*, Wallr.; 3. *Arthonia varians*, Dav.; 4. *Pharcidia congesta*, Körb.; 5. *Lecidea parasitica*, Flk.



8. *L. badia*, Ach.—Jakobshavn; Ounartok. On gneiss; copiously in fruit and spermogoniferous. The young apothecia are sometimes suburceolate, while the old ones become convex and pulviniform, the disk sometimes covering the exciple; frequently crowded, and then variously deformed from external pressure. The central ones are largest and most crowded, but they never coalesce into compound apothecia. Sporidia simple, colourless, ellipsoid, .0003" long and .00015" broad. In the Ounartok specimens the apothecia are large and scattered, many of them with the disk partly or wholly eroded, similar to the condition that is commoner in *L. tartarea*. This is a beautiful form of the species. The spermogonia on the Jakobshavn (ordinary) form of the plant are scattered over the irregularities of the thalline areolæ, which are convex or pulviniform, and mostly discrete. They are to be met with on the peripheral areolæ, as minute brown points of irregular size and form, several being dotted over each areola.

9. *L. polytropa*, Ehrh.—Jakobshavn; Godhavn; Ounartok; Egedesminde. Most usually it has crowded and confluent or compound, deformed and livid apothecia, and a very verrucose thallus. Some forms occur on the same rocks and in the same localities with *Squamaria saxicola*, and appear to me to pass into that lichen (*e. g.* in Disco-Island specimens). On the one hand *polytropa* sometimes acquires a rudimentary, subfoliaceous thallus; and on the other, as already shown, *S. saxicola* is frequently athalline, with crowded apothecia of the same colour and external character, and with the same contents as *polytropa*, though generally there is less tendency in *saxicola* to coalescence and deformity of apothecia. In the ordinary forms of *polytropa* in Greenland, the hymenial gelatine gives a beautiful blue with iodine. The sporidia are simple, ellipsoid to oval, showing double contour or not; granular or muco-granular in the young state: about .0003" long and .00015" broad. In Nylander's Exs. I found the sporidia of *polytropa* pale yellow, about .00033" long and .00013" broad, simple, and narrowly ellipsoid. Sometimes *polytropa* occupies, like *Squamaria elegans* and *saxicola*, unusual habitats; *e. g.*, it occurs on the old excrement of birds (probably the *Lagopus alpinus*) in Spitzbergen (Th. Fries, L. Spitsberg. p. 22).

10. *L. cervina*, Ach.—Lyngemarken, on decayed twigs, very sparingly.

11. *L. smaragdula*, Whlnb. Only in the young state and sparingly, on granite and gneiss. Thallus and apothecia of light colour, approaching the characters of var. *cinereo-rufescens*, Ach. *Smaragdula* has quite as good a position in the genus *Endocarpon* as in *Lecanora*. Th. Fries's description of the range of his *Aspicilia cinereo-rufescens* and var. *diamarta*, Whlnb. renders it doubtful whether he includes it in the Greenland lichen-flora\*.

12. *L. sophodes*, Ach. Several forms occur—forms that systematists would probably refer to several different so-called species, *e. g.* *turfacea*, *mniaræa* †, and *atro-cinerea*. They are mostly corticolous—on birch bark or on whitened (bleached) twigs; or muscicolous, corresponding to the *epibrya* forms of *L. subfusca*, associated with sterile (vari-

\* He says (L. Arct. p. 134) "Per totam regionem Floræ nostræ frequens;" and as his "Flora" refers to the 'Lichenes Arctoi Europæ Groenlandiæque,' it is to be inferred that all lichens so described, though not specially mentioned as Greenland plants, are nevertheless common in that country.

† *Turfacea* and *mniaræa* appear to me to constitute a single species.



olarioid or sorediiferous) states of *L. tartarea*. They also grow occasionally on old *Umbilicariae*, or the rudimentary horizontal squamules of *Cladonia*. The apothecia are sometimes very large, at other times very small; their disk very black, or as brown as in *subfusca*, convex or flat. The larger apothecia have sometimes a squamulose or crenulate, or irregularly wavy, exciple, like that of *Pannaria brunnea*. The exciple is sometimes very white, and then conspicuous, or very dark, and then apt to be confounded with the disk. The whole apothecium, especially when small, may then be mistaken for that of a *Lecidea*—the more so that the *Lecanora* is frequently associated with various forms of *Lecidea parasema*. The examination of the sporidia, however, at once distinguishes the two very different plants. In the *Lecanora* they are normally deep brown and 2-locular, ellipsoid or oval, with or without a central constriction opposite the septum (becoming in the former case figure-8-shaped), varying considerably in size, from  $\cdot 0006''$  to  $\cdot 0009''$  long and  $00030''$  to  $00045''$  broad. In the young state they are sometimes simple and olive; or the contents show a tendency to, or distinct, bilocularity, the loculi having bold outlines, surrounded by a broad hyaline envelope so delicate as to resemble mucus. Occasionally the young sporidia are slightly curved as in *Physcia* and *Ramalina*. There is considerable variety in structure, resembling, in this respect also, some of the *Physciae* (e. g. *stellaris* or *pulverulenta*). Sometimes there are three large prominent nuclei. Occasionally there is a protrusion of the epispore at each end—apparently the first effort at germination. Sometimes the loculi assume a bipolar character—isolated, or connected, as in certain *Physciae*, both of the *stellaris* and *parietina* groups. In the young state, the sporidia are more frequently pale-olive than colourless. Sometimes the loculi are granular, or exhibit both nuclei and granules as in *Abrothallus Smithii* and many other lichens, which have brown 2-locular sporidia. The hymenial gelatine assumes a beautiful blue colour with iodine, as do also the asci; and the latter when full of young sporidia, whose loculi are nuclear and 2-polar, pale olive, prominent, button-like bodies, are fine objects under the microscope. The asci are 8-spored, about  $\cdot 0024''$  long and  $\cdot 00075''$  broad. The paraphyses are agglutinated at the tips and indistinct throughout their length.

13. *L. cinerea*, L.—Jakobshavn; Kudlesæt; in both cases on trap. Occurs in various “forms,” some of them having the aspect of different “species.” The young thallus sometimes consists of a series of dull lead-grey, pulvinate areolæ, resembling those of some forms of *Lecidea atro-alba*. The mature thallus is frequently uniformly white-granulose or farinose; and in this condition it generally gives a deep greenish-yellow reaction with potash. Other forms of the white mealy thallus, however, give a beautiful lemon-yellow, while some exhibit no reaction. The apothecia are sometimes lecanorine, with a distinct thalline margin, or lecideine and immarginate; very convex, flat, or urceolate. Sometimes the disk is slightly white-pruinose as in *Lecidea abietina*. The urceolate forms are seated on or sunk in an areolate thallus—frequently of a leaden hue. Sometimes the apothecia are very minute in the young state and crowded, but always conspicuous. The lecideoid apothecia are sometimes as subspherical and prominent as in *L. calcarea*, into which *cinerea* undoubtedly passes by a series of gradations. In an intermediate stage between the lecanorine and lecideine apothecia, the disk is flat—sometimes with a thin, black, wavy margin. Between the forms bearing concave (urceolate) and convex



(lecideoid) apothecia there is the widest difference; and it is perhaps not surprising that systematists should have variously referred the very numerous and puzzling forms of this most variable of all the *Lecanoræ* to the genera *Lecanora*, *Urceolaria*, and *Aspicilia*, and to a considerable number of supposed species of these genera!

In Kudlesæt specimens especially, crystals of *hornblende*, which protrude through the thallus, are apt to be mistaken for apothecia. When fresh these crystals are black and glistening, and under the lens their crystalline structure is at once apparent. When weathered they become brown and assume more of a biatorine aspect than the apothecia of *cinerea* usually present. In all cases their outline and surface are irregular and linear or angular, as contrasted with the smoothish surface and rounded outlines of the lichen-apothecia. The difference can therefore be easily detected on careful examination under the lens. In all the Greenland forms of *cinerea* the asci and hymenial gelatine assume a very deep blue under iodine. The paraphyses are generally indistinct; in all cases short, and compactly arranged. The sporidia vary considerably in size, form, and structure. Their length varies from  $\cdot 00015''$  to  $\cdot 00020''$  in microsporous, and to  $\cdot 0006''$  in macrosporous conditions; while their breadth in the former states is  $\cdot 00009''$  to  $\cdot 00015''$ , in the latter  $\cdot 0003''$  to  $\cdot 00045''$ . Their shape varies from ellipsoid, through oval, to sub-spherical. They are always simple and colourless, sometimes possessing double contour, occasionally finely granular or muco-granular; or they exhibit one or more (generally central) largish, prominent nuclei.

What was given to me while in Norway in 1857 by the late Professor Blytt as *L. Myreni* is apparently only one of the many forms of *cinerea*\*. Here the apothecia are sometimes lecanorine, resembling those of *atra*, having a prominent raised thalline margin. But in other parts of the same thallus they are lecideine and immarginate, sub-convex sometimes, even substipitate, or at least prominently seated on thalline elevations. In the latter case the thallus is generally old, having become subgranular and thin, worn away by weathering—a circumstance that is further shown by the relatively greater size and prominence of the protruding hornblende crystals. The old apothecia are sometimes deformed—a condition that is common to those of all *Lecanoræ* and *Lecideæ* in arctic and alpine countries.

*L. cinerea* is one of the many crustaceous lichens (abundant in most parts of the world) the forms of which exhibit a diversity as great as is the variety of conditions regulating growth. Few of these forms or conditions deserve separate rank or nomenclature, by reason of the inconstancy of their characters. Yet systematists manufacture out of them both genera and species, and are constantly altering the names and rank of these subdivisions—*e. g.*, “species” being reduced to the position of “varieties,” while the latter are elevated to the rank of species †.

14. *L. calcarea*, Ach.—Jakobshavn and Kudlesæt, on the same trap rocks as *L. cinerea*, to which, indeed, I refer it as a mere form. Thallus frequently very white or cream-coloured, and farinose, or irregular and tartareous, giving at once with potash a

\* The assignation of *L. Myreni* in my ‘Northern Lichen-flora’ (p. 385) to *Lecidea amyllacea*, Ach. and Whlnb., is therefore an error.

† *Vide* my ‘Northern Lichen-Flora,’ p. 382.



beautiful lemon-yellow. Like *cinerea*, it occurs in several forms; but it is far from being so variable. In one form (Kudlesæt) the apothecia are slightly white-pruinose, black, irregular in outline and surface, sessile, flat or more or less convex. The sporidia are simple, colourless, oval,  $\cdot 0003''$  long and  $\cdot 00022''$  broad. In what appears to be simply another condition from the same locality, the sporidia are smaller, oblong, or ellipsoid; the apothecia flat, regular in outline, with a distinct exciple. The appearance of these two forms is very different—nearly as much so as it is different from the associated urceolate forms of *cinerea*. All the forms described here, under both *cinerea* and *calcareae*, appear to me to be properly referable to a *single type*. In Central Europe *Leciographa parasitica*, Mass. (Körb. 'Parerga,' p. 463), is sometimes parasitic on the thallus of *calcareae*.

15. *L. leucoræa*, Ach. About the Illartlek glacier, both terricolous and muscicolous; Jakobshavn. This plant seems to me referable to *L. ferruginea*, which is more properly to be regarded as a *Lecidea* than as a *Lecanora*—the exciple, where it exists, having, usually at least, the same colour as the disk.

#### Genus 19. LECIDEA.

Even to a greater extent than *Lecanora* does, the genus *Lecidea* illustrates the tendency of the modern or Continental school of lichenologists to split up the generally excellent genera of the Acharian era into subgenera, founded on the too frequently variable characters of the sporidia. Differences in the character of the *sporidia*, when constant, and especially the degree to which their contents are divided into loculi by septa or interspaces, may be and are useful, in large genera like *Lecidea* and *Lecanora*, in subdividing them into *sections* or groups. But it is not, I think, desirable to give these sections generic importance or rank. This elaboration, which appears to me (as I have elsewhere explained) unscientific and unnecessary, is sufficiently exhibited in Th. Fries's 'L. Arctoi,' who classes the arctic *Lecideæ* under the following separate genera\* :—

- (1.) *Lecidea*. Apothecia *black*. Sporidia 8, simple, ellipsoid, colourless.
- (2.) *Thalloidima*. Apoth. Lecideine. Sporid. 2-locular, ellipsoid, colourless.
- (3.) *Buellia*. Apoth. Lecideine. Sporid. oblong, 2- to 4- or multilocular, brown.
- (4.) *Rhizocarpon*. Apoth. Lecideine. Sporid. oblong, 4-locular to muriform, brown.
- (5.) *Arthroraphis*. Apoth. Lecideine. Sporid. acicular, multilocular, colourless.
- (6.) *Rhexophiale*. Apoth. Lecideine. Sporid. fusiform, 4-locular, colourless.
- (7.) *Biatorina*. Apoth. variously coloured, *not black* †. Sporid. 2-locular, colourless.
- (8.) *Biatora*. Apoth. Biatorine. Sporid. ellipsoid, simple, hyaline.
- (9.) *Psora*. Apoth. Biatorine. Sporid. linear, 4- to multilocular, colourless.
- (10.) *Bilimbia*. Apoth. Biatorine. Sporid. oblong, 4-locular, colourless.
- (11.) *Blastenia*. Apoth. Biatorine. Sporid. polari-2-locular, ovoid, colourless.

\* Restricting these illustrations—as in the case of the genus *Lecanora*—to sub-genera represented in *Greenland*.

† The distinction between *brownish* or *reddish*, and *black*, apothecia in *Lecidea* is far from being constant or satisfactory. Illustrations of the inconstancy of this character may be found in the *Greenland* forms of *L. parasema*, *L. sanguineo-atra* and *L. Friesiana*. There is therefore no good (scientific) ground for separating *Biatora* and *Lecidea* as genera.



(12.) *Bacidia*. Apoth. Biatorine. Sporid. acicular, multilocular, colourless.

(13.) *Lopadium*. Apoth. Biatorine. Sporid. oblong, muriform, coloured.

The genus *Lecidea* is in some respects the most important Lichen-genus in Greenland. The individuals constituting its species are most abundant—especially on rocks and stones—though occurring largely also on stems and twigs of bushes, on decayed mosses, and on the soil. Its species are generally extremely variable, and afford ample scope for the ingenuity of systematists in the manufacture of varieties and the devising of names! It contains, moreover, a greater number of unusual or *novel* forms than any other Greenland genus.

1. *L. grænländica*, n. sp. Kudlesæt: associated with a form of *Parmelia saxatilis* approaching *omphalodes*, and with *Lecanora tartarea*, and its var. *frigida*; generally terricolous, sometimes also muscicolous, or growing on the decayed fibres of twigs, &c. Apothecia sometimes athalline, and parasitic on the crust of the *Lecanora*, on which they are conspicuous by contrast of colour. Only a few fragments exist of what is, in many respects, a peculiar and most interesting lichen. The thallus is subfoliaceous, microphylline—sometimes resembling that of *Lecidea squalida* (e. g. of Nylander's Exs.), or that of *Umbilicaria arctica*. It is smoothish or irregularly papillæform or verrucose-granular; the colour variously grey, buff, or lurid (brown or blackish-brown). These lurid forms resemble *L. lugubris* both as to the thallus and apothecia.

The apothecia are wholly black (margin and disk alike), generally flat; the exciple is usually distinct and regular, sometimes tumid, at others (in age) thin and wavy. Apothecia generally scattered centrally; sometimes crowded and becoming deformed from mutual pressure; frequently degenerate, and then usually irregular in outline. The hymenial gelatine gives no reaction with iodine, or yellow (the colour of the reagent itself); while the asci give sometimes no reaction, sometimes one which is permanently red or violet, or a temporary red or violet, passing slowly into a faint, or more distinct, blue. In the young state the protoplasm of the asci is granular, sometimes partly oily, and colourless. Gradually a single sporidium is developed, granular and simple in the young state, but gradually exhibiting loculi and septa as it approaches maturity. Asci very large and delicate, varying in shape and size with age,  $\cdot 0030''$  long and  $\cdot 0008''$  broad in the young state,  $\cdot 0045''$  long and  $\cdot 0009''$  to  $\cdot 0012''$  broad in maturity.

The paraphyses are among the most peculiar and beautiful I have met with in lichens. They are discrete and distinct throughout their length, with a thickish filament  $\cdot 00015''$  broad or upwards, which is sometimes obscurely granular. Total length of the paraphyses about  $\cdot 0024''$ . In the young state the tip is simply thickened, or bulging and rounded, and of a pale-brown colour. There is no distinct articulation; but as maturity is approached, a septum is developed, and there is a distinctly articulated terminal cell of very various shape, from lanceolate to spherical. The colour, deep brown, is frequently limited distinctly to a mere segment (often the upper half) of the interior of this terminal cell, rarely occupying its whole cavity. These terminal cells are easily detached from their filaments (e. g. by gentle friction of the glass covering the object on the microscope-slide); and frequently, especially in old apothecia, they are found in masses away from their filaments, and then resemble the irregular cellules of the tissues of *Co-*



*niothecium*\* or other parasitic lichenicolous fungi, or the spores of *Torula lichenicola*. They are frequently, in this isolated form,  $\cdot 0003''$  to  $\cdot 0006''$  long and  $\cdot 0003''$  broad. The colour of the paraphyses is generally limited to the terminal cell or a portion thereof; and this limitation is a peculiarity among lichens, the colour in paraphyses generally extending some way down the filaments and gradually disappearing. There is great irregularity in the form and size of the terminal articulation. Frequently it is obpyriform or rhomboid. Invariably it is of greater breadth than the filament, into which it sometimes tapers, *e.g.* in the young state. But more usually there is a constriction at the articulation, and the terminal cell, from its size and shape, appears altogether a body of a different kind from the filament.

The very large sporidia are associated with much oil-globules, as usual of varying size. The sporidia themselves are generally oblong, with rounded ends—about 8-locular at first—the loculi transverse, but breaking up gradually in a longitudinal direction into smaller loculi and assuming a muriform character. Their size varies considerably with age—from  $\cdot 0009''$  to  $\cdot 0030''$  long and  $\cdot 0004''$  to  $\cdot 0015''$  broad. In all cases and in all stages of growth they are colourless—a circumstance that separates them from the similarly shaped sporidia of *Rhizocarpon*, *Lopadium*, *Umbilicaria*, and *Stenographa*. In the old state they break up into the subcubical or subspherical cellules of which they are composed, which cellules have, when isolated, a nuclear appearance. In the young state the sporidia are simply granular like the protoplasm of the asci. No spermogonia nor pycnidia were observed.

2. *L. geminata*, Flot. I have seen no Greenland specimens. But in specimens collected by myself in Romsdal, Norway, in August 1857, and determined by Nylander, the asci, though generally 2-spored, are sometimes 1-spored, about  $\cdot 0036''$  to  $\cdot 0045''$  long and  $\cdot 0006''$  to  $\cdot 0009''$  broad. The protoplasm of the asci frequently becomes degenerate—then assuming the appearance of irregular, linear or ribbon-like masses, brown and granular. The hymenium becomes beautifully blue under iodine; and its section forms, in this condition, a fine object under the microscope. The large sporidia are generally oblong, with rounded ends, sometimes oval or subspherical, muriform, with sometimes a central constriction of the general mass of loculi within the broad hyaline sac which envelopes them. Sometimes, in the old state, these loculi occur as an irregular agglomeration of subspherical corpuscles of nearly equal size. The colour of the loculi in question is brown or olive, according to age. The size of the sporidia varies from  $\cdot 0015''$  to  $\cdot 0018''$  long and  $\cdot 0008''$  to  $\cdot 0010''$  broad. They resemble the muriform sporidia of some species of *Sphæromphale* (Mudd, Brit. Lich. p. 281). Tips of paraphyses and hypothecial tissue deep brown. Externally this lichen has frequently the characters of *L. petræa* and *L. atro-alba*, from which its sporidia, however, distinguish it. But even as respects the sporidia there is a gradual transition from *atro-alba* to *geminata*; and the group includes several other lichens which have a most doubtful claim to the position of separate species.

3. *L. petræa*, Wulf.—Jakobshavn, on gneiss and trap; associated frequently with *Lecanora cinerea*. Apparently comparatively common in the area examined by Brown.

\* Described in Paper on "New Lichenicolous Micro-Fungi" formerly quoted, pp. 518 & 534.



Thalline areolæ frequently pulviniform, unaffected by potash. Most variable in its sporidia, which are frequently simple in the young state, and muriform in the old, their outline and size varying correspondingly. The young sporidia are sometimes colourless or pale olive; oval or ellipsoid, straight or subcrescentic; granular, or containing a single, large, eccentric nucleus or endospore; or their contents resemble those of the sporidia of many *Lecanoræ* (e. g. the *tartarea* group) in consisting of a mass of nuclei-form oil-globules and granular matter (sometimes they maintain this condition to maturity, but are then to be considered abortive); gradually acquiring the deeper olive or brown colour of the normal sporidia. As the normal sporidium is developed, its protoplasm becomes divided transversely into a varying number of loculi. The septa or division-spaces are either straight across, in which case the loculi are equal in size or nearly so; or they are variously oblique, giving rise to great irregularities in the size and form of the loculi. At first 3 transverse septa, equivalent to 4 loculi, were common in one form of the plant; while in another there were, at a later stage, the colour being dark brown, 7 to 10 such septa. Longitudinal division of the loculi sooner or later occurs as a general rule. At first it affects only one or a few loculi, and is subcentral; that is, there is a subcentral division longitudinally of the transverse loculi. But as age advances, this longitudinal division becomes much more general, and it goes on till a muriform structure results—that is, till the loculi are converted into a series of subcubical or subspherical cellules or corpuscles, as in the sporidia of *L. grælandica* and *L. geminata*. In the old state the sporidium becomes broken up, as in *grælandica*, into irregular masses of these subcubical corpuscles, which are of a dark brown colour. This brown colour of the mature and old sporidia is sometimes so deep as to obscure the contained loculi and their subdivisions. In the middle stages of development, when the transverse septa are distinct, the sporidia are frequently broadly ellipsoid or oblong-oval, straight, slightly curved, or plano-convex. Sometimes there is a bulging of the episporium opposite to each locule. In the old state (the muriform condition) the form is much more irregular and variable, resembling in this respect the sporidia of *Urceolaria scruposa*. Thus they are obovate, pyriform, or oblong, with irregular bulgings of the episporium. Linear-oblong forms, with 7–10 transverse septa, sometimes resemble, save as to colour, the sporidia of *Graphis*. With such a variety of *shape*, there must be corresponding differences in *size*. These differences, as well as other variable characters of the plant, are illustrated by the following chief forms, under which it occurs in Greenland:—

(1.) Growing on the under or shady side of stones. Areolæ, as usual, lead-coloured, or ash-grey, sometimes slightly white-pruinose, and as flat and brown as in *L. fusco-atra*, with which it is apt to be confounded. The sporidia, however, at once distinguish it. Apothecia flat and simple, though frequently or generally convex or subspherical, often deformed in age. Sporidia sometimes girt with a broad, hyaline margin, as in *geminata*; oval or oblong-oval and simple, or oblong, with a central constriction, and muriform;  $\cdot 0009''$  long and  $\cdot 00045''$  broad. Colour from deep olive-green to dark brown, in oldish or mature apothecia.

(2.) Thallus consisting of the ordinary lead-grey, discrete areolæ. Sporidia very large,



·0024" long and ·0009" broad; muriform, consisting of a close aggregation of irregular cellules. Colour very deep brown. Apothecia flat.

(3.) Sporidia irregularly oblong, pyriform or ellipsoid, with about 7 transverse septa, having longitudinal central subdivisions; deep olive or bottle-green; ·0012" long and ·00045" broad. In the older, muriform condition, there is sometimes a central constriction of epispore, the sporidia showing at this point a great tendency to split. Half-sporidia, split in this way, occur, intermixed with fully formed ones. In the old, muriform state, the colour is so dark that the contained or constituent cellules are undistinguishable. The younger sporidia exhibit no longitudinal subdivision, or only through one of the central or polar loculi. The contained cellules in the muriform state are sometimes few and discrete (sometimes only two or three in a row) as in *Urceolaria scruposa*. In other cases they are usually more minute, numerous, and crowded.

(4.) Sporidia linear-oblong, ·0009" to ·0012" long and ·00045" broad. At first exhibiting only about 7 to 10 transverse septa, which, by division longitudinally, gradually become muriform, the colour in the early stages being deep olive, in the older brown.

(5.) On the thallus of different *Lecideæ* (e. g. on forms of *L. parasema*), I found sporidia apparently referable to *L. petræa*; old, very dark brown, and very irregular in outline resembling those of *U. scruposa*; about ·0009" long and ·00045" broad. I have occasionally, in like manner, met with stray individual or single sporidia of very different genera or species on the thallus of many lichens, mostly crustaceous\*. In all the Greenland forms of the variable *petræa*, the hymenial gelatine and the asci give a very deep beautiful Prussian-blue colour with iodine.

In Schærer's Exs. No. 177 (= *L. confervoides*, DC., f. *concreta*, Sch.), the sporidia are colourless, 9-locular, becoming muriform; pyriform: ·0010" to ·0012" long and ·0005" broad. In its colourless sporidia this form of *petræa* resembles *L. grænländica*.

4. *L. atro-alba*, Ach.—Jakobshavn; Egedesminde; Atanakerdluk. In various forms, differing in their thallus, apothecia, and sporidia. The thalline areolæ are sometimes discrete and pulviniform, convex or even subspherical; or the young peripheral ones alone are so. Though whitish or grey in the dry state, they become green when moistened. Sometimes the thallus is rather tartareous, thick, verrucose, without distinct areolæ, buff or cream-coloured. In other cases the areolæ are very black, glossy, convex, confluent, and deformed. This condition is sometimes common in large patches, e. g. on granite about Egedesminde. Occasionally the areolæ are flattish and thin. The apothecia are sometimes flat, especially when young, with thin exciple, which is sometimes wavy. In age they occasionally become convex and subspherical (the disk concealing the exciple), and variously deformed. They differ considerably also in size, being largish or small. Sometimes they are compound; or several young ones cover the surface of a decayed or degenerate old one, producing various irregularities of surface and outline. Frequently also, in age, the disk becomes convex and rough on the surface, with irregularity of outline. The asci are small generally, about ·0015" long and ·00045" broad; 8-spored. The sporidia are never large, as described by Th. Fries (*L. Arct.* p. 230), but vary in size from about ·00045" to 00060" long and ·00022" to

\* Vide *Cladonia gracilis*, and *Lecidea parasema*, No. 3.



·00030" broad. In some forms of the plant they appear to be nearly double their size in others. Normally, in maturity, they are 2-locular, and olive-green of various shades. But sometimes, in the young state, they are simple, slowly (and occasionally only obscurely) developing a septum. Sometimes, in age, they become elongated, multilocular and muriform, in which case they assume the characters of the sporidia of *petræa*. In the young state, and especially in the asci, they are frequently granular; their form is usually oval, less frequently oval-oblong or ellipsoid, occasionally figure-8-shaped or soleæform from constriction at the septum; straight generally, but sometimes slightly curved. The colour of the young sporidia is sometimes very pale—and of the old or mature, sometimes brown.

In Schæerer's Exs. No. 44 (= *L. confervoides*, DC., var. *atro-alba*), the asci are 1-spored; the tips of the paraphyses a deep purplish-brown, their filaments indistinct. The sporidia are colourless when young, but acquire a dark bottle-green or brownish-green colour with age. In the young state they are sometimes 4-locular, but in maturity they are muriform. Their shape varies from oval to ellipsoid; their size is about ·0020" to ·0023" long and ·0010" broad.

In Schæerer's Exs. No. 178 (= *L. confervoides*, var. *fusco-atra*, Hoffm.), the asci are about ·0040" long and ·0011" broad; the paraphyses ·0050" long, closely agglomerated, their tips deep brown; the sporidia 2-locular, deep brown, ·0010" long and ·0005" broad.

5. *L. badio-atra*, Flk.—which is placed by Nylander (Scand. p. 233) between *L. atro-alba* and *L. petræa*, and which is sometimes referred to the one, sometimes to the other species by different lichenologists—has, in Schæerer's Exs. No. 179, the characters rather of *L. geminata*. The asci are ·0050" long and ·00133" broad; variously 1- 2- or 4-spored, frequently only one sporidium attaining maturity, as (*e. g.*) in *Umbilicaria pustulata*. The tips of the paraphyses are brown. The sporidia are colourless when young, bottle-green in maturity, muriform, ·0013" to ·0016" long and ·00065" to ·00100" broad. The specimen in Nylander's Exs. has apothecia externally resembling those of *Lecanora intumescens*, Rebent., with large, deep-brown, 2-locular sporidia, ·0010" long and ·0005" broad.

This and many of the other *Lecideæ* above described (under the species, or so-called species, *geminata*, *petræa*, and *atro-alba*) show that a close connexion exists between these species by means of numerous passage-forms of the most variable character.

6. *L. insignis*, Næg.—About the base of the Illartlek glacier. On a white thallus, resembling that of the muscicolous forms of *Lecanora tartarea*, coating mosses. Asci and paraphyses delicate; the former beautifully blue with iodine. Sporidia normally 2-locular, olive or brown, straight or slightly curved, ellipsoid or oval, sometimes figure-8-shaped, the central constriction more or less marked. Size ·0009" to ·0012" long and ·0003" broad, but size and form equally variable, some of the more elongated, narrow, ellipsoid being nearly twice as long as the short, broad, oval ones. Sometimes they exhibit four loculi from subdivision of the two primary ones. Occasionally there is no distinct septum, the sporidia being then simple, their contents consisting only of granules or larger nuclei, variable in size and position. In age the sporidia frequently present bulgings at the ends, the beginnings of germination. Sometimes, also, in age they split



into two, giving exit to the contained granules or nuclei. The sporidia, in all their stages of growth, bear a general resemblance to those of *Physcia stellaris*. *Insignis* appears to me to pass into *disciformis*, just as the latter graduates into *myriocarpa*. All three may very properly be referred to a single aggregate species or type, the varying size of the apothecia and sporidia being altogether a subordinate "character," just as it is in the *petræa* group.

7. *L. myriocarpa*, DC.—Egedesminde; Illartlek glacier; Jakobshavn, on birch-bark, associated with minor forms of *Lecanora subfusca*. Several states occur, athalline as well as thalline, including forms having the characters of *L. punctata* and *L. pinicola* of authors. The following were the chief forms met with:—

(1.) Saxicolous, Egedesminde. On a very irregular, whitish, verrucose (tartareous) thallus, associated with a state of *Lecanora polytropa*. Apothecia subspherical, black, small, crowded. Hymenial gelatine beautifully blue with iodine. Hypothecial tissue and tips of paraphyses deepish brown. Sporidia 2-locular, oval or ellipsoid, brown,  $\cdot 00030''$  to  $\cdot 00045''$  long and  $\cdot 00015''$  to  $\cdot 00022''$  broad.

(2.) On dead twigs, Illartlek glacier. Apothecia minute and subspherical, black, maintaining their black hue under moisture. Hymenial gelatine blue with iodine. Tips of paraphyses very deep brown; filaments very deep blue with iodine. Asci pale blue with iodine,  $\cdot 0015''$  long and  $\cdot 0006''$  broad; 8-spored. Sporidia 2-locular, brown or olive, ellipsoid, straight or slightly curved, sometimes figure-8-shaped. In young state frequently simple, sometimes containing nuclei instead of loculi. Size about  $\cdot 0005''$  to  $\cdot 0006''$  long and  $\cdot 0002''$  to  $\cdot 0003''$  broad.

(3.) Athalline; parasitic on the white (bleached) decayed thallus of various *Umbilicariæ*. Apothecia small, black, crowded, subspherical, nearly superficial, the base only being slightly sunk in the alien thallus. Hymenial gelatine blue with iodine. Asci 8-spored,  $\cdot 00150''$  long and  $\cdot 00045''$  broad. Sporidia variable in size and shape, 2-locular, ellipsoid or oval, sometimes figure-8-shaped\*, olive,  $\cdot 00045''$  long and  $\cdot 00015''$  broad.

I believe, on the one hand, that systematists of the modern Continental school of lichenology would make a separate species of the last-named "form" or condition of *myriocarpa*, simply because it is athalline, and occurs in an unusual habitat in a foreign country; and, on the other, that many so-called athalline parasitic "species" of *Lecidea* are mere conditions of commonly spread types (e. g. *parasema* and *disciformis*).

8. *L. discoënsis*, n. sp.† Thallus subfoliaceous or parmelioid, microphylline, whitish or grey, resembling that of some forms of *Physcia stellaris*. Apothecia (only one mature) those of a *Lecidea*, both the flat disk and inconspicuous exciple being black. Sporidia resembling those of the *stellaris* group of *Physciæ* in size, colour, and form, being 2-locular, oval or ellipsoid, straight or somewhat curved, deep olive,  $\cdot 0006''$  to  $\cdot 0009''$  long,  $\cdot 00030''$  to  $\cdot 00045''$  broad. Asci 8-spored,  $\cdot 0030''$  long,  $\cdot 0009''$  broad. The plant bears certain resemblances to *L. grænländica*, which differs in the colour of its thallus and the structure of its sporidia. It has also certain points of resemblance to *Physcia obscura*,

\* Figure-8-shaped sporidia differ from those that are soleæform by the equality of the halves of which they consist. The upper half of the soleæform sporidium is broader, longer, or otherwise larger than the lower.

† The specific name *discoënsis* is borrowed from the island of Disco.



var. *adglutinata*, and to *Lecidea adglutinata* of Nylander's Exs. The latter, however, has simple sporidia, while the colour of the thallus is also very different.

9. *L. alpicola*, Sch.—Jakobshavn. On gneiss, associated with *L. geographica*, L., both in fruit. The former has paler areolæ, generally also subconvex or pulviniform. The apothecia also are more convex and more frequently seated on, as well as between, the areolæ. The sporidia of *alpicola* are here regularly 2-locular, olive or brown, oblong or oval, sometimes figure-8-shaped or soleæform, or assuming various irregularities of outline and size. Size about ·0006" to ·0009" long and ·0003" to ·0004" broad. In the young state, occasionally simple and granular, or full of nucleiform corpuscles. In age, the sporidia frequently split at the septum, the halves occurring on the field of the microscope intermixed with full-sized sporidia.

Th. Fries (L. Arct. p. 236) considers *alpicola* a variety of *geographica*; and in one sense he does so correctly, inasmuch as the 2-locular sporidia become in some cases muriform; that is, their characteristic form in *alpicola* passes into that supposed to be peculiar to *geographica*. But in the Greenland plant the sporidia are constantly 2-locular. In a specimen of *geographica* on basalt, collected by myself on the hills above Balthayock, near Perth, in April 1858, besides sporidia of the ordinary (muriform) character, are others, apparently young ones, which are colourless, broadly ellipsoid, and 2-locular.

If *alpicola* is to be associated with *geographica*, the same principle would require the association of *atro-alba* with *petræa*, and *myriocarpa* with *disciformis*. Such a procedure would reduce to a very large extent the present enormous number of *Lecideæ*, by enlarging, or adding to, the comprehensiveness of the definitions of "species," and degrading from the rank of species many *Lecideæ* which at present hold this separate position in classification. Of the general principle involved in such a procedure, and of the consequent practice, I most thoroughly approve. But there are great difficulties in carrying the principle out in practice, sometimes from the extreme variability of organs, sometimes from the unequal values in different genera of the same organs as specific characters.

10. *L. galbula*, Ram. A sterile thallus (only), which I assign to this species, occurs in the present collection. It is of a much more brilliant green than that of *L. geographica*, and has more convex or pulviniform areolæ. Only sometimes does this species, so called, exhibit the beautiful citrine yellow of *Lecidea citrinella*, *L. lucida*, *Coniocybe furfuracea*, or *Evernia vulpina*. The plant is not mentioned as a Greenland lichen by Th. Fries (L. Arct. p. 176, where it is described as *Catolechia pulchella*, Schrad.). It seems to me referable to the section *Buellia*, and undeserving a separate generic name.

11. *L. fusco-atra*, L.—Jakobshavn. On gneiss; apothecia abundant; associated and apt to be confounded with *L. atro-alba*, requiring microscopical examination for its distinction. The thalline areolæ are sometimes small, subconvex, and pale, resembling those of *atro-alba*. In the young state they are sometimes sparsely scattered, and their convexity is such that they have the character externally of certain immarginate apothecia. The disk of the apothecium is sometimes white-pruinose, as in *L. abietina*. In Europe, the thallus of *fusco-atra* is occasionally the seat of certain parasites, e. g. *Verurrcaria gemmifera*, Tayl.



12. *L. atro-brunnea*, Ram. I have seen no Greenland specimens; but in Nylander's Exs. the paraphyses are  $\cdot 0023''$  long, their tips indigo-blue; the sporidia irregular in form and size, simple,  $\cdot 00025''$  long and  $\cdot 00013''$  broad.

13. *L. Vahliana*, n. sp. Thallus with the characters of that of *fusco-atra* and *atro-brunnea*; and its sporidia are also simple, but their colour is constantly olive or brown. The hymenial gelatine gives a beautiful blue with iodine. The tips of the paraphyses are agglutinated and pale brown. The sporidia vary considerably in size, generally  $\cdot 00030''$  long and  $\cdot 00022''$  broad; their form generally oval or oval-oblong; frequently granular in the young state; generally with double contour in maturity. They are very numerous and distinct, in which characters they contrast with the sporidia either of *fusco-atra* or *atro-brunnea*. I name this lichen after the distinguished Danish botanist, J. Vahl, by whom the greater part of the Greenland lichens described in Fries's 'L. Arctoi' were collected.

14. *L. Campsteriana*, n. sp.—Atanakerdluk. Thallus resembling that of *L. geographica* as to colour. It is, however, thicker, and more tartareous, its areolæ more pulviniform. The apothecia are black, convex, becoming sometimes subspherical; immarginate, or having sometimes a spurious thalline border. They thus resemble the apothecia of *Lecanora sulphurea*, in being sometimes sublecanorine, though more properly or usually they are lecideine. *Polytropia* is another *Lecanora*, which, like *sulphurea*, has a better title to rank as a *Lecidea*, its apothecia being much more frequently immarginate and lecideine than possessing a conspicuous thalline exciple. The sporidia of *Campsteriana* are small, ellipsoid, simple, and colourless.

*Campsteriana* possesses some of the characters of the following *Lecideæ*, with which I have carefully compared it. But it differs sufficiently to induce me to give it separate rank, until at least it is fully examined in different conditions and stages of growth.

(1.) *Lecidea sulphurella*, Th. Fries (L. Arct. p. 221), if it deserves specific rank. *Campsteriana* appears to agree more closely with this than with the species that follow; but I have seen no specimen of Fries's plant.

(2.) *Lecanora calcarea*, Kudlesæt. Sporidia and apothecia the same; but the colour and farinosity of the thallus constitute points of difference.

(3.) *Lecidea elata*, Schær., Hepp's Exs. No. 250. Thallus not so green as that of *Campsteriana*; while the apothecia are generally flatter, and more frequently have no exciple.

(4.) *L. viridi-atra*, Mudd (Brit. Lich. p. 205; E. Bot. t. 2030), not at all Hepp's No. 255. Thallus and apothecia as in *L. elata*.

(5.) *L. Kochiana*, Sch., Hepp's Exs. No. 239; and *Lecanora sulphurea*, Ach.

The coincidence in name between the enterprising explorer of Vancouver Island and the collector of the Lichens described in the present memoir, on the one hand, and the late distinguished Director of the Botanical Department of the British Museum, on the other, forbids my attaching the name of *Robert Brown* to any of the new species now described, as not being a sufficiently distinctive designation\*. Desirous, nevertheless, of

\* The more especially seeing that various arctic lichen-collections were named by the late Robert Brown, F.R.S., e. g. those made during the discovery-voyages of Sir John Ross, Sir Edward Parry, and Dr. Scoresby. [Vide my Paper on the "Greenland Lichen-flora," pp. 35 and 47.]



marking my opinion of the value of the explorations and botanical collections of *the present* or first-named Robert Brown (Junior or Secundus), I have borrowed a specific name from the ancestral acres in Caithness, which were at one time, I believe, in his possession, or in that of his family, viz. the small estate of Campster (also his birth-place); and I have attached *its* name to the most beautiful of the *Lecideæ* which occur in his Greenland collection of 1867.\*

15. *L. parasema*, Ach.—Illartlek glacier; Godhavn. Corticolous, muscicolous, and athalline. Occurs in various forms, of which the following were the chief met with:—

(1.) Associated with corticolous forms of *Lecanora sophodes*; athalline, on bleached, whitened twigs; or with a thin white thallus, coating the bark of birch; or seated on the thallus of the *Lecanora*. Apothecia very minute, black, flat, margined, becoming convex and immarginate, resembling in size and other external characters those of *L. pinicola*, Auct., or some forms of *Abrothallus Smithii*. Hypothecial tissue brown. Tips of paraphyses agglutinated, irregular and brown; filaments indistinct throughout their length. Asci 8-spored, very pale blue with iodine; sublinear or ribbon-like; in tufts; frequently bulging from the pressure of the contained sporidia, which are generally arranged in single series. The sporidia are most variable in form, less so in size. In this respect, as well as frequently in their granular or nucleiform contents, they resemble gonidia on the one hand, and stylospores on the other. Their size is usually  $\cdot 00045''$  long and  $\cdot 00030''$  broad. In maturity, and especially while still within the asci, they are frequently spherical, as much so as those of *Lecideia lugubris*, *Pertusaria paradoxa*, or *Sphærophoron coralloides*, than which, however, they are much larger. Frequently also they are oval or oblong-oval, becoming variously pyriform or otherwise irregular in outline. They are always simple and colourless. Generally, especially in the young state, they are finely granular or muco-granular, the degree of granularity being in proportion to their immaturity. At other times they exhibit one large, spherical, central nucleus, or two or more prominent, subcentral nuclei, differing in size. Sometimes they possess double contour.

(2.) On birch-bark, associated with *Lecanora sophodes*. Accompanies the same *Lecanora* also on moss, grass-stems, twigs, and other forms of decayed and generally bleached vegetation. Athalline. Apothecia subspherical, immarginate; black when dry and young. After being thoroughly moistened, in mass or only on section, they assume a port-wine-red colour—a colour that is sometimes also obscurely exhibited in the natural state in old or degenerate apothecia. This character constitutes a link of connexion with *L. sanguineo-atra*, into which *parasema* in Greenland seems to pass. So intimate is this connexion, that it is frequently difficult to determine to which species to assign certain specimens with reddish-black apothecia and simple sporidia. Both apothecia and sporidia are generally longer than in form No. 1 (above described). But there is here also great variability of size and form. The largest sporidia occur in the old, subspherical, reddish apothecia. Their size is sometimes nearly  $\cdot 0006''$  long and  $\cdot 00040''$  broad, the shape being oval or ellipsoid. More frequently they are spherical, and then are often about  $\cdot 00045''$  in diameter. In this case, as in form No. 1, they are apt to be confounded with gonidia, which they resemble, save as to colour. They are always simple, seldom granular, pro-

\* The same name has also been conferred upon a *Verrucaria*, described under *Lecanora tartarea*.



bably because here they are mostly either old or mature; but frequently they contain one or more large spherical nuclei, which become lemon-yellow and distinct under iodine.

(3.) Muscicolous; associated with *Lecanora tartarea* and *L. oculata*. Apothecia black, convex, and immarginate. Sporidia oval or ellipsoid, simple, colourless:  $\cdot 0006''$  long and  $\cdot 00022''$  broad; very granular in the young state, the granules being large, uniform in size, and nucleiform; with double contour in maturity; sometimes tapering at one end into a filament or tubule, as the first step towards germination. Hymenium deep blue with iodine. The apothecia are the seat of a minute, black, papillæform parasite, containing olive or brown spores, frequently associated in ramose chains. Intermixed with the sporidia of *parasema* on, or in, some apothecia, I have met with stray sporidia of *L. petræa*\*.

(4.) Also associated with *Lecanora tartarea*, about the Illartlek glacier. Hymenium giving a more vivid blue with iodine than the other Greenland forms of *parasema*; while the sporidia are larger, more numerous and distinct. They are broadly ovate, with double contour, full of large nucleiform granules,  $\cdot 0006''$  long and  $\cdot 0005''$  broad.

(5.) Godhavn; associated with *Squamaria saxicola*, on stones and rocks. Sporidia differing from those in the other forms by their inferior size and breadth, being simple, narrowly ellipsoid, or ellipsoid-oblong,  $\cdot 0003''$  long and  $\cdot 00009''$  broad.

16. *L. sanguineo-atra*, Ach.; associated with *Lecanora tartarea* and *Parmelia saxatilis*, var. *panniformis*; on decayed mosses, foliaceous lichens, and other vegetation. Thallus a grey or white, thin crust, sometimes verrucose and very irregular, resembling that of some forms of *L. tartarea*. Apothecia convex, adnate, immarginate, minute, crowded, apparently black when dry. Under moisture they become semitranslucent and port-wine-red. Hymenium pale violet, or pale or deep blue, with iodine. Hypothecial tissue and tips of paraphyses brown. Sporidia very variable in size and form; always colourless and simple; oval, broadly or narrowly ellipsoid, or subspherical; with double contour; margin varying in breadth and distinctness, being sometimes as broad as in *Pannaria brunnea*; sometimes granular or muco-granular when young. Size  $\cdot 0004''$  to  $\cdot 0009''$  long,  $\cdot 0003''$  to  $\cdot 0004''$  broad. Spermogonia apparently occur as very minute, scattered, brown, punctiform conceptacles; but they exhibit no structure. The plant has much of the character of *Biatora tornoënsis*, Nyl. (Th. Fries, L. Arct. p. 196); and it may be compared also with *Biatora uliginosa*, *Lecidea sabuletorum*, and *L. turgidula*, as defined in the 'L. Arctoi.' In Nylander's Exs. No. 72, the sporidia of *sanguineo-atra* are very much smaller and narrower than is common in the Greenland plant. *L. sanguineo-atra* has many close allies, such as *fusco-rubens*, Nyl., *atro-rufa* and *uliginosa*, Ach. Many of these so-called species would be more properly arranged as mere forms of one variable type!

17. *L. Friesiana*, n. sp. On moss; associated with *Lecanora tartarea*, *L. sophodes*, and *Pannaria brunnea*, about the Illartlek glacier. The apothecia vary in size, thickness, colour and form. Their normal condition appears to be flat, round, marginate, very thin sometimes, and of a beautiful port-wine-red colour. More frequently, however, they are variously convex, confluent, very compound, large and deformed, sometimes verrucæform.

\* Vide *L. petræa*, No. 5, p. 354.



Occasionally they resemble minute saucers made of red-coloured gelatine, or they are opaque, as if from intermixture of their colouring-matter with a whitish pruina. The translucency is in all cases assisted by moisture. Sometimes the disk is covered with a peach-coloured or whitish bloom, pruinosity being less common in the convex, deformed apothecia. The colour of the disk is sometimes that of light sherry or of flesh, or it assumes various dusky shades of buff- or reddish brown; in some cases it becomes black. The brown and black hues are usually the results of age. The exciple, where it exists, is very thin. The outline and surface of the whole apothecium become, when flattish, sometimes wavy or flexuous. Very seldom there is slight concavity of the disk. In all forms of apothecium the hymenium and its contents are the same. The hymenium gives, occasionally only, a very pale blue with iodine. The paraphyses and asci are indistinct. The sporidia vary considerably in structure. In all cases they are colourless. Their shape is generally fusiform or narrowly ellipsoid, and straight, sometimes slightly curved or crescentic. Their size varies from  $\cdot 0006''$  to  $\cdot 0009''$  long and  $\cdot 00020''$  to  $\cdot 00025''$  broad. In the young state, they are usually simple—sometimes granular or muco-granular—occasionally with faint double contour. In maturity and age they are from 2- to 4-locular, the septa frequently being obscurely marked. Those sporidia which are 2-locular, sometimes split in age at the central septum; whence it happens that half-sporidia occur with the entire forms on the microscope-field. Both in the young and the old state, instead of distinct loculi and septa, they exhibit sometimes two or more large spherical nuclei, usually central, sometimes bipolar, with irregular outline in age.

The plant has many of the characters of *Biatora castanea*, Hepp (Exs. No. 270, and Th. Fries, L. Arct. p. 195), and of *Biatora Berengeriana*, Mass., as I collected it in Norway in 1857, and as it is described (sub nom. *B. miscella*) in L. Arct. p. 194\*. In certain respects, however (*e. g.* the sporidia), it differs from both.

I dedicate this beautiful Greenland *Lecidea* to the distinguished author of the 'Lichenes Arctoi' and 'Lichenes Spitsbergenses' as an acknowledgment of the value of his many Contributions to the Lichen-Flora of Scandinavia and the Arctic regions.

18. *L. vernalis*, L. (according to the restricted definition of Th. Fries, L. Arct. p. 191, who places it in *Biatora*, which has *simple* sporidia). Muscicolous, about the Illartlek glacier; associated with *Lecanora sophodes* and *Peltigera canina*, Lyngemarken; on decayed stems of herbaceous plants, Jakobshavn. The colour of the apothecia is very variable, and to a less extent their size, convexity, number, and degree of crowding. They are always convex and immarginate. They sometimes exhibit externally the varying characters of those of *Lecanora cerina*, *ulmicola*, and *leucoræa*, and of *Lecidea luteola*; from all which, however, the sporidia distinguish *vernal*. In all the Greenland forms the sporidia are simple, but they vary considerably in size and shape. Most usually they are fusiform or narrowly ellipsoid, with or without a faint double contour. Sometimes they are granular in the young state. Their size is about  $\cdot 00045''$  to  $\cdot 00090''$  long and  $\cdot 00015''$  broad. In one form (from Lyngemarken) they are oval, like the larger sporidia of *parasema*, and  $\cdot 00050''$  to  $\cdot 00060''$  long by  $\cdot 00025''$  broad. In this form the asci are 8-spored and bulge

\* The reader may also compare certain North-American corticolous *Biatoræ*, *e. g.* *B. porphyritis*, Tuckerman (Synopsis, p. 61) and its allies.



from the pressure of the contained sporidia; they are  $\cdot 0018''$  long and  $\cdot 0006''$  broad. The hymenial gelatine always gives a blue with iodine, varying, however, in tint, pale in Illartlek forms—dark Prussian blue in those from Lyngemarken. In the latter forms, paraphyses, asci, and sporidia are all indistinct. In other forms, the constituents of the hymenium are also indistinct. In some cases the tips of the paraphyses are very deep brown: more generally they are pale brown and agglutinated. The section of the hymenium under the action of iodine is sometimes a beautiful microscopic object, *e. g.* in the Lyngemarken forms.

The sporidia of *vernalis*, as defined by Nylander (Scand. p. 201), are simple or 2-locular\*; and I have frequently met with British lichens, referable, I think, to *vernalis*, whose sporidia are variable in their structure. But the present rigid system of classification, according to the character of the sporidia, places those forms with simple sporidia in *Biatora*, and those having 2-locular ones in *Biatorina*! This is only one of many illustrations that may be cited to show the awkwardness and arbitrary character of the too elaborate generic distinctions of modern systematists! Th. Fries himself remarks upon the multiplicity of forms included under *vernalis*, and the repulsive confusion of its nomenclature or synonymy.

#### Genus 20. NORMANDINA.

1. *N. viridis*, Ach.—Lyngemarken. Sterile as usual. Thallus covered with a vermilion-red, roe-like powder or granular matter, having the characters of soredia, and containing gonidia of the normal type. Both genus and species occupy a position in relation to *Cladonia* as provisional and anomalous as that of *Thamnolia vermicularis*. The apothecia of the *Normandina* are unknown. Fries, father and son, are disposed to refer it to *Cladonia*; but its thallus is much more delicate than the phyllocladia of that genus usually are, while it differs also in its concentric striation or banding. By other authors it is associated with *N. Jungermannia*, which has endocarpoid apothecia.

#### Pseudo-genus 21. PYRENOTHEA.

1. *P. grænländica*, n. sp. Consists only of *spermogonia*, which therefore cannot be referred to the species to which they must belong. The thallus is olive-coloured and verrucæform. The spermogonia are perched on the apices of the thalline verrucæ; they are always black and conspicuous, but they vary considerably in size and form. They are mostly small and papillar, but sometimes large and discoid, having quite the aspect of some lecideoid apothecia. The outline of these flattish, large, discoid forms is generally more or less irregular. The spermatia are apparently straight rods seated on sterigmata, which consist of only two or three linear simple articulations.

The plant has various of the characters of the British *P. corrugata* (as regards its perithecia), of *P. sulphurea* and *P. lithina* (as respects its thallus). The two latter are probably referable to *Verrucaria chlorotica*, Ach. (= *trachona*, Ach.), which, however, does

\* Thus they are both simple and 2-locular in an athalline form which grows on the decayed thallus of various *Peltideæ*.



not appear to occur in Greenland. Possibly *P. grælandica* may belong to *Verrucaria clopima*, Whlbn., which does occur in Greenland, according to Th. Fries.

Closely resembling *P. grælandica* is a saxicolous lichen sent me in 1858 by Mr. Carroll as an unknown *Lecidea*, collected by Miss Hutchins, and doubtless Irish; but no locality was given. The perithecia, supposed to be apothecia, are *spermogonia*, containing rod-shaped spermatia about  $\cdot 00014''$  long and  $\cdot 00005''$  broad—borne on simple, linear, filiform sterigmata—branching simply (generally bifurcating) at their base: about  $\cdot 0005''$  long with spermatia attached. The thallus (on which the spermogonia are scattered, unassociated with apothecia of any kind) is deep olive-green, crustaceous, verrucose-rugose, frequently becoming subpulverulent. They are seated on the wart-like elevations of the thallus, at first partly immersed, their apex always protruding, latterly quite emergent. In their young, semiimmersed state they are verrucarioid, with regular or irregular ostioles. As they become older they gradually expand and become flattened out, so as to assume a lecideoid character. There is then a sort of disk with a thin margin, which is flexuous but entire. In this condition the perithecia frequently resemble in size and appearance the apothecia of *Lecidea chalybeia*, Borr., or the spermogonia of *Lecanora Ehrhartiana*, Ach. \*, which constitute *Cliostomum corrugatum*, Fr. The spermogonal walls consist of a deep blackish-brown cellular tissue. The spermogonia of the Irish *Pyrenothæa* are probably what Leighton describes and figures as *P. lithina* †. By some lichenologists *P. lithina* is assigned to *Verrucaria chlorotica*, Ach., by others to *V. umbrina*, Whlbn. ‡ as their spermogonia. The thallus is quite that of some saxicolous *Verrucariæ*, but it is also that of certain saxicolous *Lecideæ*, to which it is equally likely it may belong. *V. chlorotica* is represented as possessing both pycnidia and spermogonia.

Possessing certain characters common to both *P. grælandica* and *P. lithina* are:—

(1.) *P. sulphurea*, Leight. (Ang. Lich. p. 69, pl. 29. fig. 5), which is referred by some lichenologists to *V. chlorotica* as spermogonia; and

(2.) *P. mollis*, Leight. (Ang. Lich. p. 67, pl. 29. fig. 2.), which is a *Verrucaria*, according to Taylor, but is undoubtedly, like the other *Pyrenothææ* above-mentioned, the spermogonia of some lichen, if I may judge from a specimen in my herbarium—on rock from the top of Carig mountain, co. Kerry.

\* Mudd, 'Brit. Lichens,' p. 177.

† 'Angiocarpous Lichens,' p. 68, pl. 29. fig. 3.

‡ = *Endocarpon lithinum*, Leight., Mudd, 'Brit. Lichens,' p. 281.



## DESCRIPTION OF THE PLATES.

## PLATE XLVIII.

- Figs. 1-5. *Calicium furfuraceum*, L.
1. Schærer's Exs. 14: *a*, sporidia; *b*, sterigmata and spermatia.
  2. Var. *fulva*, L. Schær. Exs. 296: sporidia.
  - 3-5. Var. *sulphurella*, Fr.
    3. Schær. Exs. 639: sporidia.
    4. Nylander, Exs.: sporidia.
    5. Hepp, Exs. 154: sections of spermogone, showing sterigmata and spermatia.
- Fig. 6. *Cladonia alcicornis*, Flk., Leighton, Exs. 15: stylospores of parasitic pycnidia.
- Fig. 7. *C. cervicornis*, Ach., Jakobshavn: *a*, portion of thallus, showing the pseudo-spermogonia; *b*, cellular tissue of one of their perithecia; *c*, spores.
- Fig. 8. *C. gracilis*, L., Jakobshavn: *a*, spore-chains of parasite; *b*, alien sporidium (Buelliod).
- Fig. 9. *C. bellidiflora*, Ach., Ireland: *a*, portion of thallus, showing the parasitic *Lecidea Cladoniaria*, Nyl.; *b*, section, showing its apothecia and pycnidia.
- Fig. 10. *C. deformis*, L., Jakobshavn: *a*, portion of thallus, showing the pseudo-apothecia; *b*, one of these stipitate pseudo-apothecia isolated; *c*, spore-chains.
- Fig. 11. *C. degenerans*, Flk., Godhavn: *a, b*, portions of thallus, showing the marginal spermogonia; *c*, spermogonia isolated.
- Fig. 12. *C. fimbriata*, Hffm., Jakobshavn: *a*, portion of a podetium covered with the parasitic pycnidia; *b, c*, sections of one of the latter; *d*, isolated stylospores; *e*, isolated stylospores with basidia still attached.
- Fig. 13. *C. deformis*, L., Schær. Exs. 49: stylospores of parasitic pycnidia.
- Fig. 14. *Lecidea cladoniaria*, Nyl., on *Cladonia uncialis*, L., Birnam Hill: stylospores and basidia of pycnidia.
- Fig. 15. *Thamnolia vermicularis*, Sw., Jakobshavn: *a*, cornute condition; *b-g*, *Microthelia vermicularia*, Linds.: *b*, perithecia; *c*, spermogonia; *d*, asci; *e*, sporidia; *f*, spermatia; *g*, oil-globules.
- Fig. 16. *Cetraria islandica*, Ach., Norway, bearing the parasitic *Lecidea cetraricola*, Linds.: *a*, portion of thallus, showing the deformed apothecia of the *Lecidea*, and the cyphellæ of the *Cetraria*; *b*, sections of the said apothecia; *c*, section of hymenium in Braemar forms, showing an ascus (under iodine), and sporidia.
- Fig. 17. *C. nivalis*, L., Jakobshavn: portions of thallus showing the marginal spermogonia.
- Fig. 18. *Dactylina arctica*, Br., Kikerton Islands: *a*, portion of thallus, showing spermogonia; *b*, section of a spermogone, showing sterigmata and spermatia; *c*, sporidia.
- Fig. 19. *Nephroma arcticum*, L., Godhavn: *a*, portion of thallus, showing marginal spermogonia; *b*, free spermatia.
- Fig. 20. *Peltigera canina*, Hffm., Lyngemarken: *a*, portion of thallus showing an apothecium and marginal pycnidia; *b*, stylospores and basidia of pycnidia; *c*, sporidia; *d*, oil-globules.
- Fig. 21. *P. canina*, on tufts of *Bolax*, Falkland Islands, Dr. Hooker, in Herb. Kew: sporidium.
- Fig. 22. *P. canina*, Schær. Exs.: *a*, ascus and its protoplasm under the action of iodine; *b*, sporidia.
- Fig. 23. *P. canina*, Scotland: *a*, section of hy-



- menium, showing ascus and paraphyses; *b*, sporidia, one under iodine.
- Fig. 24. *Lecidea Egedeana*, Linds., on *Parmelia saxatilis*, Ach., Jakobshavn: *a*, section of hymenium under iodine; *b*, sporidia.
- Fig. 25. *Peltigera scabrosa*, Th. Fr., Kikerton Islands: *a*, ascus; *b*, sporidia.
- Fig. 26. *Physcia stellaris*, L., Jakobshavn: *a*, sporidia; *b*, spermatia and sterigmata.
- Fig. 27. *Parmelia stygia*, L., Jakobshavn: sporidia.
- Fig. 28. *Cladosporium lichenicolum*, Linds., on *Peltigera canina*, Braemar.
- Fig. 29. *Parmelia saxatilis*, Barmouth, bearing the parasitic *Dothidea homostegia*, Nyl.: *a*, sections of parasitic perithecia.
- Fig. 30. *Dothidea otagensis*, Linds.: sporidia [after Cooke\*].
- Fig. 31. *D. homostegia*, Nyl.: *a*, section of a compound perithecium; *b*, sporidia [both after Cooke\*].
- Fig. 32. *Lecanora frustulosa*, Ach., Jakobshavn.: sporidia.
- Fig. 33. *L. badia*, Ach., Jakobshavn: sporidia.
- Fig. 34. *L. badia*, G. Don, 1805, in Herb. Kew: sporidia.
- Fig. 35. *Lecidea badio-atra*, Flk., Nyl. Exs.: sporidium.
- Fig. 36. *L. atro-brunnea*, Ram., Schær. Exs. 444: sporidia.
- Fig. 37. *L. atro-brunnea*, Nyl. Exs.: sporidia.
- Fig. 38. *L. galbula*, Ram., Pyrenees, Spruce & Babington, in Herb. Kew: sporidia.

## PLATE XLIX.

- Fig. 1. Parasite on *Solorina crocea*, L., Ben Lawers: *a*, sections of its perithecia.
- Fig. 2. Parasite on *S. crocea*, Kerry: *a*, stylospores.
- Fig. 3. Parasite on *S. crocea*, Lyngemarken: *a*, free sporidia; *b*, section of hymenium.
- Fig. 4. Parasite on *S. crocea*, Himalayas: sporidia.
- Fig. 5. *Umbilicaria cylindrica*, L., Jakobshavn: *a*, apothecia; *b*, sporidia.
- Fig. 6. *U. cylindrica*, Nyl. Exs.: sporidia.
- Fig. 7. *U. cylindrica*, Scotland: sporidium.
- Fig. 8. *U. arctica*, Ach., Jakobshavn: sporidium.
- Fig. 9. *U. anthracina*, Wulf., Norway: *a*, section of hymenium under iodine; *b*, *c*, two forms of sporidia.
- Fig. 10. *U. spodochoa*, Hffm., Norway: *a*, ascus with rudimentary sporidia; *b*, free sporidia.
- Fig. 11. Parasite on *U. vellea*, L., Dunoon and Norway: *a*, section of hymenium, showing asci (one under iodine) and rudimentary sporidia; *b*, free sporidia.
- Figs. 12, 13. *Pannaria brunnea*, Sw., Jakobshavn and Illartlek: *a*, sections of hymenium, showing asci with young sporidia, and paraphyses; *b*, free sporidia.
- Fig. 14. *Squamaria chrysoleuca*, Sm., Kudlesæt: *a*, section of hymenium under iodine; *b*, free sporidia.
- Fig. 15. *S. chrysoleuca*, Schær. Exs. 345: *a*, *b*, two forms of sterigmata and spermatia.
- Fig. 16. *S. chrysoleuca*, Nyl. Exs.: sporidia.
- Fig. 17. *S. elegans*, Link., Jakobshavn: *a*, tips of paraphyses; *b*, isolated articulations of paraphyses; *c*, sporidia; *d*, sporidia of parasite.
- Figs. 18, 19. *Lecanora calcarea*, Ach.; Jakobshavn and Kudlesæt: sporidia.
- Fig. 20. *L. calcarea*, Ach.: *a*, Northumberland, W. Robinson, 1812; *b*, Switzerland; *c*, Pyrenees, Spruce and Babington; *d*, var. *concreta* = Schær. Exs. 476: all in Herb. Kew; sporidia.
- Fig. 21. *L. subsophodes*, Nyl., Arctic America, Franklin's first land journey; in Herb. Kew: sporidium.
- Fig. 22. *Lecidea petraea*, Wulf., Schær. Exs. 178: sporidium.
- Fig. 23. *Lecanora sophodes*, Ach., Schær. Exs. 569: sporidium.

\* In letter of date 1867.



## PLATE L.

- Fig. 1. *Lecanora tartarea*, L., and its parasite *Verrucaria tartaricola*, Linds., Godhavn: *a*, perforate apothecium of the *Lecanora*, and section thereof; *b*, sporidia; *c, d*, warts bearing the parasitic perithecia (*c*) and spermogonia (*d*); *e*, section of said perithecia; *f*, asci, with young sporidia; *g*, free sporidia.
- Fig. 2. Parasite (*Verrucaria Campsteriana*, Linds.) on var. *gonatodes*, Ach., Illartlek glacier: *a*, sections of perithecia; *b*, section of hymenium under iodine; *c*, free sporidia.
- Fig. 3. Parasite on *L. tartarea*, Braemar: *a*, section of thalline warts, and the parasitic perithecia.
- Fig. 4. Parasite on var. *frigida*, Sw., Lyngemarken: spores.
- Fig. 5. *L. oculata*, Ach., and its parasites, Illartlek: *a*, punctiform parasite, with its *Torula* spores (*b*) and stylospores (*c*); *d*, *Pertusaria paradoxa*, Linds.; *e*, section of one of its perithecia; *f*, section of hymenium; *g*, free sporidia.
- Fig. 6. *L. oculata* (sub *Isidium*, Ach.), named by Acharius himself, in Herb. Kew: sporidium.
- Fig. 7. *Lecidea fuscescens*, Smrf., Nyl. Exs., 135. *a*, section of hymenium (one ascus under iodine); *b*, free sporidia.
- Fig. 8. *Lecanora bryontha*, Ach., Illartlek: one-spored asci (one under iodine); *a*, oil-globules.
- Fig. 9. *L. ventosa*, Ach., with its parasite, Lochnagar: *a*, section of hymenium; *b*, sections of perithecia; *c*, spores.
- Fig. 10. *L. ventosa*, Lochnagar, bearing the parasitic *Sphaeria ventosaria*, Linds.
- Fig. 11. *L. ventosa*, Spittal of Glenshee: *a*, sections of apothecium of the *Lecanora*, and of the parasitic perithecia (*Sphaeria*).
- Fig. 12. Sporidia of *Sphaeria ventosaria*, Linds.: Glenshee.
- Fig. 13. *Lecanora ventosa*, Schær. Exs. 320: sterigmata and spermatia.
- Fig. 14. Sporidia of *Sphaeria ventosaria*, Jakobshavn.
- Fig. 15. Spermogonium on an apothecium of *Lecanora subfusca*, L., Corramulzie.
- Fig. 16. Two parasites on apothecia of *L. albella*, Pers., Morchone: sporidia.
- Fig. 17. Pycnidia on *L. subfusca*, Kinnoull Hill: basidia and stylospores.
- Fig. 18. Pycnidia of *L. albella*, Pers., Hepp 187: section showing stylospores and basidia.
- Fig. 19. Spermogonia on *L. subfusca*, Dunglass: sterigmata and spermatia.
- Fig. 20. Pycnidia on *L. subfusca*, Scotland: stylospores.
- Fig. 21. Spermogonia on, or accompanying, *L. subfusca*, Carrigaloe: sterigmata and spermatia.
- Fig. 22. *L. polytropa*, Ehrh., Egedesminde: sporidia.
- Fig. 23. *Thelidium epipolytropum*, Mudd, parasitic on *L. polytropa*, Ben Lawers: *a*, asci of the *Thelidium* (one ascus under iodine), containing sometimes 4, sometimes 8 sporidia; *b*, free sporidia (one under iodine); *c*, ascus of *L. polytropa*; *d*, sporidia of *L. polytropa*.
- Fig. 24. *L. polytropa*, var., Scotland, Carmichael; referred by Nylander to *L. alpicola*!, by other annotators to *L. frustulosa*; in Herb. Kew: sporidia.
- Fig. 25. *L. polytropa*, Nyl. Exs.: sporidia.
- Fig. 26. *Thelidium epipolytropum*, Mudd, Braemar: ascus and sporidium.
- Figs. 27, 28. *Lecanora sophodes*, Ach., Jakobshavn and Egedesminde: sporidia.
- Fig. 29. *L. sophodes* (form) Illartlek: *a*, apothecium and section; *b*, sporidia.



## PLATE LI.

- Fig. 1. *Lecanora sophodes*, Lyngemarken: *a*, section of hymenium under iodine; *b*, free sporidia.
- Figs. 2, 3. *L. cinerea*, L., Jakobshavn, Ounartok, Atanakerdluk, and Kudlesæt, different forms: sporidia.
- Fig. 4. *Endococcus erraticus*, Mass., parasitic on *L. cinerea*, Scur-na-Gillea: *a*, ascus with young sporidia, hymenial gelatine under iodine; *b*, mature free sporidia.
- Fig. 5. *Lecanora leucoræa*, Ach.; Scher. Exs. 215: sporidia.
- Fig. 6. Alien sporidia on *L. leucoræa*, Hepp, 200.
- Fig. 7. *Lecidea grænlandica*, Linds., Kudlesæt: *a*, portion of psoroid thallus with apothecia; *b*, sections of apothecia and thallus; *c*, section of hymenium, showing asci with young sporidia and paraphyses; *d*, tips of paraphyses and isolated terminal articulations; *e*, free sporidia and oil-globules.
- Fig. 8. *L. geminata*, Flot., Norway: *a*, asci; *b*, free sporidia.
- Fig. 9. *L. geminata*, Schær. Exs. 443: ascus and sporidium.
- Fig. 10. *L. petræa*, Wulf., Egedesminde: sporidium.
- Fig. 11. *L. petræa*, Jakobshavn: sporidia.
- Fig. 12. *Lecidea petræa*, Godhavn: sporidia.
- Fig. 13. *L. petræa*, Illartlek: sporidium.
- Fig. 14. *L. petræa*, Schær. Exs. 183: sporidia.
- Fig. 15. *L. petræa*, Leight. Exs. 93: sporidia.
- Fig. 16. *L. petræa*, Leight. Exs. 159: sporidia.
- Fig. 17. *L. petræa*, Leight. Exs. 184: *a*, spermogonia and section; *b*, sterigmata and spermatia.
- Fig. 18. *Verrucaria rimosicola*, Leight., parasitic on *L. petræa*, Schær. Exs. 183: ascus and sporidia.
- Fig. 19. *L. petræa*, Ounartok: sporidia.
- Fig. 20. *L. atro-alba*, Ach.: Atanakerdluk: *a*, section of hymenium; *b*, free sporidia.
- Figs. 21, 22, 23. *L. atro-alba*, Ach., different forms, Jakobshavn, Egedesminde, Godhavn: sporidia.
- Fig. 24. *L. atro-alba*, [sub *L. ocellata*, Flk. "Gryphiæ"] in Herb. Kew: sporidia.
- Fig. 25. *L. atro-alba*, Kerry: sporidium.
- Fig. 26. *L. myriocarpa*, DC., Illartlek: *a*, section of hymenium under iodine; *b*, free sporidia.
- Fig. 27. *L. myriocarpa*, Jakobshavn: sporidia.
- Fig. 28. *L. myriocarpa*, Hepp 159: sporidia.
- Fig. 29. *L. myriocarpa*, form *terrestris*, Nyl. Exs.: sporidia.
- Fig. 30. *L. myriocarpa*, Anglesea: sporidia.

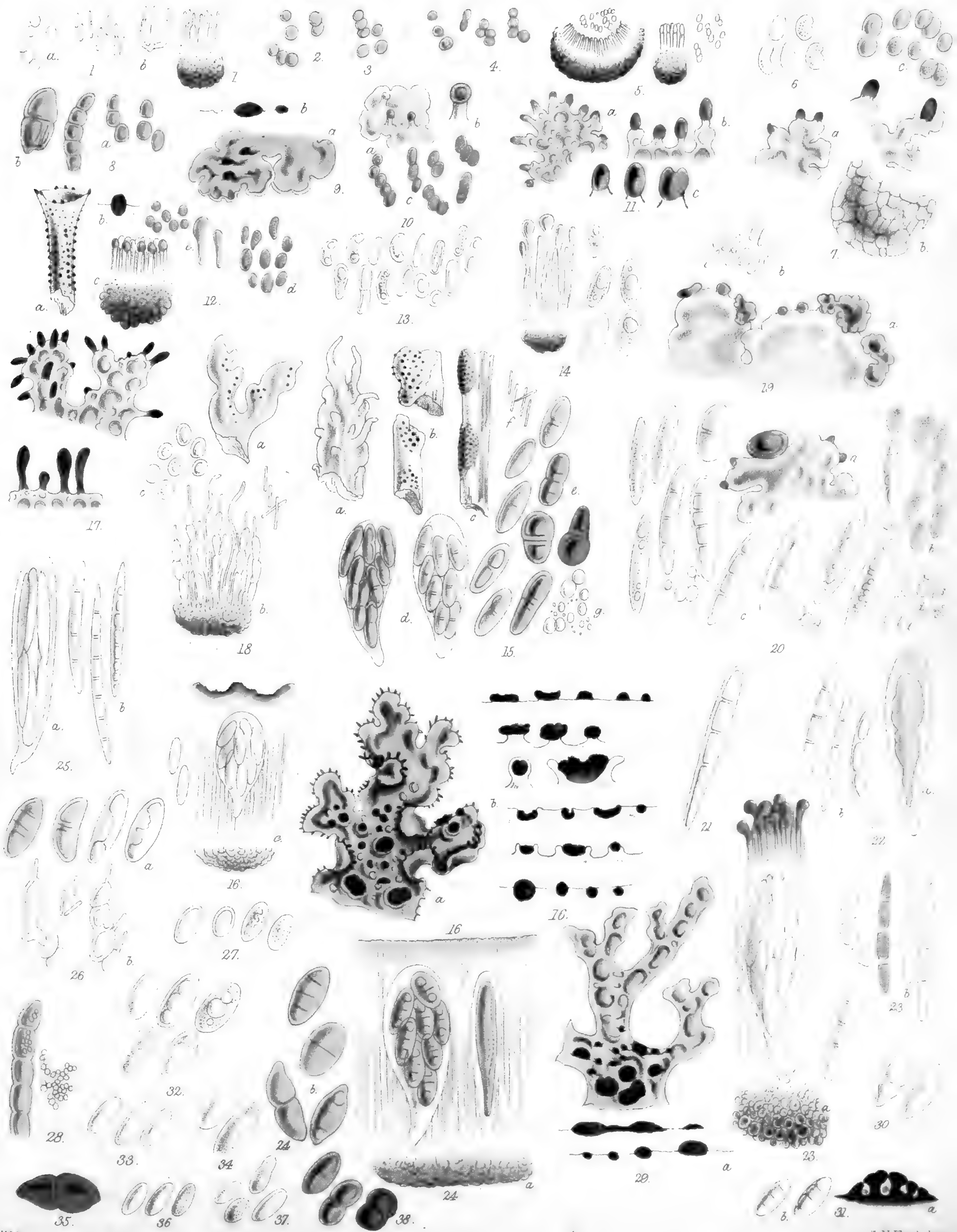
## PLATE LII.

- Fig. 1. *Lecidea insignis*, Næg., Illartlek: sporidia.
- Fig. 2. *L. myriocarpa*, Egedesminde: *a*, section of hymenium, under iodine; *b*, free sporidia.
- Fig. 3. *Lecidea discoënsis*, Linds., Godhavn: sporidia.
- Fig. 4. *L. alpicola*, Sch., Jakobshavn: sporidia.
- Fig. 5. *L. alpicola*, Himalayas, 13,000 ft., in Herb. Kew: sporidia.
- Fig. 6. *L. alpicola*, Schær. Exs. 173: sporidia.
- Fig. 7. *Endococcus erraticus*, Mass., parasitic on *L. geographica*, L., f. *conglomerata*, Schær. Exs. 577: *a*, perithecium; *b*, asci, young and mature; *c*, sporidia; *d*, sporidium of *L. geographica*.
- Fig. 8. *Lecidea geographica*, f. *atro-virens*, Schær. Exs. 623: sporidia.
- Fig. 9. *L. geographica*, f. *pulverulenta*, Schær. Exs. 624: sporidia.
- Fig. 10. Sporidia on the apothecia of *L. geographica*, Leight. Exs. 93.
- Fig. 11. Sporidia of *Endococcus erraticus* on *L. geographica*, Schær. Exs. 322.
- Fig. 12. *Ticothecium stigma*, Körb., parasitic on *L. geographica*, Hepp, 153: *a*, asci with young sporidia, under iodine; *b*, portion of thallus showing the

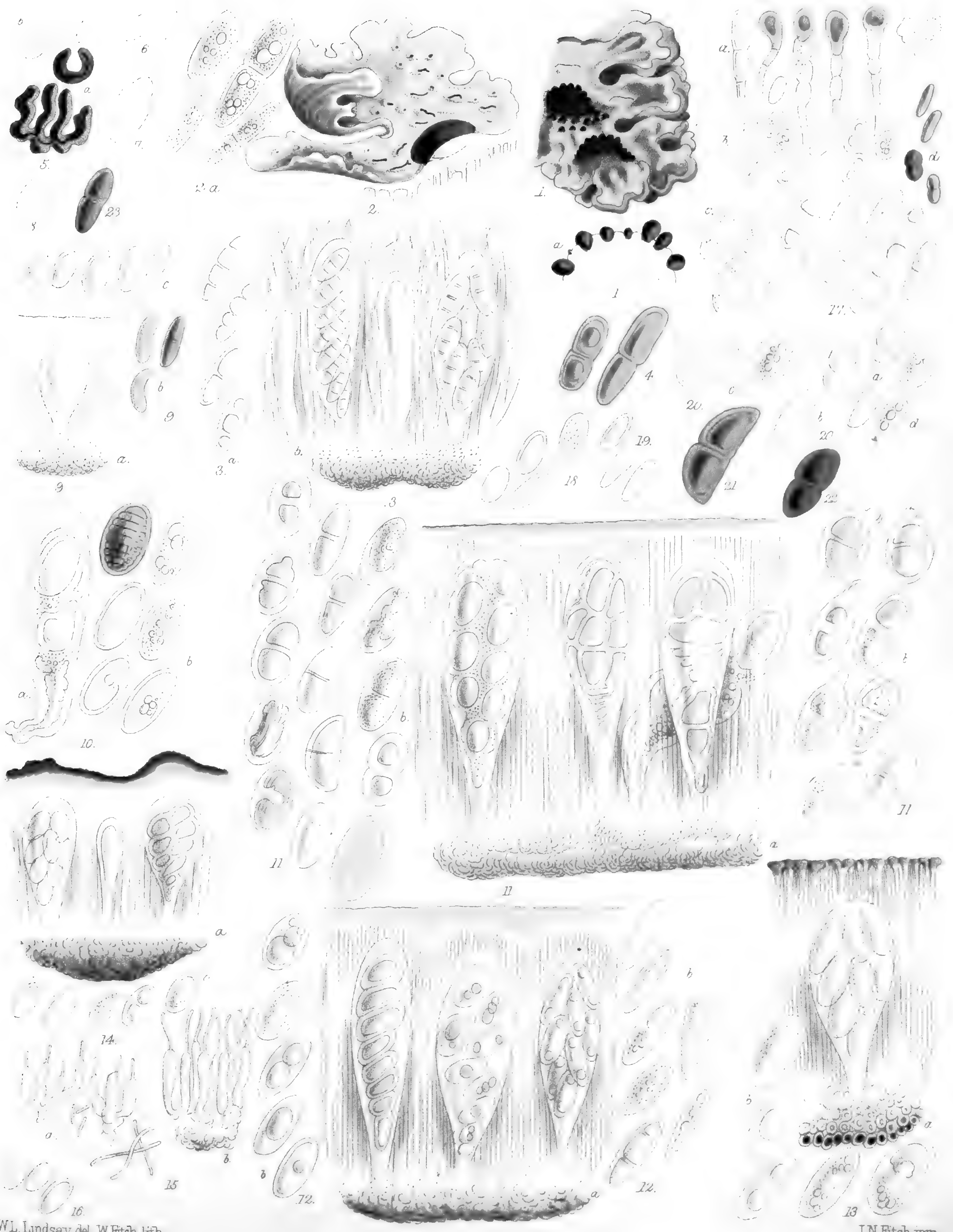


- perithecia; *c*, sterigmata and spermatia.
- Fig. 13. *Lecidea geographica*, f. *alpicola*, Leight. Exs. 129: sporidia.
- Fig. 14. *L. Vahliana*, Linds., Illartlek: sporidia.
- Fig. 15. *L. Campsteriana*, Linds., Atanakerdluk: *a*, portions of thallus, showing the apothecia; *b*, sections of apothecia; *c*, sporidia.
- Fig. 16. *L. parasema*, Ach., muscicolous form, Illartlek: sporidia.
- Fig. 17. *L. parasema*, Ach., Godhavn: sporidia.
- Fig. 18. *L. parasema*, Ach., Jakobshavn: *a*, sporidia; *b*, spores of a parasite.
- Fig. 19. *L. parasema*, Ach., Egedesminde: sporidia.
- Fig. 20. *L. parasema*, Ach., Ounartok: *a*, section of hymenium; *b*, sporidia.
- Fig. 21. *L. parasema*, Ach., microsporous form, Farringdon, Berkshire: sporidia.
- Fig. 22. *L. parasema*, Ach., f. *elæochroma*, Ach., Nyl. Exs. 140: sporidia.
- Fig. 23. *L. sanguineo-atra*, Ach., Illartlek: *a*, portion of thallus with apothecia; *b*, sections of apothecia; *c*, sporidia.
- Fig. 24. *L. sanguineo-atra*, Jakobshavn: sporidia.
- Fig. 25. *L. sanguineo-atra*, Nyl. Exs. 92: sporidia.
- Fig. 26. *L. Friesiana*, Linds., Illartlek: sporidia.
- Fig. 27. *L. vernalis*, L., Lyngemarken: *a*, section of hymenium, under iodine; *b*, sporidia.
- Fig. 28. *Lecidea vernalis*, Illartlek: sporidia.
- Fig. 29. *L. vernalis*, Jakobshavn: sporidium.
- Fig. 30. *Pyrenotheca grælandica*, Linds., Jakobshavn: *a*, portion of thallus with spermogonia; *b*, sections of thallus and spermogonia; *c*, sterigmata and spermatia.
- Fig. 31. *P. lithina*, Leight., Ireland: *a*, portion of thallus with spermogonia; *b*, isolated spermogonia; *c*, sections of thallus and spermogonia; *d*, sterigmata and spermatia.
- Fig. 32. *Endocarpon lithinum*, Leight. Exs. 98: sterigmata and spermatia.
- Fig. 33. Pycnidia on or accompanying *Verrucaria umbrina*, Whlnb., Leight. Exs. 101: basidia and stylospores.
- Fig. 34. *L. fossarum*, Duf.: *a*, perithecia on or associated with *Lecidea luteola*, Ach., Borrer, 1805; *b*, sporidia: Thornhill, 1806; both in Herb. Kew.
- Figs. 35, 36. *L. elata*, Schaer. Exs. 229 (= *L. amylacea*, Ach., Nyl.): ascus and sporidia.
- Fig. 37. *Diplotomma calcareum*, Weiss, England: *a*, portion of thallus, showing apothecia and pycnidia; *b*, sections of apothecia and pycnidia; *c*, sporidia of the *Diplotomma*; *d*, stylospores and basidia of the pycnidia.

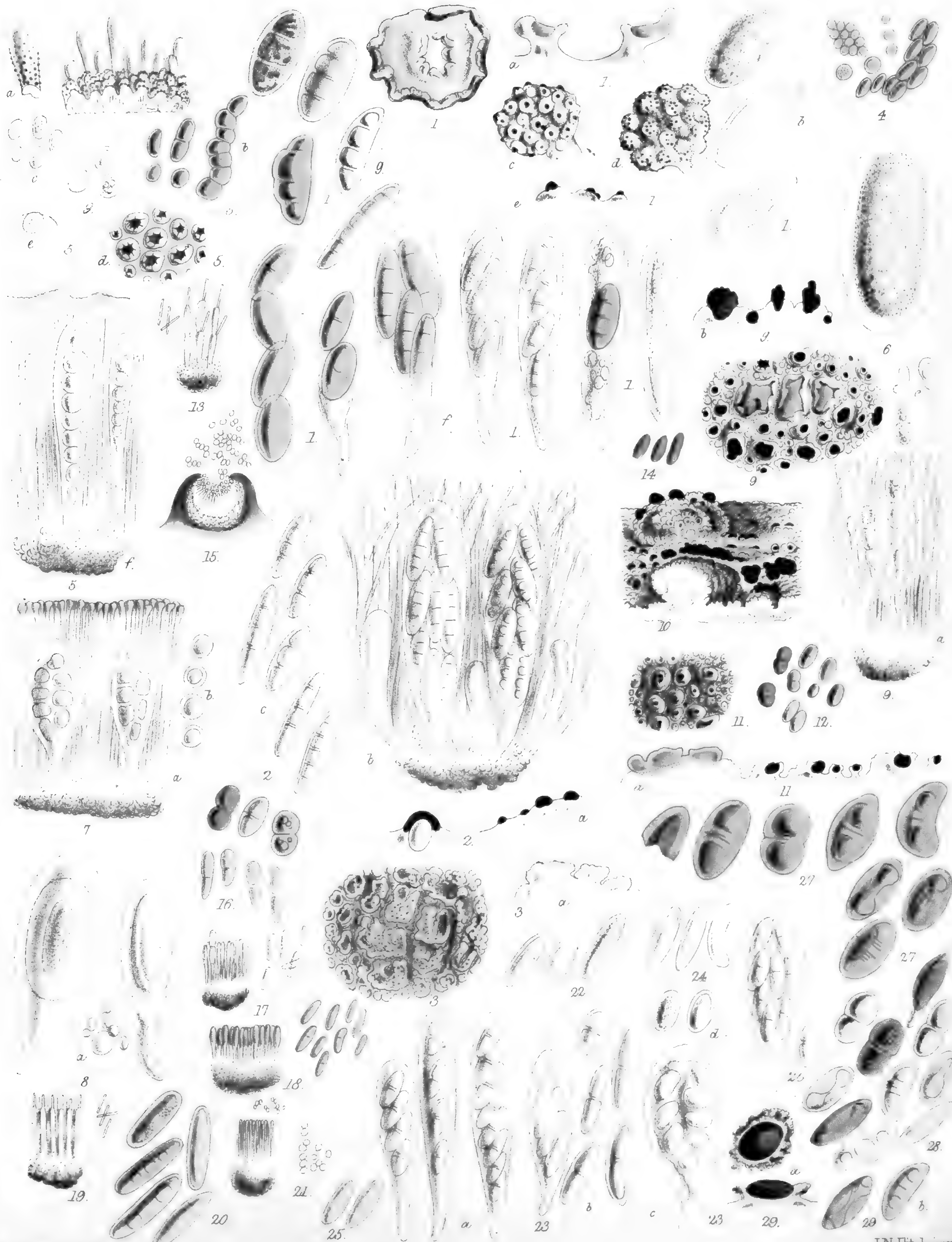




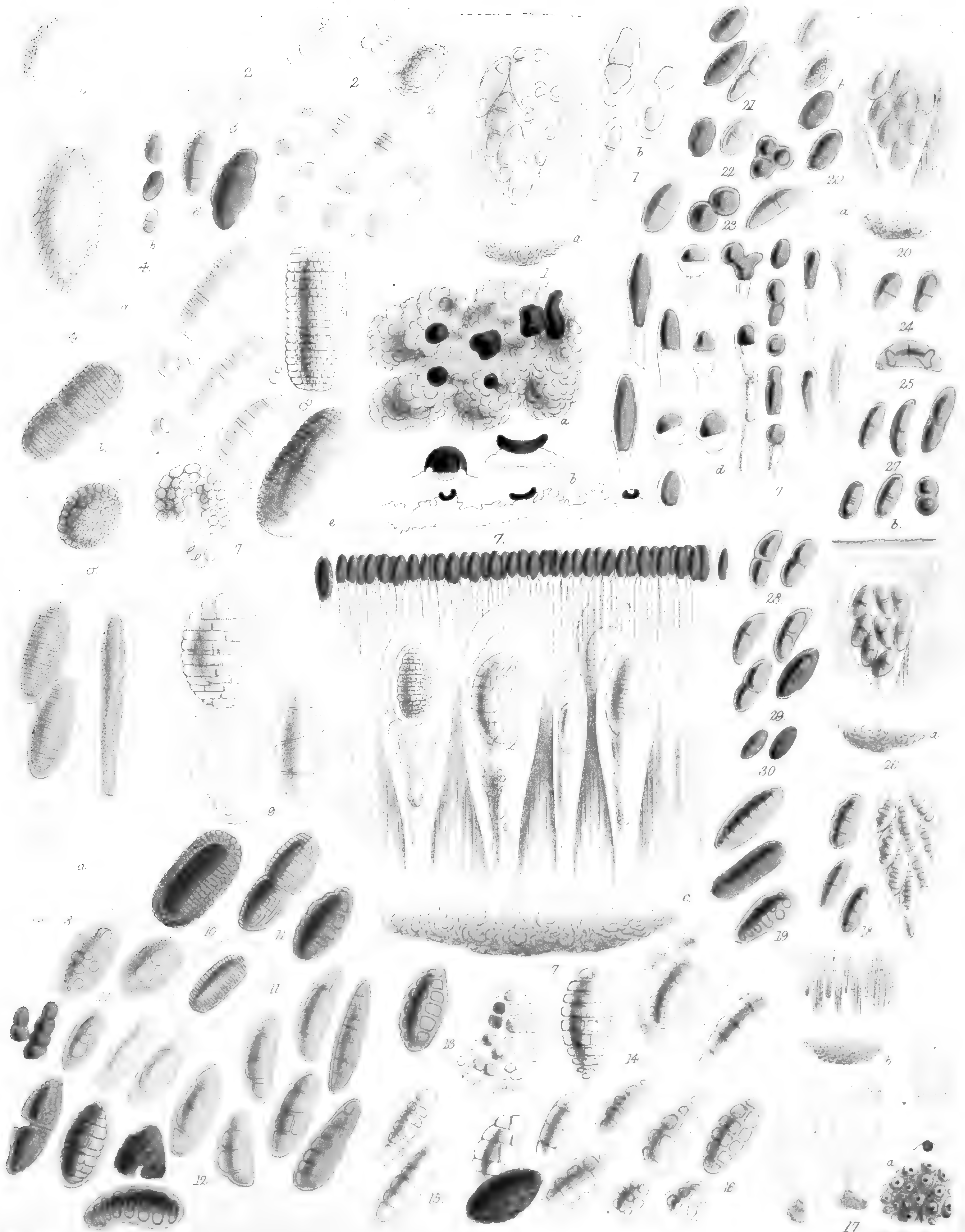




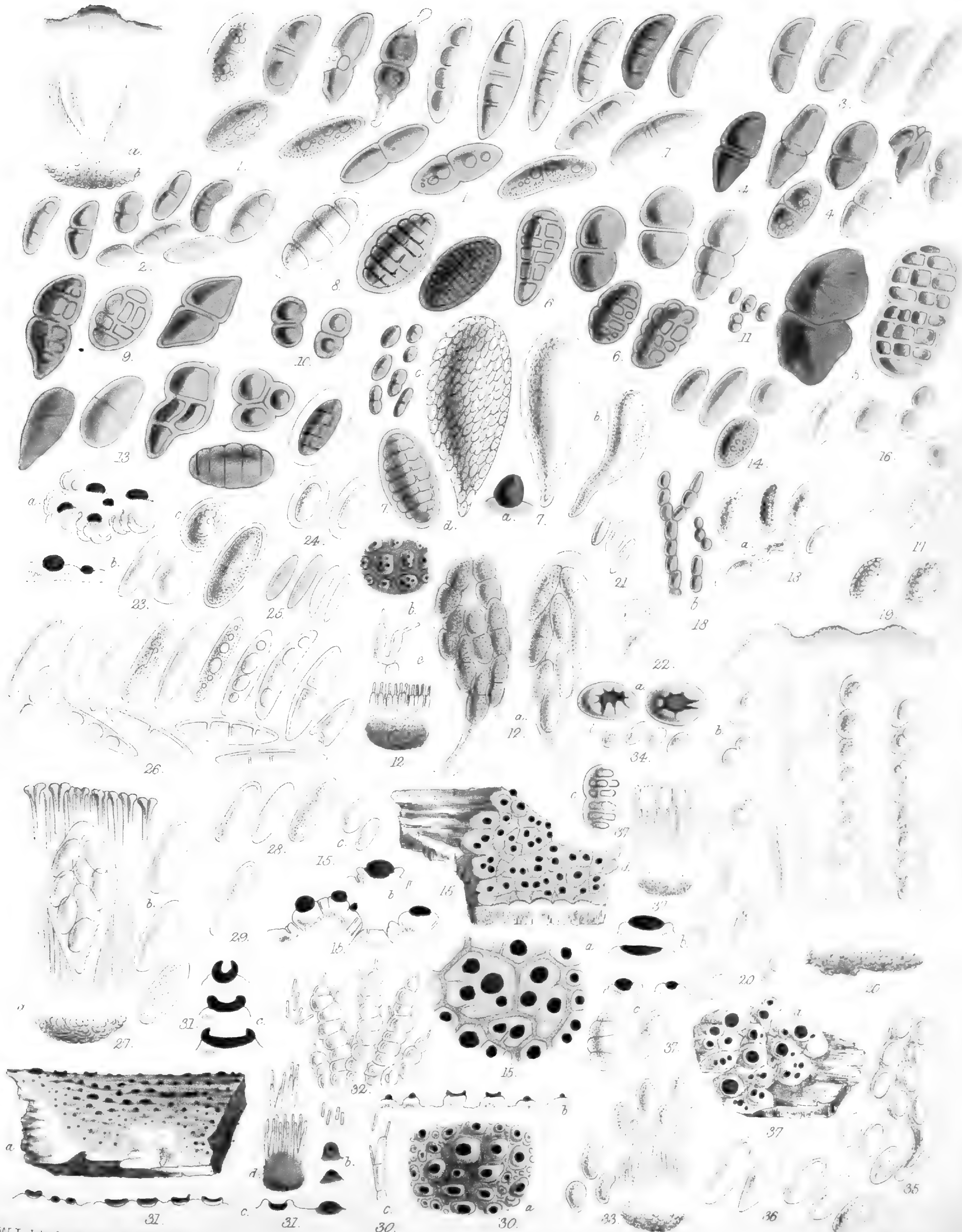














XV. *On the Vertebrate Skeleton.* By ST. GEORGE MIVART, F.R.S.

(Plate LIII.)

Read April 21st, 1870.

THE paper which I have now the honour of submitting to the Linnean Society, is an endeavour to throw, if possible, a little additional light on relations believed to exist between certain subordinate portions of the vertebrate skeleton.

In order to attain this object I am compelled to make certain general observations on the skeleton as a whole, and upon the different ways in which its component parts may be regarded.

The term, "skeleton," in its broadest sense, may be considered to denote that system of structures which invests and supports the whole frame; but it is generally and conveniently taken to mean such parts of that system as assume (at least occasionally and in some animals) a cartilaginous or osseous condition.

The skeleton, so restricted, is generally considered to be divisible into two categories, namely:—one external, comprising dermal and epidermal structures—the *exoskeleton*; the other internal, and thence termed the *endoskeleton*.

The endoskeleton consists of a greater or less number of temporarily and permanently distinct parts; and these parts may be distinguished, grouped, and classified in as many distinct ways as there are distinct modes of regarding them. Thus they may be regarded:—

1. Teleologically, or according to the use, object, or application of parts, or groups of parts—as when we say "a wing-bone" or a "brain-protecting part."

2. According to shape and outline of parts—as when we say "a long bone," as in speaking of the tibia.

3. Histologically, or according to structure—as when we speak of "cartilaginous parts of the skeleton," or, again, of bones ossified from membrane (like the frontal), or from cartilage (like the basioccipital).

4. Developmentally, or according to the way parts arise—as when we speak of "skeletal structures developed in the dorsal plates of the embryo."

5. Specially, or according to the relation parts in one animal bear to parts in another animal—as when we speak of the alisphenoid of a bird and of a reptile.

6. Genetically, or accordingly as the resemblance between similar parts in different animals is due to inheritance from a common ancestor, or has arisen independently through similarity of conditions.

7. Serially, or according to the relation parts of an animal bear to other parts, in front of or behind them, in the same animal—as when we speak of "the last rib but one."



8. According to relations of bilateral symmetry—as when we speak of “the right clavicle.”

9. According to relations of vertical symmetry—as when we speak of “the upper and lower arches of the tail of a flat fish,” e. g. of a sole.

10. According to radial symmetry—as when we speak of “the processes diverging in various directions from a single vertebral centrum.”

11. Generally, or according to the place or rank occupied by a part, or series of parts, in an abstract ideal vertebrate skeleton—as when we speak of “a centrum,” or “a neural arch.” Such an abstract ideal, to be a suitable typical conception, should be the “simplest possible generalized expression of observed facts”\*.

Now it is to a certain extent of special, but more of serial and general relations that I have to speak; and these have been so well defined and described by Professor Owen † under the happily chosen terms *special homology*, *serial homology*, and *general homology*, that little more, I think, need here be said with regard to them.

In investigating the special homology of skeletal parts, the test employed must be the connexions or contiguity existing, at first or ultimately, between the parts in question and other structures in the two or more animals compared.

In investigating serial homology the test employed must be the resemblance at first or ultimately existing between a certain skeletal part of some animal and other parts, in the same animal, in front of or behind that certain part. No other test than that of parts being or not being “in series” is, I believe, possible in questions of serial homology.

In investigating general homology, both the foregoing tests must be employed, and applied to the several parts of all the more divergent vertebrate animal forms.

The endo-skeleton is, at least conveniently, divisible into, 1, the *axial* skeleton, and, 2, the *appendicular* skeleton. Such a division I believe to be not only convenient but also natural.

### THE AXIAL SKELETON.

The parts which together make up the axial skeleton are not yet all satisfactorily grouped and classified, as regards their general homology; and this remark especially applies to some of the inferior arches. Before, however, the general homology of these arches can be investigated with any chance of success, it is necessary to determine relations of special and serial homology.

The uncertainties which hang over these inferior arches have been forcibly brought home to my mind in studying the skeleton as it exists in tailed Batrachians—animals presenting such interesting resemblances to Fishes on the one hand, and to Reptiles and Mammals on the other.

To endeavour, if possible, to contribute towards the removal of some of these uncertainties, I have been led to review the labours of previous writers, and to reexamine and reconsider observations of my own. The results I venture now to present, in the hope

\* Prof. Huxley's Croonian Lecture, 1858.

† Archetype and Homologies of the Vertebrate Skeleton, pp. 1 & 72.



that, if they cannot be deemed to supply what has been felt as a desideratum, they may yet provoke such investigation and criticism as by their refutation to elicit truth, and thus occasion, indirectly, what they may fail directly to accomplish.

In studying these tailed Batrachians I have been especially perplexed as to how it may be best to regard the hyobranchial apparatus on the one hand, and the subcaudal arches and processes on the other.

This perplexity has resulted in an endeavour to obtain, if possible, satisfactory answers to the following questions.

1. What is the best way to seek *à priori* a general view of the axial skeleton, or in what way may the axial skeleton as a whole be most reasonably regarded *à priori*?

2. What is the essential nature of ribs, transverse processes, and sternum?

3. What is the essential nature of branchial arches, and in what relation do they stand to ribs?

4. What is the essential nature, as compared with branchial arches, of the hyoidean arch, mandible, and more anterior structures?

5. What relation exists between "chevron bones"\* and other parts of the vertebrate skeleton?

1. *As to the best way in which the axial skeleton, as a whole, may be regarded à priori.*

The more morphology is prosecuted, the more it becomes plain and evident that trustworthy views cannot possibly be arrived at without the study of development. Of late years this truth has been more or less recognized and acted on by almost all who have investigated the nature of the vertebrate skeleton. The most reasonable way, then, to endeavour to understand the skeleton is to recur to its earliest embryonic condition.

Dr. Cleland, in his interesting paper† on ribs and transverse processes (read at the Meeting of the British Association at Cambridge, in October 1862), differs from most of his predecessors in declining to regard the skeletal structures which envelope the cerebro-spinal centres as primary elements corresponding to those which embrace the trunk below, but rather as secondary offshoots from the latter. He says, "But the laminae of the vertebræ are at right angles to the main direction of the dorsal plates and the layers of the embryo; and even as the elevations of blastema in which they are developed are processes from the middle layer of the embryo, so do the laminae diverge from the main circle of the skeleton; and in that respect they are to be compared with the various processes directed outwards to the skin in fishes, and with the epicostal bones in birds"‡.

Although I think many of the ideas put forth by Dr. Cleland in the paper quoted exceedingly valuable, nevertheless I cannot follow him in this view as to the subordinate and secondary character of the neural arch; for though in estimating the nature and importance of structures as parts of a system we must carefully study their mode of origin, yet we must nevertheless consider fairly the outcome and the result of that process, in order to get the most complete general conception of that system as a whole. Now though "the cylinder which the cerebro-spinal axis forms" may be "the product of only

\* By "chevron bones" I mean those detached Y-shaped ossicles so often found beneath the caudal vertebræ of animals above the class of Fishes.

† Nat. Hist. Review, 1863, vol. iii. p. 116.

‡ *Loc. cit.* p. 125.



a small portion of the external layer of the embryo," while the inferior cylinder is composed of "the whole internal layer of the embryo," yet in all vertebrate animals, when developed, the importance of the contents of the former is not inferior to that of the latter. The neural laminae come to be of primary consequence, even if of secondary origin—just as the spinal nerves and their roots in the myelon come to be single and continuous structures in spite of the contrast presented by their several modes of development.

The nervous system, indeed, can hardly be considered as ranking below any other in the body. The special homologies of the cranial bones are best determined by taking the places of exit of the cranial nerves as fixed points; and it is certainly probable that the relations of the skeleton generally closely resemble those existing between different parts of the nervous system.

The mode of regarding the embryo which has been adopted by Professor Huxley seems to me to be the most simple and natural. According to that the embryo is developed from three pairs of antero-posteriorly extending laminae, which radiate from the chorda dorsalis.

The first pair of laminae, the dorsal plates, ascend and form the enclosure of the cerebro-spinal centres.

The ventral plates descend; and each bifurcates, the space formed by the bifurcation constituting the pleuro-peritoneal cavity. The outer walls of this cavity (formed by the outer bifurcation of each ventral plate) constitute the second pair of laminae, or external ventral plates.

The parts within the internal wall of the pleuro-peritoneal cavity (except the lining membrane of the alimentary canal, which is formed by the mucous layer of the embryo) are formed by the third pair of laminae, or internal ventral plates.

Now "such being the case, we might expect *à priori*, that a branch from each nerve-root would ascend into the dorsal lamina, that another would pass directly outwards, and two others would follow the laminae formed by the bifurcation of the ventral plates—one passing along the body-wall (or external ventral plate) the other going down the mesentery to the alimentary canal (the internal ventral plate); and this is what we find to be really the case"\*.

For the so-called sympathetic appears to be no separate system distinct from the spinal nerves, but merely to consist of those branches of the latter which descend into the third pair of laminae (or internal ventral plates) together with commissural fibres.

This striking and original suggestion was made by Professor Huxley in the twelfth lecture of his last Hunterian course. Such being the conditions of the embryonic laminae, and the spinal nerves being each arranged in this, at the least, triradiate manner on each side, we might expect *à priori* some parallelism as to arrangement to exist in the skeleton. In endeavouring to obtain a good general idea of the vertebrate skeleton, it seems reasonable, then, to look, in the most completely developed skeleton, for three longitudinal series of parts in addition to, and on each side of the common axis. I say "in the most completely developed skeletons," because we may expect in many forms a certain coales-

\* British Medical Journal, for May 15th, 1869, No. 437, p. 445.



cence and indeterminateness of skeletal parts—just as nervous structures run together or fail to be differentiated. These series of parts may be expected, then, to be:—

I. Parts related to the first pair of laminae (that is, in the ascending or dorsal plates of the embryo), which may be spoken of as “dorsal” or *epaxial* parts (Plate LIII. fig. 2, E).

II. Parts related to the second pair of laminae (that is, in the external ventral plates), which may be spoken of as the “outer ventral” or *paraxial* parts (fig. 2, P).

III. Parts related to the third pair of laminae (that is in the internal ventral plates), which may be spoken of as the “inner ventral” or *hypaxial* parts (fig. 2, A, B, C).

Epaxial parts will be parts embracing the cerebro-spinal axis, or parts serially homologous with parts which embrace that axis.

Paraxial parts will more or less embrace externally the pleuro-peritoneal cavity (or at least lie without it), or be serially homologous with parts which do so in the trunk. These parts may be also expected to include skeletal elements tending to pass directly outwards, just as certain of the nerves pass directly outwards.

Hypaxial parts will be parts situated between the skeletal axis and some part of the pleuro-peritoneal cavity, or serially homologous with parts so situated.

Now between the skeletal axis and the pleuro-peritoneal cavity we find in the trunk:—

1. The great dorsal aorta.

2. The alimentary tract.

3. The heart with the great vessels springing from it.

It is conceivable then that we might have in a skeleton developed to the most complete possible degree, three kinds of hypaxial parts (Plate LIII. fig. 2, A, B, C):—

A. Some embracing, or tending to embrace the dorsal vessels (fig. 2, A).

B. Some embracing, or tending to embrace the alimentary canal (fig. 2, B).

C. Some embracing or tending to embrace the heart and the great vessels springing from it (fig. 2, C).

These hypaxial skeletal structures might be defined, *à priori*, as skeletal parts either, on the one hand, intervening between the skeletal axis and the pleuro-peritoneal cavity together with any prolongations of it (if such there be), or else skeletal parts serially homologous with others which do so intervene,—or, on the other hand, as skeletal structures placed within the inner wall of the pleuro-peritoneal cavity together with any prolongations of it, or else skeletal parts serially homologous with others which are so placed.

Putting aside, then, all exoskeletal parts, with which we have, in this paper, nothing to do, and also putting aside the appendicular skeleton, the rest of the endo-skeleton (that is to say, the axial skeleton) may, from the mode of development of the embryo, and from that of the nervous system, be expected to appear (in its most developed condition) as a longitudinal axis whence three longitudinal series of more or less developed parts diverge on each side for a greater or less extent, namely:—1, epaxial; 2, paraxial; and 3, hypaxial parts. But a certain coalescence or connation of these parts may also be expected to occur more or less frequently, especially in lower forms.

So much for the *à priori* view; it remains to test its value by-and-by by *à posteriori* considerations.



2. *What is the essential nature of ribs, transverse processes, and sternum?*

Dr. Cleland, in the paper before referred to, has, I think, thrown much light upon this question; and with many of his arguments and determinations I fully agree. I do so especially as to the subordinate importance, in questions of serial or general homology, of the mode of ossification of parts or of their points of attachment to the vertebral column. With him, I believe that "ribs" are parts of the skeleton the primary office of which is to support the outer wall of the trunk, and I think the degree of segmentation of such structures is of very little consequence morphologically.

As to the significance, however, which is to be attached to the fact of parts being or not being "in series" I cannot at all agree with him; for I am at a loss to know what better or other guide we have in matters of serial homology.

All will admit that that part of the rib which intervenes between its head and tubercle in one animal is the general homologue of the part which so intervenes in another animal; and yet the researches of Rathke and Professor Huxley seem to show that sometimes it is a primary part of the rib, sometimes a mere outgrowth. Again, all will admit that the rudimentary neural arches of the tail of the dog are the serial homologues of the fully developed ones of the trunk; yet, as Dr. Cleland himself tells us\*, the former are merely exogenous structures. These, and many other instances it would be easy to bring forward, show that diversity as to mode of development is no bar to the legitimacy of serial or general homologies.

Just as little can relations of functions claim a preference as a mode of determining such homologies. Otherwise the neural rudiments of the os coccygis could not claim to be serial representatives of those of the trunk, or caudal transverse processes to represent parts of the viscera-encircling girdles in front of them. Thus the fact of parts being "in series" is most important in determining serial homologies, and, when carefully used and checked by comparing results obtained in many different forms, is the best available guide.

I believe that all transverse processes, ribs, and sternal structures are elements of one system of parts, the primary office of which is to surround the visceral cavity (fig. 2, P, t, tr, tr', c, cr', vr, sr, & s), that they are essentially parts belonging to the external lamina of the ventral plate of the embryo, and that their serial relationships, as whole arches and as component parts of such arches, are revealed by the fact of serial position in such arches or parts of arches.

As to the conditions presented by the hard parts forming these arches, we find commonly in the highest animals a rib with a head and tubercle, the latter articulating with a transverse process.

In many of the *Amphibia* we find a rib bifurcating proximally and more or less distally also, and articulating, by the branches of its proximal bifurcation, with two superimposed transverse processes (Plate LIII. figs. 14 & 15, t, c).

In many fishes we find two series of ribs, one placed above the other; and sometimes these are attached to two more or less distinct, superimposed, transverse processes (Plate

\* *Loc. cit.* p. 120.



LIII. fig. 9, *t, c*). There are also in many fishes additional bony rays (as notably in the Herring), generally admitted to be of quite subordinate importance, and which, as far as I know, are not represented, at least by hard structures, in any higher class.

In all the higher Vertebrata the ribs, and in fishes the lower series of ribs, lie, in the trunk, in close proximity to the outer wall of the pleuro-peritoneal cavity. These then are hard parts developed in the layer of a membrane enclosing that cavity. Another layer of membrane extends from the skeletal axis outwards, above the former; and in this layer (in fishes, at all events, if not also in higher vertebrates) hard parts are also sometimes developed.

It occurs forcibly to the mind, then, that the paraxial system of each side may be of an essentially duplex nature; and I venture to suggest for inquiry whether the facts of comparative anatomy, as regards these parts, may not be well and conveniently grouped together by some such conception as the following.

That there are really two series of paraxial elements on each side of the body:—

1. An upper series, which, leaving the central axis, tends outwards towards the skin (corresponding with the nerves passing directly outwards), and which may be termed *upper paraxial* or (making use of a name employed by Professor Owen) *diapophysial elements* (fig. 2, *t, tr, tr'*);

2. A lower series, which, leaving the central axis, tends downwards (corresponding with the abdominal nerves) to embrace the visceral cavity, or is serially homologous with other parts which do so, and may be called *lower paraxial* or (again after Professor Owen) *parapophysial elements* (fig. 2, *c, cr, vr, sr, & s*). And:—

That these two series of parts frequently coalesce (before or after solidification) for a longer or shorter distance, and by so doing give rise to double (superimposed) transverse processes with ribs bifurcating at each end (Plate LIII. figs. 14 & 15), or to ribs with the proximal bifurcation modified into “head” and “tubercle,” and with the distal bifurcation disguised by having only one limb of such bifurcation ossified, the other remaining membranous, or, finally, to bifurcating transverse processes simply (figs. 12 & 13).

According to this conception, the root of each upper paraxial element (when a solid structure) is the cartilage or bone (however ossified or wherever situated) connected with the tubercle of the rib of higher vertebrates; and it may be termed the upper transverse process, or the tubercular process, or the diapophysis\* (fig. 2, *t*, & fig. 14).

This is continued outwards, in many fishes, by an upper series of ribs (fig. 9, *t, tr'*),— in other vertebrates by entering for a certain extent into the composition of the ribs, and thence onwards by a bifurcation of the rib, in *Amphibia*† (figs. 14 & 15), or, in the highest vertebrates, possibly by membranes passing upwards from the ribs external to the *erector spinæ*, or outwards from the ends of the caudal transverse processes.

The root of each lower paraxial element (when a solid structure) is the cartilage or bone (however ossified and wherever situate) which is connected with the head of the

\* Professor Owen originally instituted this term to denote a process essentially *exogenous*. See ‘Archetype and Homologies,’ p. 82.

† Are the costal processes of Birds and Crocodiles similar?



ribs in certain vertebrates; and it may be termed the lower transverse process, or the capitular process, or the parapophysis (fig. 2, *c*, & fig. 14)\*.

This (according of course to the same conception) is continued outwards by the ribs, and is often completed inferiorly by skeletal structures which, when ossified or chondrified, are termed sternal, *i.e.* sternal ribs and sternum proper (fig. 2, *sr* & *s*).

Thus we may have complete coalescence proximally of the upper and lower paraxial elements, and then we have a simple transverse process; or we may have a simple transverse process essentially diapophysial, because in series with the tubercular processes of vertebræ in front, as in *Delphinus*; or we may have an apparently quite similar transverse process essentially parapophysial in nature, because in series with the heads of the ribs of vertebræ in front, as in *Physeter*.

These distinctions, as they exist in the *Cetacea*, were pointed out by Professor Flower in his recent Hunterian Course.

Very often, as in so many fishes, the parapophyses and ribs of the trunk are represented in the tail by a single continuous ossification which answers to both. Thus the ribs of most vertebrates, according to this view, would be of essentially complex nature, and consist of an ossification which has taken place in the line where the upper and lower paraxial elements have coalesced. Amongst fishes, the Carp appears to have a single series of ribs into which both elements enter. It must be recollected that this conception is thrown out only as a *suggestion*.

It might be objected that the parts here treated as more or less distinct are often merely outgrowths one from the other. But this is no objection to the view that the form described is the one that the skeleton tends to assume, and actually does assume more or less completely. However solidification be attained, the tendency to solidify *in these particular lines* must preexist in the soft tissues. From the frequent point of origin of the diapophysis it is manifest that we often have coalescence or connation between paraxial and epaxial parts, *i. e.* between the transverse process and neural arch; yet they are accounted distinct.

The "*chevron bones*" and *caudal hæmapophyses* of Professor Owen belong, I believe, to an altogether different skeletal category.

### 3. *What is the essential nature of branchial arches, and in what relation do they stand to ribs?*

These arches have been regarded by Carus and Professor Owen as forming part of the splanchno-skeleton, and therefore as altogether distinct in nature from the vertebral and sternal ribs, and, indeed, constituting no part of the true endo-skeleton.

Professors Goodsir† and Huxley‡, on the other hand, take them to be the serial homologues of the thoracic or abdominal ribs, and therefore consider them what I call

\* Though Professor Owen originally employed this term to denote a process essentially autogenous, now, however, he regards it as normally exogenous. See 'Anatomy of Vertebrates,' vol. i. p. 28.

† See 'Edinburgh New Phil. Journal,' vol. v. New Series, p. 131.

‡ "Hunterian Lecture" for 1869, see 'Brit. Med. Journal,' No. 443, June 26, 1869, p. 589.



paraxial elements—that is, parts which embrace externally the pleuro-peritoneal cavity, or serially homologous with other parts which so embrace it.

I venture to assert, on the other hand, that they are rather hypaxial elements; consequently I agree with Carus and Professor Owen in considering that they belong to a different category altogether from that to which ribs and hæmal arches belong; while at the same time I differ from these authors, and agree with Professors Goodsir and Huxley, in taking them to be certainly portions of the true endo-skeleton.

My reason for so considering them—for counting these hard parts as belonging to the internal laminæ of the ventral plates, or as belonging to those parts (of the undifferentiated ventral plates) which correspond to the internal laminæ of those portions of the ventral plates which *are* differentiated into internal and external laminæ—is the relation which they (*i. e.* the branchial arches) bear to the root-vessels of the arterial system (Plate LIII. figs. 3 & 20, *v*).

The pericardium, with its serous lining (derivations from the primitive pleuro-peritoneal sack), is continued for some distance along the great vessels which leave the heart. These continuations probably indicate the primitively greater extent of the pleuro-peritoneal cavity, and that parts embraced by such pleuro-peritoneal extension belong to the internal laminæ of the embryonic ventral plates. Moreover the parts which spring from and are directly continuous with the parts so embraced may fairly be reckoned (in the absence of any proof to the contrary) as belonging to the same category. I mean that if the roots, so embraced, of the great vessels belong to the inner portion of the ventral plates, then the parts of such vessels, just beyond the point to which such investment can be traced, also belong probably to the same portion of the ventral plates.

This is the more probable as the pericardium is continued on to the large blood-vessels so as to “form tubular prolongations, which become gradually lost upon their external coats”\*.

Now in osseous fishes the heart and aortic arches lie *outside* and extend along the *external* margins of these branchial arches (Plate LIII. fig. 20, *v*); and consequently these arches must belong to the inner portion of the ventral plates, and therefore cannot correspond to ribs or other hard parts which embrace the pleuro-peritoneal cavity on its outer side.

Professor Goodsir† long ago called attention to the fact that “in Fish and Amphibia the heart and the branchial artery and its branches are situated below and external to the skeleton of the branchial apparatus.” He further expresses his wonder “that those who refer the branchial and pharyngeal arches to a splanchno-skeleton, have not adduced the external position of the hæmal axis to these arches as an argument in support of their opinion;” but he rejects the argument himself as involving consequences (concerning the mandible &c.—points which will be considered further on) which he regards as fatal, but which are not at all so in my eyes.

I have been much strengthened in my confidence as to the correctness of this view by finding that my friend Mr. W. K. Parker has independently arrived at a similar result, at least as far as regards the non-correspondence between branchial arches and ribs.

\* Quain and Sharpey's 'Elements of Anatomy,' 5th edit., 1848, vol. ii. p. 1101.

† *Loc. cit.* p. 129.



The branchial arches of osseous fishes and of Amphibia appear, then, to me to be most probably hypaxial elements belonging to the category B—hypaxial elements because they are hard parts either placed within the inner wall of the pleuro-peritoneal cavity or serially homologous with parts so placed, and belonging to the category B because they embrace or tend to embrace a portion of the alimentary tube. They are thus considerably different in nature from the parts (chevron bones, hypapophyses, &c.) which constitute the category A of hypaxial parts. The latter are essentially in close connexion with the skeletal axis. The hypaxial parts of category B, on the other hand, are essentially related to the alimentary tube and its prolongations. Thus, when these latter hypaxial parts exist without corresponding solidifications of the category A, it is evident, *à priori*, that they may be quite detached from the skeletal axis, may arise\* independently, and may have not only primitively but even ultimately, no solid connexion with it.

If this reading is correct, the nerves which descend beside these branchial arches (Plate LIII. fig. 20, *l*) cannot answer to the abdominal branches of the spinal nerves, but are rather hypertrophied representatives of the sympathetic. Now the branches of the vagus which descend in the posterior mediastinum should also be considered sympathetic, as that space is the upper portion of the internal laminae, *i. e.* within the pleuro-peritoneal cavity.

Moreover Professor Huxley in his last Hunterian course supported the view of the essentially sympathetic nature of the vagus; and, as regards the branches supplying the branchial arches, he said “it is probable that these are distinct nerves, the true origins of which have become quite inconspicuous, while their antero-posterior commissural fibres have become exceedingly developed” †.

It remains to notice the branchial arches of the Elasmobranchs and of the Lamprey.

In the Elasmobranchs (Plate LIII. fig. 3) it is manifestly the internal cartilages (within the arterial branches) which correspond to the branchial arches of osseous fishes. To what, then, do the external cartilages correspond? I should suggest that they are paraxial parts, and really do correspond to the ribs and hæmal arches of posterior segments of the trunk (fig. 3, *p*).

In the Lamprey, on the other hand (Plate LIII. fig. 4), the vessels are internal, and therefore the cartilaginous basket cannot at all answer to the branchial arches of osseous fishes; it answers only to the external branchial cartilages of the Elasmobranchs, and so is probably also paraxial in its nature (fig. 4, *p*).

This view is confirmed by its line of suspension, which runs along the *side* and *outer wall* of the skeletal axis. The branchial arches, on the other hand, are suspended, as manifestly in certain Elasmobranchs, to the *under* surface of the spinal column (Plate LIII. fig. 5).

The cartilaginous protection of the heart of the Lamprey is thus no part of the hypaxial

\* If the resemblance to Vertebrates lately discovered in larval Ascidiæ be a resemblance due to genetic affinity, and not, as is quite possible, to some similarity of conditions, then this part of the hypaxial system may turn out to have originally arisen in a different mode from the rest of it. But the generalized expression of facts here adopted will none the less apply to the skeleton as it exists in the five vertebrate classes; as was before said, the outcome and result of development must have its weight as well as the mode by which that result is attained.

† *Loc. cit.* May 22, 1869, p. 466.



system, but is a median inferior portion of the paraxial system, and is thus a representative (and, as far as I know, the only true representative in Fishes) of the sternum.

4. *What is the essential nature, as compared with branchial arches, of the hyoidean arch, mandible, and more anterior structures?*

The hyoid arch and mandible have both been considered by Professor Owen to belong to the true endo-skeleton, and therefore to differ radically in their nature from the branchial arches, the latter, as has been said, appertaining to the splanchno-skeleton according to the same Professor.

Carus has taken the same view of the hyoidean arch, but not of the mandible.

Professors Goodsir and Huxley concur in thinking that the mandible and hyoidean arches are both endo-skeletal structures, and similar in essential nature to the branchial arches behind them.

I agree in these opinions with the distinguished Professors last named; but, as they (as before mentioned) have considered the branchial arches essentially similar to ribs, while I do not do so, there is, of course, a similar divergence in our estimation of the hyoidean arch and mandible.

As to structures in front of the mouth, Professors Owen and Goodsir both believe that there is a maxillary hæmal arch serially homologous with the mandible; while Professor Goodsir counts the palatine arch as a separate hæmal segment.

Professor Huxley, in his last Hunterian course, threw out a very original and striking idea as to the præ-stomal serial homologues of the mandible. He said\*, "May not the maxillo-palatine processes and the trabeculæ cranii be the most anterior members of the same lateral series?"

I am inclined to fully accept this view as regards the trabeculæ; and I am again strengthened, in so doing, by the valuable opinion of my friend Mr. Parker, who has described to me the primitive downward-tending position of the trabeculæ cranii of the Frog.

By an elaborate description of the arrangements of the vascular and nervous systems, Professor Huxley supported his conjecture as to the præ-stomal arches, and by the very same considerations he seems to me to have conclusively and unanswerably demonstrated the essentially similar nature of the hyo-mandibular and branchial arches. He showed how the serial homologues of the branchial arteries were represented, or their course indicated, by the pseudobranchiæ of *Heptanchus* and *Lepidosiren*, and by the "so-called" carotid gland of the Frog. He stated that the external carotids were the continuations forwards of the ventral aortic roots, and that the internal carotids were the representatives of the most anterior part of the dorsal aorta.

He also showed that as the branches of the vagus (Plate LIII. fig. 2, *l*) skirted the branchial arches, so the ninth nerve, or glossopharyngeal, divided and then skirted the adjacent sides of the hyoidean and first branchial arches—that similarly the seventh nerve divided to go to the adjacent sides of the hyoidean arch and mandible respectively—that, in the same way, the fifth nerve supplied the adjacent sides of the mandible and

\* See 'British Medical Journal' for June 26, 1869, p. 590.



palato-quadrate arches, while, finally, the ophthalmic division of the fifth skirted the adjacent sides of the palato-quadrate arch and the trabecula cranii of the same side.

Thus, then, if I am right in believing the branchial arches to be hypaxial skeletal elements, it follows that the mandible and hyoidean arches, and most probably the trabeculæ cranii are hypaxial also.

Are there, then, any solid parts belonging to the paraxial system—*i. e.* answering to the external branchial cartilages of the Elasmobranchs, and to the cartilaginous branchial skeleton of the Lamprey (figs. 3 & 4, P)?

On this point I am not prepared to absolutely affirm any thing; but I am inclined to believe that the labial cartilages of Sharks (the nature of which has been so much disputed) will be found to belong to the paraxial and costal category. Some of the complex labial cartilages of the Marsipobranchii may possibly also be of the same nature essentially; and it does not seem to be impossible that even some of the cartilages of the nose may be modified representatives of the true hæmal arches of the anterior extremity of the axial endo-skeleton.

##### 5. *What relation exists between the "chevron bones" and other parts of the vertebrate axial skeleton?*

By "chevron bones" I mean those subcaudal arches which exist in many Mammals and are so largely developed in the Cetacea, and the serial homologues of these arches, supposing such homologues to exist. To inquire, therefore, into the relation of these bones or processes to other parts of the axial skeleton as it exists in all five classes of the vertebrate subkingdom implies the asking of two important questions.

1. What is the nature of the mammalian "chevron bones"?
2. What is the nature of the analogous subcaudal arches of Fishes?

Professor Owen\* regards the distinct bony arches beneath the tail of Cetaceans and other Mammals, and of Crocodiles and other Reptiles, as the serial homologues of the hæmal arches embracing the trunk, while the small arches beneath the cervical vertebræ of the Pelican belong, according to him, to another category altogether—namely, to that to which the inferior median processes of Serpents and Lizards belong, together with the processes to which the chevron bones are sometimes attached, as in *Myrmecophaga* †.

In this view of the chevron bone as a hæmal arch removed from its normal costal attachment and articulating with the centrum, Professor Owen has not been followed by many; and it is an interpretation I can by no means accept, believing as I do that the distinction between autogenous and exogenous parts is of quite subordinate importance ‡.

\* 'Archetype and Homologies,' and Part I. of Memoir on the Megatherium, Phil. Trans. for 1851.

† See Memoir on the Megatherium, plate liii. fig. 60, *hy.*

‡ Dr. Cleland is of a similar opinion, which he thus supports in a passage before referred to:—"There are caudal vertebræ in many mammals, the Dog for example, entirely ossified from the centra, which send upwards very small pairs of processes forming the rudiments of neural arches, and outwards small transverse processes. Whatever we may think of the latter, we cannot fail to see that there is a greater amount of correspondence between the former and neural arches than can be counterbalanced by the fact of their being productions of the centrum and not auto-genous." "So also the anterior part of the upper jaw in man indubitably corresponds to the intermaxillary bone in any other mammal, although, except in cases of cleft palate, it is ossified, as M. Em. Rousseau has shown, from the



The learned Professor himself has modified the views he first put forward on the subject, as he himself states; for at first he was disposed to regard even the subcervical canal of the Pelican as the homologue of the thoracic hæmal arch\*.

This change of opinion is so far an approximation to the view which I venture to believe is correct—namely, that neither the subcervical nor the subcaudal arches are homologous with hæmal ones, but are hypaxial and not paraxial parts.

Professor Goodsir† differs from Professor Owen, and, while he deems it probable that the chevron bones are similar in nature to such parts as the subcervical canal of the Pelican, at the same time considers the hæmal arches (vertebral and sternal ribs) quite distinct from either. The true representatives in the tail of these hæmal arches of the trunk he takes to be the transverse processes with the aponeuroses extending down from them. In a note he says:—“In dissecting lately a large Crocodile, I found that an aponeurotic membrane extended outwards, and curved downwards on each side from the extremities of the caudal transverse processes. These aponeuroses met one another in the mesial line below the tail, and were there joined by a mesial aponeurosis which extended down from between the chevron bones. A layer of fat one-third of an inch in thickness lay on the outside of the lateral aponeuroses; and imbedded in it the hæmal divisions of the spinal nerves extended outwards, downwards, and backwards, like a series of intercostal nerves. The lateral muscular mass of the tail, arranged in myotomes with metamyotomic fibrous laminæ nearly as distinct as in the fish, lay on the outside of the layer of fat. Each of the lateral aponeurotic cavities was occupied by the ‘fémoro-péronéo-coccygien’ muscle of Cuvier‡, which arose from the under surfaces of the transverse processes, the sides of the chevron bones, and mesial aponeurosis, and passed out of the cavity through a space left in its outer wall behind the ischium to be inserted into the thigh bone. The mesial membrane divided above, its two laminæ corresponding to the limbs of the chevron bones, and passing in front into the walls of the pelvis.” He adds, “This arrangement appeared to me to indicate that the transverse processes and the lateral aponeuroses and the hæmal divisions of the spinal nerves, were in the position of the proper hæmal arches of the tail—that the two aponeurotic chambers constituted in fact, together, the abdominal or visceral cavity, divided by the mesial lamina, and occupied by a pair of muscles referable to that group of muscles which in the trunk lie on the inner surface of the visceral chamber—and that therefore the chevron-bones are not real hæmal arches, but subcentral developments.”

Dr. Cleland appears to take a similar view. He says§, “In Saurians the inferior caudal arches are only in series with structures projecting into the interior of the visceral cavity: those in the anterior part of the tail so project; and further forwards, in series with

maxillary. August Müller also demonstrates the small importance of the division or non-division of the costal element into ‘rib,’ and ‘transverse process.’”

Professor Huxley in his Hunterian Lectures has brought forward numerous instances of diverse modes of ossification of similar parts; and Professor Flower has done the same in his recent and first course of the same lectures.

\* Geol. Trans. vol. v. 2nd Series, p. 519, pl. 44. figs. 2 & 3.

† *Loc. cit.* p. 128.

‡ My femoro-caudal in *Iguana*, *Menopoma*, and *Menobrainchus*, Proc. Zool. Soc. June 27, 1867, and April 22 and June 24, 1869.

§ *Loc. cit.* p. 130.



them, there are, in certain species, imperforate processes projecting in the middle line, and not even forking to enclose the great vessels."

Professor Huxley, speaking of the chevron bones of the Amphibia, says, in his last course of Hunterian lectures\*, "These processes certainly, however, do not answer to ribs, as they coexist with transverse processes to the extremities of which moveable ribs are articulated." This is well seen in *Menobranchus*.

Now, reverting to the condition of the embryo, and the bifurcation of the ventral plates into the external and internal laminae, I think it is most probable that median azygos processes beneath the centra of the trunk vertebræ belong to the common root of the internal laminae. Such processes are, *e. g.*, those in the lumbar and last dorsal vertebræ of the Hare, the last cervical vertebræ of the Great Auk and Penguin (Plate LIII. fig. 11, Hy.), the trunk vertebræ of the Rattle-snake or Cobra, &c. &c.

Often, *e. g.* in the Penguin, median azygos and quite single processes are in series with others which begin to bifurcate, and these again with others in which the bifurcating limbs reunite inferiorly so as to form a subcentral bony ring.

Such parts in the trunk evidently, if they do not actually belong to the internal laminae, are clearly related to them, and belong to that part of the undifferentiated mass from which those laminae elsewhere proceed; they are therefore what I propose to call hypaxial parts.

Now as, in the series of hypaxial parts forming the hyo-branchial apparatus and jaws, the branchial arches (if any) in front of the bifurcation of the ventral plates into external and internal laminae are most probably similar in nature to those behind (and therefore within) such bifurcation, so the processes, ridges, or arches in parts of the body where there may be no distinct differentiation into external and internal laminae must be held similar in nature to the serially homologous ridges, processes, and arches developed in parts of the body where there is such a differentiation.

Again, just as the aortic arches may be taken as indicating the potential line of such differentiation beyond its actual limit, so the continuation backwards of the dorsal aorta may similarly be taken as a potential (if not actual) division—the parts immediately embracing it in the tail being evidently serially homologous with the parts embracing it in the trunk. Now the dorsal aorta in the trunk belongs surely to the system of the internal laminae and their common root, the external laminae lying altogether without and surrounding the visceral cavity. Therefore any hard parts immediately embracing the caudal continuation of the dorsal aorta must belong to the same system (*i. e.* to the internal laminae), unless, by the atrophy of the visceral cavity, parts serially homologous with ribs are brought into immediate contact with the caudal vessel, and coalesce or are connate with or replace and simulate absent hypaxial parts.

The coexistence, however, in the tail, of the transverse processes of both kinds (tubercular and capitular) with chevron bones, as in *Menobranchus*, proves that the latter bones cannot be the homologues of the paraxial hard parts of the trunk (as has already been said); while the fact of their being embraced externally, in the Crocodile, by the lining membrane of the continued visceral cavity (as observed by Professor

\* *Loc. cit.* p. 279.



Goodsir) proves them, in my opinion, to belong to the system of the internal laminae, and to be true hypaxial parts.

If, then, my view be correct that the mode of ossification and the degree of segmentation of skeletal elements is of secondary importance, it seems to me that the subcervical rings or processes, and the azygos or bifold subthoracic plates of Birds, together with their homologues in other Sauropsidans and in Mammals (in fact, all parts in these groups which are termed hypapophyses by Professor Owen), are serially homologous with the "chevron bones" of the same animals, and that they all belong to my category A of hypaxial parts. At the same time it must always be borne in mind that the hypaxial and paraxial parts have a common starting-point, that it is probable *à priori* that they will sometimes coalesce, and that this coalescence may take place before solidification, and that thus we may have a skeletal part which is neither completely paraxial nor hypaxial, but partakes of the nature of both, and may therefore be called *parhypaxial*.

The second question about chevron bones has now to be answered, namely, *What is the nature of the analogous subcaudal arches of Fishes?*

Professor Owen\* regards these arches as formed by bent-down paraphyses, *i. e.* by essentially paraxial elements. I have not as yet ascertained what precise view Professor Goodsir held as to the homology of these piscine arches with parts of the mammalian or sauropsidan skeleton.

J. Müller† considers them to answer to the chevron bones, and the piscine and mammalian ribs to be homologous.

A. Müller‡ thinks the ribs of fishes peculiar, and different from those of mammals; and it seems to follow from his views that "chevron bones" are the homologues of the former, the mass of muscles below the lateral intermuscular septum being considered by him to answer to the subvertebral muscles placed within the ribs in higher animals.

Dr. Cleland§ combats (I think, very successfully) August Müller's view, saying, "In the saurian tail the lateral intermuscular septum is found as in fishes. The muscles superior to it are, as August Müller rightly observes, continued into the muscles of the back; but the muscles below that line cannot be justly described as continued into the interior of the visceral cavity. The superficial ones are attached to the pelvis; and continuous with them, in front of the pelvis, are those muscles of the abdomen which lie superficial to the ribs, among others the rectus, which can easily be distinguished in some fishes. When the fore part of the tail is laid open, we find, indeed, two masses of muscle continued into the abdominal cavity, and which, as has been shown by Professor Goodsir, are enclosed in the continuation backwards of the lining membrane of the abdomen; but that that membrane corresponds not to the lateral intermuscular septum of the first, but to the lining membrane of the fish's abdomen, is proved by the co-existence of the lateral intermuscular septum, which finds its way to the skin in fishes. Forward in the trunk there are both infracostal and transversi abdominis muscles internal

\* Anatomy of Vertebrates, vol. i. p. 40.

† Vergleichende Anatomie der Myxinoiden, p. 100.

‡ "Beobachtungen zur vergleichenden Anatomie der Wirbelsäule," Müller's Archiv, 1853, p. 260 &c.

§ *Loc. cit.* p. 127.



to the costal arches; but the main trunks of nerve are outside these, not on their abdominal aspects, as they would have been were August Müller's theory correct."

Dr. Cleland regards the costal arches of fishes as homologous with those of the higher vertebrata; but I do not find a distinct affirmation of any general relationship between the subcaudal arches of fishes and chevron bones or other parts of higher animals. But he does not appear to coincide with my view, as he denies the homology between what I believe to be the same parts in *Menobranchus* and *Naseus fronticornis*\* and asserts that the subcentral arches of the trunk-vertebræ of the Sole are of essentially the same nature as transverse processes.

Professor Huxley has not, so far as I know, given forth any decided view as to the real nature of the subcaudal piscine arches. For myself, I believe that the facts will not warrant us in saying that they belong altogether to any one category, but that their nature is more or less different in different cases.

*A priori* we might expect that in these lower vertebrata "differentiation" in some parts of the skeleton would be less complete than in higher classes; and such I believe to be the case as regards the hypaxial and paraxial elements.

In the embryo before the bifurcation of the laminae of the ventral fold is complete, it can only be approximately determined to which category portions of tissue belong which are situated in the as yet undifferentiated part. And if, by arrest of development, the bifurcation never extended further, hard parts so situated could only be so determined during the whole of life. But as the alimentary tube (except of course its mucous lining) is undoubtedly formed from the internal laminae, the parts lying directly above it and beneath the vertebral column may well be taken to belong to the same category, lying, as they do, at least in the roots of such laminae and above their points of suspension.

Such skeletal elements in the trunk, when they coexist with distinct paraxial elements surrounding externally the visceral cavity, being deemed hypaxial, the nature of the subcaudal arches must be determined by examining whether they are serially related to one or the other set of elements.

That they should partake of the nature of both systems and be parhypaxial, or that distinct paraxial ribs should start from undifferentiated parhypaxial root-processes, would only harmonize with what we might expect *a priori* to find in some cases, especially in members of the lowest class. We have seen that in some vertebrates, upon an hypothesis suggested a little back, coalescence or connation takes place between parts which are distinct in other forms (*i. e.* the coalescence between diapophysial and parapophysial elements); it is therefore not improbable that we may find a similar want of differentiation (coalescence or connation) with regard to such skeletal elements as the paraxial and hypaxial ones.

Again, the internal and external laminae of each ventral plate merge one into the other superiorly; and we might expect sometimes to find solid skeletal parts in certain situations, the true and essential nature of which is only be determined by following it serially in the same individual, or by carefully comparing it with other forms.

From the piscine skeletons I have as yet examined, I believe that in the great majority

\* *Loc. cit.* p. 131.



of fishes this undifferentiated condition of the paraxial and hypaxial parts obtains. Nevertheless, sometimes both elements coexist in full perfection, as is well shown by Dr. Cleland himself, whose instructive woodcut of *Naseus fronticornis* I have had copied (Plate LIII. fig. 9). In this fish we have on each side a diapophysis (or tubercular process) with an upper rib (fig. 9, *t*, *tr*), and a parapophysis (or capitular process) from which an aponeurosis (fig. 9, dotted line), in the position of a lower rib, runs down to embrace the visceral cavity while the hypaxial arch plainly and manifestly dips into that cavity (like the caudal chevron bone of a crocodile) in the line of suspension of the primitive embryonic internal laminae. Dr. Cleland declines to recognize a relation of homology between this arch of *Naseus fronticornis* and the chevron bone of *Menobranchus*, because in the latter animal the visceral cavity "lies entirely below the inferior caudal spine, whose top only reaches its upper margin." But this objection, if valid, would destroy the homology between the chevron bones of *Menobranchus* and those of the crocodile, as described by Professor Goodsir, at least of such of them as are quite posterior to the caudal leg-muscles; and it seems to me to imply no more than that the area of the internal laminae has become narrowed for a certain space, certainly not any essential difference in the nature of the parts—nothing being more common than the application of serially homologous parts to diverse uses.

In *Muraena Helena* we have a good example (Plate LIII. figs. 16, 17, 18 & 19) of a rudimentary and undifferentiated condition of these parts. In the vertebrae immediately behind the head (fig. 16) we have a transverse process on each side, and a single median inferior process. This latter process, as it lies directly in the line suspending the viscera, must be regarded as hypaxial (fig. 16 H). Further backward it divides and approximates toward the transverse process, with which it gradually coalesces (fig. 17, PH). This single process is now the serial homologue of both the hypaxial and paraxial parts of the more anterior vertebrae, *i. e.* it is parhypaxial. It is short and does not extend beyond the walls of the groove for the aorta, which groove is formed into a canal by membrane extending transversely beneath it. From the ends of these parhypaxial processes the membrane extends which bounds the pleuro-peritoneal cavity externally, and in which there are no hard parts; but if hard parts did exist there, they would be ribs. Further backward the parhypaxial process becomes again differentiated into its elements (fig. 18); and still further back the hypaxial ones, meeting below, form inferior arches (fig. 19) which are the general homologues of the Mammalian and Reptilian chevron bones, and the serial homologues of the inner parts of the single more anterior processes. Did the transversely extending subaortic membrane of the trunk ossify, then such median ossification would be plainly hypaxial, and would connect together (if it extended completely across) the two parhypaxial processes.

Of such an essentially complex nature are the subcaudal arches of most fishes. These arches are in general evidently the bent-down serial homologues of the paraxial elements of the trunk; but they are often also the serial homologues of the margins of a subcentral abdominal aortic groove, and so far are hypaxial, as also are the transverse bars of bone sometimes extending beneath the caudal vessels.

In certain cases, however, we have (as in *Muraena Helena*) a more complete differenti-



ation; and thus it is that in the Sole (Plate LIII. fig. 7) the subcaudal arches are hypaxial in nature, while in the Flounder (Plate LIII. fig. 6) they are certainly in part paraxial, being, in the latter case (as pointed out by Dr. Cleland), to a certain extent in series with the transverse processes of the trunk, but in the former case with the aortic investment, as they are in *Lophius piscatorius* (Plate LIII. fig. 8), where they are also, to all appearance, simply hypaxial parts.

That the subcaudal arches of the Sole should be reckoned as belonging to a more or less different category from the subcaudal arches of the Flounder, may by some be deemed paradoxical. It is, nevertheless, simply a short statement of facts—namely, that they succeed serially in a certain different manner in one case from what they do in another.

We have already met with a parallel instance in the caudal transverse processes of certain Cetaceans; and the instances are numerous, indeed, in which skeletal parts in one animal closely resemble, in external appearance and function, skeletal parts in another animal, which parts nevertheless have a different origin. Thus the different ways in which the cranial walls are formed in different animals, now by an enlargement of a lateral part, *e. g.* the alisphenoid, now by the greater extension downward of an upper part, *e. g.* the parietal, will supply an example of functional resemblance and genetic divergence.

We have now reviewed, in connexion with the questions proposed, the more important modifications of the axial skeleton as it exists in its fullest development in the five vertebrate classes. And it seems to me that the view thence derivable *à posteriori*, appears to coincide tolerably well with the *à priori* view derived from a consideration of the mode of development of the vertebrate embryo with its three pairs of laminæ; for we have found, beside the neural arches (or epaxial parts), a series of more or less segmented hard parts embracing externally the pleuro-peritoneal cavity (paraxial parts) and also a series of hard parts (hypaxial parts) either situated within the pleuro-peritoneal cavity and its prolongation, *e. g.* the branchial arches, or else placed within the paraxial elements, and related to the dorsal vessels, *e. g.* chevron bones and hypapophyses.

Moreover, as the laminæ start from a common longitudinal axis, so we have found that coalescence or connation sometimes takes place between adjacent series, whether between paraxial parts and epaxial parts, on the one hand, or between paraxial parts and hypaxial parts on the other.

Adopting then the view before mentioned as to the nature of the trabeculæ cranii, the axial skeleton of vertebrates may be shortly described as follows (Plate LIII. fig. 1):—

1. A central axis, terminating anteriorly behind the sella turcica, and posteriorly at the end of the spine itself, and segmented antero-posteriorly or not, but generally so, the segments having a numerical relation to the spinal nerves.

2. A superior cylinder, enlarged (except in *Amphioxus*) at its anterior end to embrace the brain. The cylinder is generally segmented, the segments (except at the anterior end) generally corresponding in number to those of the axis, though sometimes much more numerous—*Epaxial parts*.

3. An inferior cylinder external to the pleuro-peritoneal cavity (or continuous with



parts which are so), in which two longitudinal series of hard parts (having a numerical relation to the epaxial hard parts) may be developed, and may coalesce more or less completely together after or before solidification—*Paraxial parts*.

They are subdivisible into (A) diapophyses and upper ribs, and (B) parapophyses, lower ribs and sternum.

4. An inferior cylinder internal to the pleuro-peritoneal cavity (or continuous with parts which are so), in which hard parts may be developed (having generally a numerical relation to the other, axial hard parts)—*Hypaxial parts*.

These may be of two very different kinds. They may be (A) in close relation with the dorsal vessels—*Hypapophyses*, including “chevron bones;” or (B) they may bound exteriorly the anterior part of the alimentary canal, or be in series with parts so bounding it—*Visceral arches*.

By “visceral arches” I mean the branchial arches, the hyoidean arch, the mandible, and the trabeculæ cranii. On the authority of Mr. Parker, I do not count the palatine structure as a distinct arch, as he informs me it is but a secondary growth.

*Hypaxial parts*, then, are skeletal structures either, on the one hand, intervening between the axis and the pleuro-peritoneal cavity together with its prolongations, or else parts serially homologous with others which do so intervene; or, on the other hand, parts placed within the inner wall of the pleuro-peritoneal cavity, together with its prolongations, or else parts serially homologous with others which are so placed. Finally, a greater or less degree of coalescence, before or after solidification, may take place between epaxial parts and paraxial parts, or between paraxial parts and hypaxial parts.

In vertebrates generally (Plate LIII. fig. 1) we have, at the anterior end of the axial skeleton, hypertrophied epaxial and hypaxial parts, *i. e.* the brain-case and visceral arches. Further back we have hypertrophied paraxial parts with much diminished hypaxial ones. Finally, towards the hinder end of the body (except in tailless forms) we have, in vertebrates above fishes, a reappearance of hypaxial elements, generally accompanied by coexisting but distinct paraxial parts. In Fishes, in the same region, we have generally paraxial parts in union with more or less of the hypaxial element, or we have paraxial parts only, or, much more rarely, only hypaxial parts.

In this way the much discussed theory of the essentially vertebrate nature of the skull reappears, but in diminished proportions. As suggested by Professor Huxley, we have no vertebral body beyond the sella turcica—the region of the trabeculæ belonging to the system of inferior arches, not of neural ones or of bodies. The anterior end of the neural canal (in an ossified condition) seems to present us with three segments, suggesting three vertebral elements, *viz.* :—1, the occipital segment; 2, the alisphenoids and parietals; 3, the orbito-sphenoids and frontals. A sense-capsule is at the anterior part of each of these three segments.

All the ossifications of the acoustic capsule belong to a different category. Only two distinct vertebral centres (the basi-occipital and part of the basi-sphenoid), however, correspond now to these three pairs of neural arches; but many others may have at one time existed and since disappeared. Professor Huxley suggested this as possible in his last Hunterian course.



With regard to the descending arches, it may be that more than one pair belongs to each vertebral element, just as in some fishes there are two neurapophyses on each side to a single centrum. But as they are hypaxial and not paraxial in nature, there is no embarrassment in assigning some of them, in fishes, to vertebræ provided with true costal elements.

Such are the results which seem to me to follow from the study of the vertebrate axial skeleton, in the light afforded by the works and labours of the authors before referred to; and if these results are not themselves correct, I trust they may nevertheless contribute (as I before said), by provoking further examination and criticism, to the elucidation of truth on this somewhat puzzling question.

#### THE APPENDICULAR SKELETON.

That this part of the skeleton is an independent, separate part, and no mere modification of any of the before described axial elements, has, I think, been satisfactorily demonstrated by previous writers.

The serial homology between the parts of the anterior and posterior limbs of the same side\* has also been pretty satisfactorily determined. The femur answers to the humerus, the tibia to the radius, the hallux to the pollex, &c. (Plate LIII. fig. 1).

But can the limb-skeleton have a yet simpler expression than a mere statement of their average development in the higher classes? can we reduce it to a form in which it shall correspond to piscine structures also, and reveal genetic relationships?

Professor Gegenbaur, in a recent paper†, has given an affirmative answer to this question.

From a consideration of the limb-bones of *Ichthyosaurus*, *Plesiosaurus*, Amphibia and Elasmobranchs, he comes to the conclusion that a common form may be arrived at, a type at once of both fin and limb, according to the figure which I have had copied (fig. 4).

He conceives that the increasing number of parts as we proceed distad from the root of the limb, is owing to the limb having originally consisted of a fin with a marginal chain of ossicles (H, R,  $r$ ,  $c^1$ ,  $m^1$ , &c.) and with a secondary longitudinal series of ossicles attached to the distal end of each marginal ossicle, all the series ending at about the same level transversely. Thus the root marginal ossicle, H, (the future humerus or femur) would have attached to one side of its distal end a chain of ossicles (U,  $u$ ,  $c^5$ ,  $m^5$ , &c.), the future ulna, cuneiforme, part of unciforme, fifth metacarpal, and phalanges of fifth digit. The second marginal ossicle (the future radius) would have attached to one side of its distal end a chain of ossicles ( $i$ ,  $c$ ,  $c^4$ ,  $m^4$ , &c.), the future lunare, first part of os centrale, other part of unciforme, fourth metacarpal, and phalanges of fourth digit. The third marginal ossicle,  $r$  (the future scaphoid), would have attached to one side of its distal end a chain of ossicles ( $c$ ,  $c^3$ ,  $m^3$ , &c.), the future second part of os centrale,

\* That special relationship between the ilium and scapula, with the attached muscles, which I had the honour of suggesting in a paper published in the Linnean Society's Transactions (vol. xxv. p. 395) has been accepted, confirmed, and reinforced by Professor Flower in his recent course of Hunterian Lectures.

† Ueber das Gliedmaassenskelet der Enaliosaurier. Von C. Gegenbaur, Jenaischen Zeitschrift, Bd. v. Heft. 3.



the magnum, the third metacarpal, and phalanges of the third digit. The fourth marginal ossicle,  $c'$  (the future trapezium) would have attached to one side of its distal end a chain of ossicles ( $c^2$ ,  $m^2$ , &c.), the future trapezoides, the second metacarpal, and the

Fig. 1.

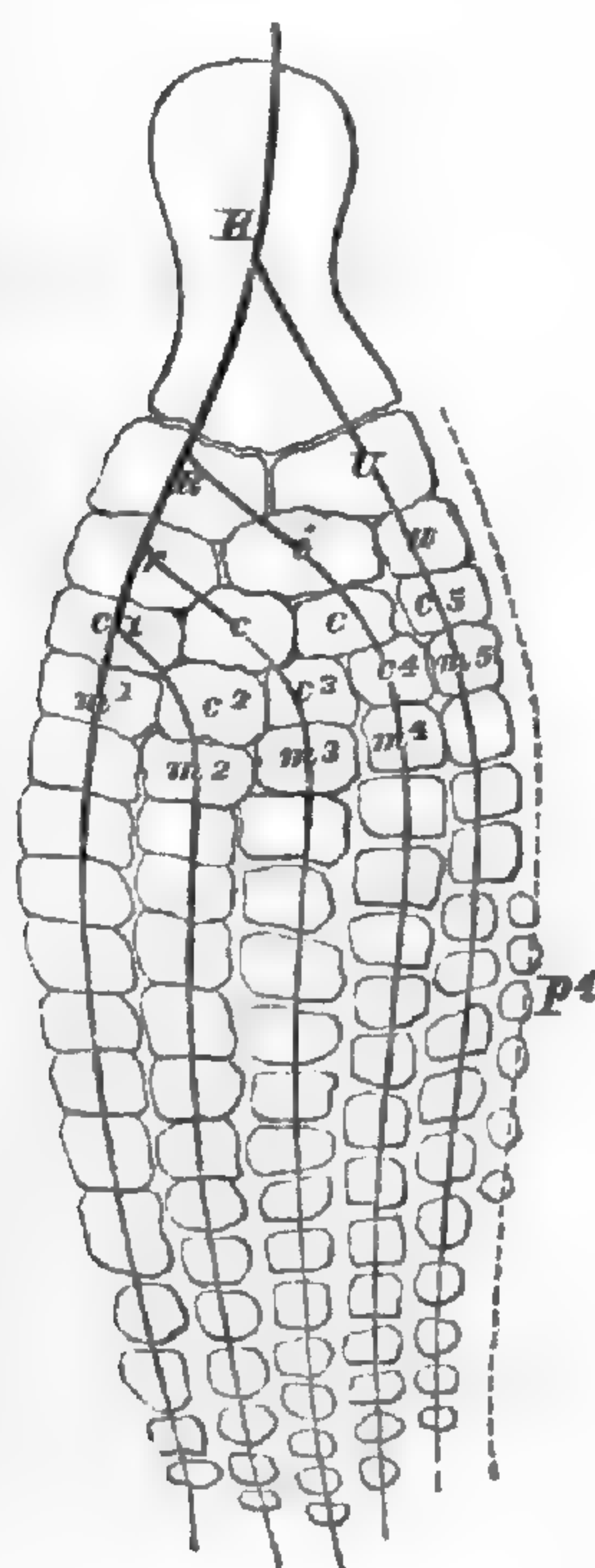


Fig. 2.

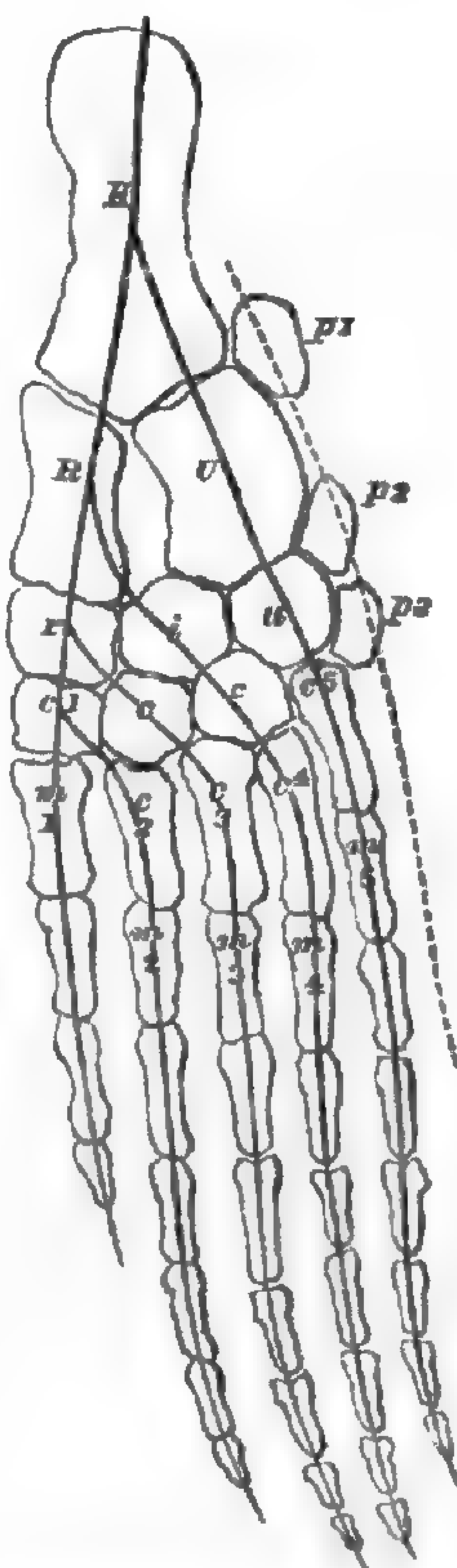


Fig. 3.

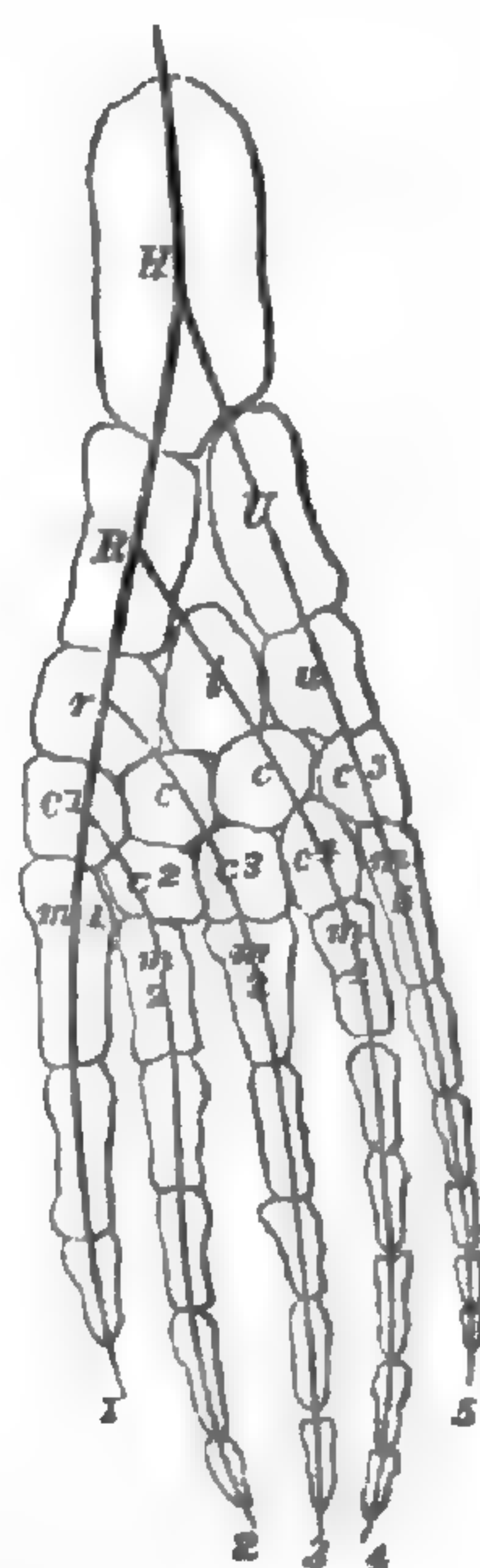


Fig. 4.

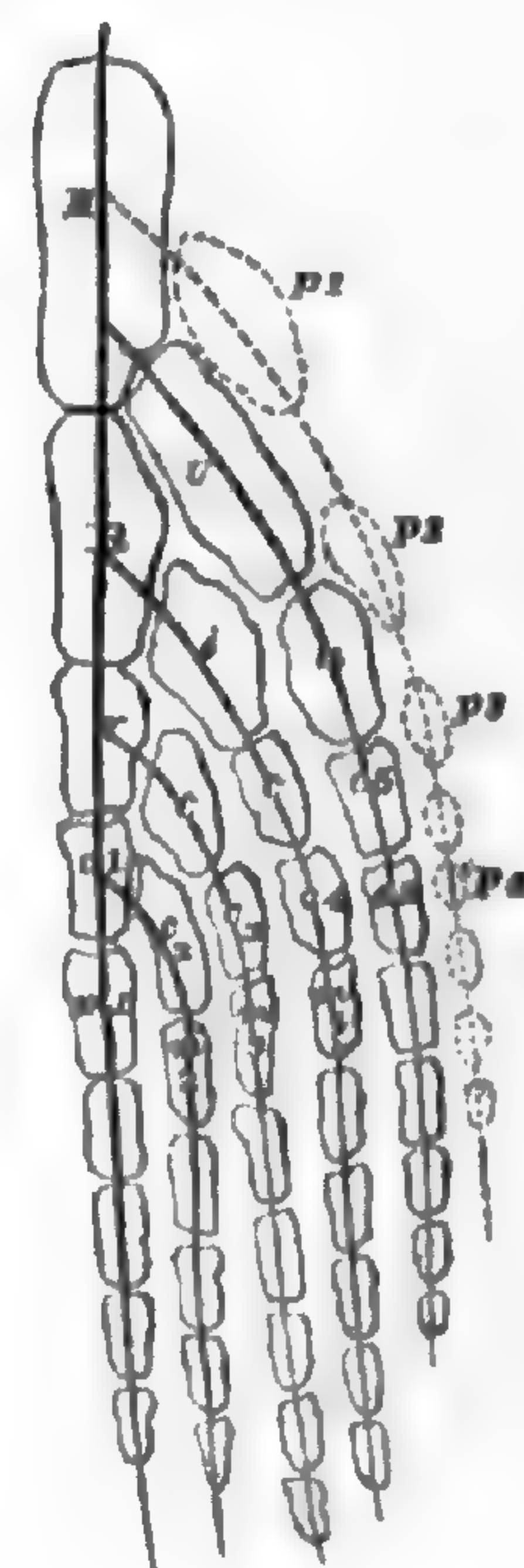
Fig. 1. Limb-bones of *Ichthyosaurus*.Fig. 2. Limb-bones of *Plesiosaurus*.

Fig. 3. Ideal fore limb of Amphibian.

Fig. 4. Ideal typical limb developing from a fin.

H. Humerus. R. Radius. U. Ulna. r. Scaphoides. i. Lunare. u. Cuneiforme. c. Os centrale (represented as divided).  $c^1$ . Trapezium.  $c^2$ . Trapezoides.  $c^3$ . Os magnum.  $c^4$ . One part of unciforme.  $c^5$ . Other part of unciforme.  $m^1-5$ . Metacarpal bones.  $p^1-4$ . A sixth chain of ossicles, of which the pisiforme is supposed to be the last rudiment.

phalanges of the second digit,—the fifth marginal ossicle (the future first metacarpal) having attached to it other marginal ossicles, the future phalanges of the pollex in the manus, or of the hallux in the pes.

This view is applied to the limb-bones as they exist in *Ichthyosaurus*, *Plesiosaurus*, and to an ideal amphibian, as the woodcuts sufficiently explain.

The hypothesis is very ingenious and tempting; still, much as one is naturally disposed to accept it, there are yet certain difficulties which it will not do to ignore.

In the first place, the exact nature of some of the ossicles of *Ichthyosaurus*, together with the division of the os centrale, seems yet open to dispute. And again, though the pisiforme is accounted for by reckoning it as the rudiment of a sixth digit, yet there is no way of accounting for the presence of the corresponding ossicle on the radial side; it cannot be similarly explained, because it is on the outer side, and would be external to the series of original marginal ossicles; nevertheless this radial ossicle is very often present even in Primates\*, and in the Mole it becomes enormous. Moreover, as I have been reminded by Professor Huxley, some specimens of *Ichthyosaurus* not only have extra ossicles along the ulnar side of the limb, but along the radial side also, and extending far up its radial border. A fine specimen showing this has been pointed out to me at the British Museum by Mr. Davis.

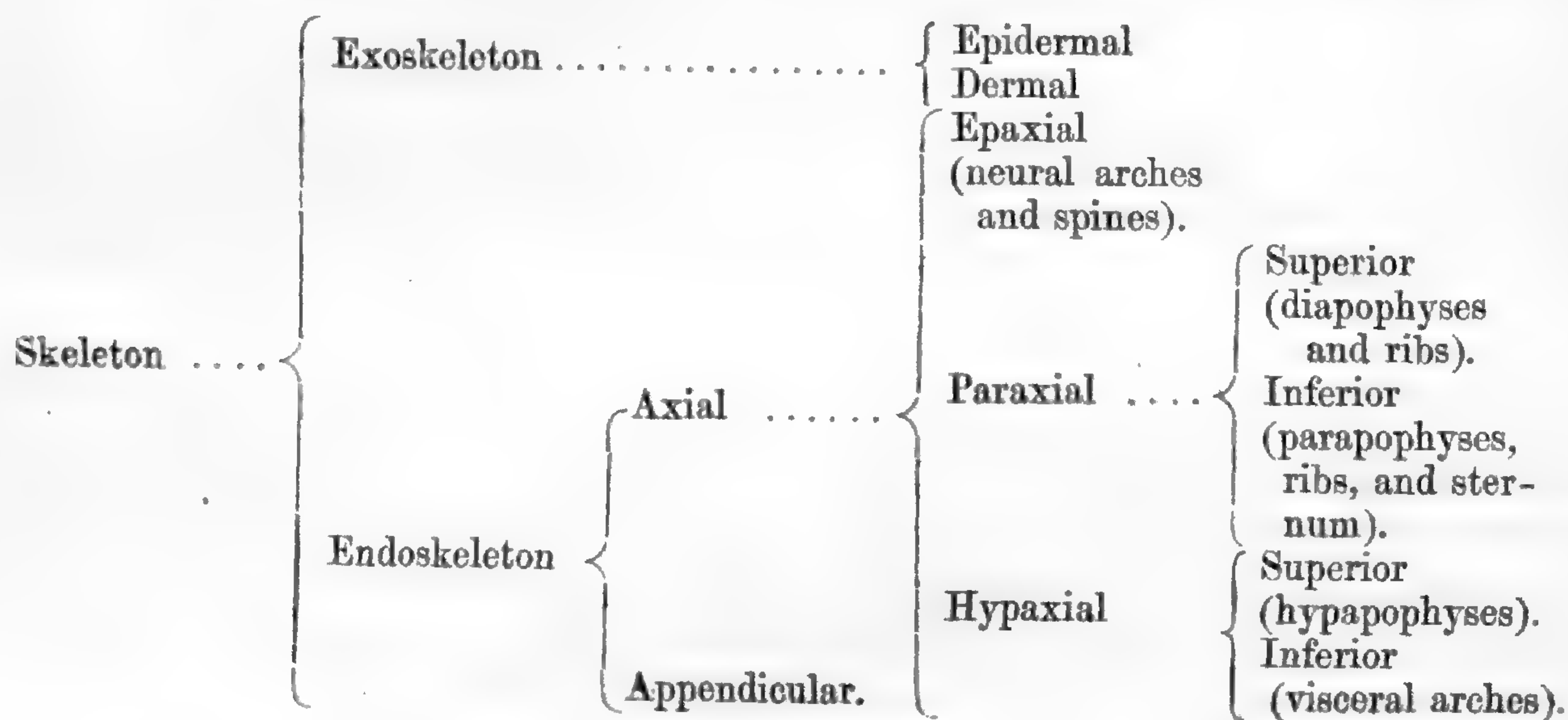
\* Phil. Trans. 1867, p. 319.



Thus at present, I think, we are hardly in a position to generalize the expression of the vertebrate limb more than to take it, in our typical form, as a pentadactyle member differentiated as in vertebrates generally, and approximating to what we find in certain amphibians.

Of course, we may be confident *à priori* that the typical differentiation of the higher classes has been evolved from *some* antecedent quasi-piscine condition. But that condition does not seem to me yet to have been made out; and, whatever may be in future determined by further investigations into known forms, or by the discovery of others as yet unknown, I hardly think that the view propounded by Professor Gegenbaur is the one destined eventually to prevail.

Summing up what has been stated, then, the divisions of the vertebrate skeleton may, according to the views here advocated, be conveniently represented as follows:—



The most generalized and simplest expression of observed facts may also, I think, be diagrammatically represented as it is in Plate LIII. fig. 1.

I will conclude in the words of Professor Jeffries Wyman\* :—“Such a conception as an archetype involves is necessary in our attempts to study the creative idea which underlies all animal structures, apart from their adaptation to the modes of existence in each species; and just in proportion as such conception is based upon a more and more complete knowledge of the plan of structure and of development, anatomy will, in the same degree, become philosophical.”

\* “On Symmetry and Homology in Limbs,” Proceedings of the Boston Society of Natural History, vol. xi. June 5th, 1867.



## DESCRIPTION OF THE PLATE.

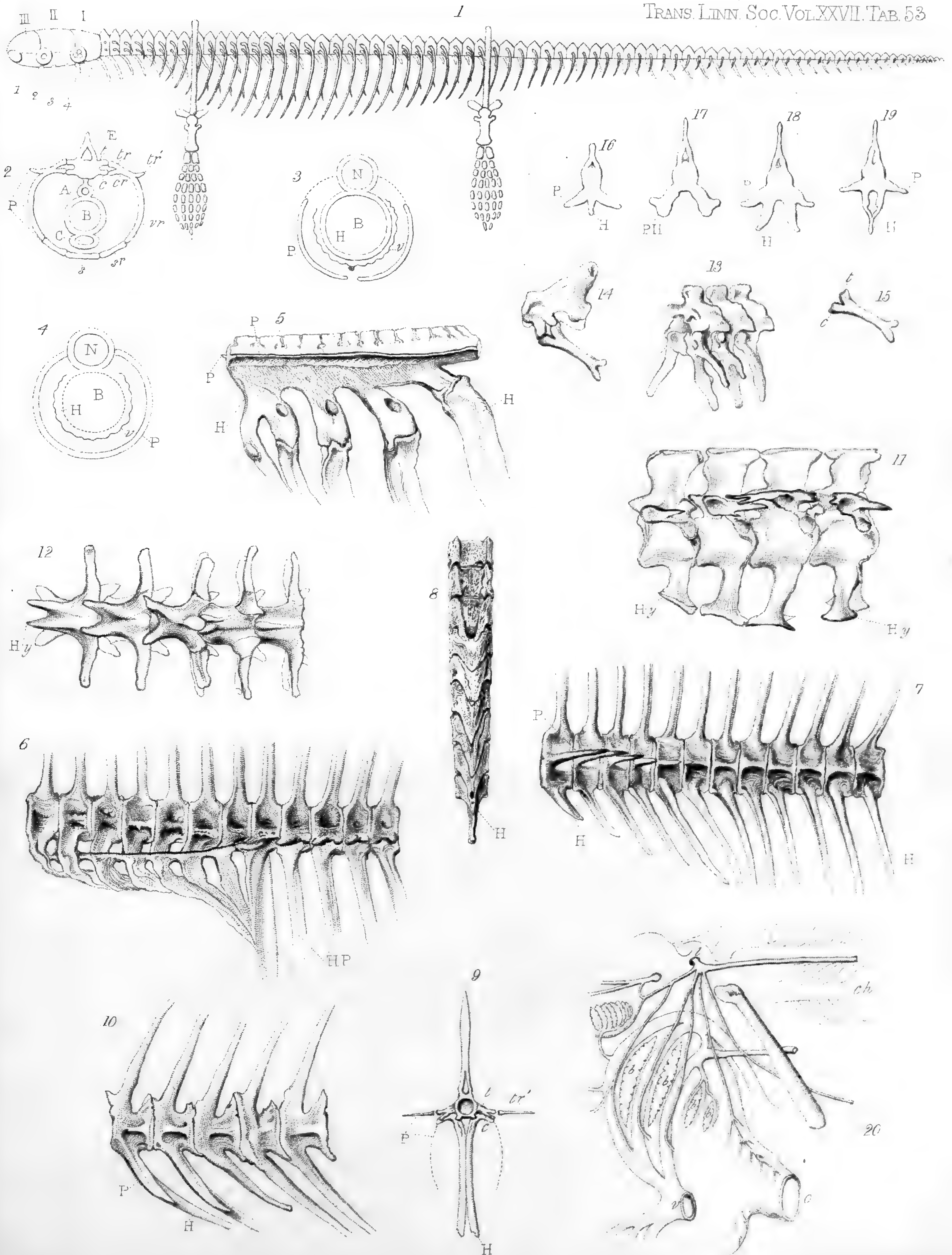
## PLATE LIII.

- Fig. 1. Ideal generalized expression of the vertebrate skeleton. Descending from the cranium (or expanded, anterior part of the epaxial system) are the enlarged anterior parts of the hypaxial system:—1, the trabeculæ cranii; 2, the mandible; 3, the hyoidean arch; 4, the first branchial arch. The paraxial parts are made to show their generally double origin (tubercular and capitular), and a certain tendency to distal bifurcation. These parts diminish in the caudal region concomitantly with the increase in the hypaxial system. The skull, or expanded anterior end of the epaxial system, is represented as consisting of three segments (I., II., III.), with a sense-capsule (nasal, ocular, auditory) at the anterior aspect of each segment. The limbs are supposed to be simplified according to the view before expressed by me in the Transactions of the Linnean Society—namely, a correspondence between the greater tuberosity and the lesser trochanter, and between the lesser tuberosity and the great trochanter.
- Fig. 2. Diagram of a transverse section of the most developed skeletal segment according to the ideal here expressed. From above the centrum the epaxial parts, E (neural arches and neural spine), ascend. From each side of the centrum the paraxial system proceeds outwards and downwards to coalesce in the sternum below.
- t*, tubercular process; *tr*, tubercular part of the rib; *tr'*, its continuation outwards towards the surface of the body; *c*, capitular process; *cr*, capitular part of the rib; *vr*, vertebral rib; *sr*, sternal rib; *s*, sternum. From beneath the centrum the hypaxial system descends.
- A, The part of the hypaxial system which is related to the great vessels; B, part related to the alimentary system; C, part related to the heart.
- Fig. 3. Diagram of the conditions existing in sharks. N, neural canal; B, alimentary tract, surrounded by solid hypaxial parts, H (the branchial arches). V, the aortic vessels, extending up outside the branchial arches and inside the paraxial system (P), here represented by certain external branchial cartilages.
- Fig. 4. Diagram of the conditions existing in the Lamprey. N, neural canal; B, alimentary tract, only bounded by H, a membranous representation of the hypaxial system. V, the ascending vessels; P, the paraxial system or branchial basket.
- Fig. 5. Branchial arches, H, of the Monk fish (*Squatina*), attached to the under surface of the spine; P, ridge representing the root of the paraxial system. Drawn, by permission, from the specimen No. 442 in the Museum of the Royal College of Surgeons.
- Fig. 6. Part of the vertebral column of a Flounder, showing the caudal arches, HP, apparently formed by the bending down of the paraxial parts of the trunk.
- Fig. 7. Part of the vertebral column of a Sole, showing the caudal arches formed by the simple elongation of the hypaxial elements of the trunk—the paraxial elements, P, retaining their independence till they disappear.
- Fig. 8. Under surface of part of the vertebral column of *Lophius*, showing the caudal arches, H, formed by the production of the margins of the subcentral aortic groove of the trunk.
- Fig. 9. Vertebra of *Naseus fronticornis* (copied from Dr. Cleland's article in the Natural-History Review, vol. iii. p. 129). H, hypaxial elements; P, paraxial elements, consisting of:—*t*, tubercular process; *tr*, the rib from it, continuing outward toward the body-wall; *c*, capitular process, which is continued on by membrane only.
- Fig. 10. Part of the vertebral column of a fish, showing the suspension of hypaxial elements, H, to the paraxial parts, P, of the first caudal vertebræ.



- Fig. 11. Side view of four vertebræ of the Great Auk (*Alca impennis*). Hy, hypaxial elements of category A, *i. e.* hypapophyses. From the specimen No. 1151 in the Museum of the Royal College of Surgeons.
- Fig. 12. Under view of four ophidian vertebræ, showing the coexistence of hypaxial elements (hypapophyses) with bifurcated paraxial parts. Specimen, No. 634 A, in the same Museum.
- Fig. 13. Side view of four vertebræ of a Python. Specimen, No. 630, in the same Museum, showing the bifurcating paraxial elements.
- Fig. 14. Vertebra and rib of the Axolotl, showing the bifurcation of the rib both at its proximal end, where it is attached to the superimposed tubercular and capitular processes, and also at its distal end.
- Fig. 15. Rib of a Salamander, similarly bifurcating at each end.
- Figs. 16, 17, 18 & 19. Four vertebræ of *Muraena Helena*, seen from behind. Specimen, No. 36, in the same Museum. P, paraxial element; H, hypaxial element; PH, parhypaxial process.
- Fig. 20. Lateral view of the aortic arches and descending nerves (*external to them*) of *Lepidosiren paradoxa*. Copied from Professor Hyrtl's Memoir, tab. iv. fig. 2. *ch*, the spine or chorda dorsalis; O, part of the œsophagus; V, aortic root, whence diverge the aortic arteries, ascending outside the branchial arches; *b, b, b, b*, the gill-apertures between the branchial arches; *l*, the exit of the nervus vagus—the nerves descending outside the arches, and to the outer wall of the œsophagus.







XVI. *Descriptions of some British Spiders new to science; with a Notice of others, of which some are now for the first time recorded as British species.* By the Rev. O. P. CAMBRIDGE. Communicated by JAMES SALTER, Esq., F.R.S.

(Plates LIV–LVII.)

Read January 20th, 1870.

THE materials of the present paper are a portion of those which have been accumulating since the publication by the Ray Society, in 1864, of Mr. Blackwall's work on British and Irish Spiders, with the intention of forming a supplementary volume to that work; none of these materials have been yet made public, the author having delayed any record of the numerous undescribed species contained in them, on the supposition that the supplementary volume alluded to would have long since been published. As, however, its publication appears to be indefinitely delayed, it has been thought advisable not to postpone longer some notice of the occurrence of so many new and interesting species. Towards this end the Ray Society have kindly permitted the use of a portion of the beautiful and accurate drawings made by Mr. T. H. Hollick for the above-mentioned supplement, which the Society contemplates publishing at some future time; the present descriptions will therefore be accompanied by illustrations of interesting structural features, taken from Mr. Hollick's drawings, as well as from the author's own sketches.

In the arrangement of the species now recorded, the system adopted by Mr. Blackwall has been adopted, for obvious reasons; not, however, to mix up with the descriptions of species considered to be new to science mere notices of others, or records of first occurrence as British, these latter follow the former at the end of each genus respectively; the relative position, therefore, within the genus, of those species here noticed and recorded is not to be understood as specifying a linear arrangement on any scientific grounds.

Order ARANEIDEA.

Family LYCOSIDES.

Genus LYCOSA.

LYCOSA CONGENER, n. sp. (Pl. 54. no. 1.)

Female adult, length  $\frac{1}{4}$  of an inch, or 3 lines; male adult rather shorter; some females, when the abdomen is distended with eggs, are a little longer.

*Cephalothorax* of the adult male long, rather narrow, profile line of upper part slightly hollow behind the caput; hind slope rather abrupt, sides somewhat depressed towards the margins. Caput projects considerably beyond the insertion of the falces; ocular region deep brown, approaching black.

The colour of the rest of the *cephalothorax* is dark brown, with a central and two lateral



longitudinal bands of yellow; these bands are broadish, and irregular on their edges; the lateral ones are a little above the margins of the cephalothorax, and comprise the clypeus, where they run together. The central band is strongly constricted near its extremity at the thoracic junction, the constriction in some examples representing a spot of dark brown encroaching on the yellow band from the brown one on either side. The central band has also a short longitudinal median line of dark brown near the commencement of the hind slope; it is furnished sparingly with whitish hairs and some prominent black bristles on the caput.

In some specimens the breadth of the yellow bands exceeds that of the dark ones between them; generally they are nearly, if not quite, equal to them in breadth.

*Eyes.* The two central ones of the front row, which is on a rather prominent portion of the facial space, are larger than the laterals, and the length of this row is less than the space occupied by the two large eyes above it; these two eyes are the largest of the eight, and are about equal in distance one from the other to the distance between either of them, and that of the third row on its side.

*Legs* long, strong; colour yellow; femora slightly marked and blotched with brown on the uppersides, and furnished with spines, of which some are of considerable length; in specimens which have not long attained maturity some longish, slender, erect hairs are visible, principally on the tibiæ of the first and second pairs.

*Palpi* similar in colour to the legs.

*Falces* moderate in length and strength, greatly inclined to the sternum; colour a clear yellow, immaculate, though in some specimens rather darker than in others.

*Maxillæ and labium.* These present no deviation from the normal type; their colour is generally brownish yellow.

*Sternum* furnished with hairs; colour dark brown, with a central longitudinal, pointed, oval patch or band of yellow.

*Abdomen* oval, slightly broadest behind in some specimens, furnished with yellow, whitish, and blackish hairs; the fore half of the upperside presents the characteristic spear-head marking, which is yellowish brown, with a black-brown margin, on which there is a somewhat angular point two-thirds towards its hind extremity on either side: on each side, slightly removed from the spear-head marking, is a longitudinal, narrowish band of dark brown; these bands converge towards the spinners, and for two thirds of their length are strongly angulated or dentate, the outer angles being clothed with pale hairs, and forming on either side a row of spots; from the outer angular point several oblique lines, more or less perfect, of brown spots traverse the sides of the abdomen. The sides of the abdomen (as also the space between the converging brown angulated bands) are of a brownish yellow colour; posterior to the extremity of the spear-head marking the central portion is often spanned at intervals with several angular lines or chevrons; the underpart is of a brownish yellow colour, more or less clear, sometimes with a longitudinal streak of dark brown on either side; the markings on the abdomen are visible enough on young specimens, and also on the female before the deposition of eggs; in males the abdomen is much darker, and the markings are more or less obscured by many greyish hairs, though the general pattern is preserved.



The palpi of the male have the radial and digital joints densely furnished with strong black hairs; the digital joint is large, round-oval behind and sharp-pointed at the extremity; the palpal organs are well developed and rather complicated, consisting of several corneous processes; a strong corneous sharpish-pointed projection issues from near their base, and stretches obliquely over them, its point terminating near the outer side of their extremity; they are also embraced transversely by one or two black filiform spines, which issue from their inner side.

This species is very active, and is abundant on heaths and moors in Dorsetshire, where it is adult in June and July. It was supposed by Mr. Blackwall to be his *Lycosa exigua*, from which, however, it is clearly distinct, and may be distinguished at once by the longitudinal yellow bands on the cephalothorax; in the *Lycosa exigua* these are narrow, especially the central one, which, narrow throughout, fines off to a sharp point at its fore extremity. The sternum also in *exigua* is of a uniform dark blackish brown, whereas in *Lycosa congener* it has a broad central band or patch of yellowish colour. A close examination, also, with a magnifying glass will show the structure of the palpal organs to be quite different. The legs also in *exigua* are much more distinctly and regularly marked with dark brown. It is nearly allied also to *Lycosa herbigrada* (Bl.), which occurs more locally in the same localities; the latter is, however, adult, generally speaking, much earlier (in May), and its hoary ground-colour and black markings cannot fail to distinguish it at a glance from the present species, even if the structure of the palpal organs be not examined.

**LYCOSA FARRENII, n. sp.** (Pl. 54. no. 2.)

Male adult, length  $2\frac{1}{2}$  lines.

In general form and appearance this species nearly resembles several other small *Lycosæ* indigenous to Britain (*Lycosa exigua* &c.), but it may at once be distinguished by the strong, tumid radial joint of the palpi, as well as by specific marks in colouring &c.

The *cephalothorax* is of a dark yellow-brown, with a broad longitudinal deep-brown band on either side of the median line, and another narrow one just above the lateral margins; the central yellow-brown longitudinal space between the lateral bands is not, as in *exigua*, clearly and evenly defined on its margins; the line is somewhat irregular, and broken into by the convergence of lateral lines, which follow the direction of the normal grooves and furrows of the thorax; the fore part of the space occupied by the eyes is strongly suffused with black; and each of the falces, which are yellow brown in colour, has a broadish deep-brown longitudinal band in front; the eyes of the lower row are of about equal size, but the two centrals are further from each other than each is from the lateral one on its side. The maxillæ are strong, straight, obliquely truncate at their extremity on the outer side, and of a pale yellow-brown colour; labium oblong, of a deep brown tipped with yellowish. Sternum heart-shaped, and of a deep rich brown colour.

*Legs* moderately long and strong; relative length 4, 1, 2, 3, the difference between 1, 2, and 3 being very slight; they are generally of a yellow-brown colour, the femoral and general joints being deeply suffused with dark brown, and the tarsi and metatarsi are



pale yellowish ; all are moderately furnished with hairs and spines. The *palpi* are moderate in length, and of a deep yellow-brown colour, deepest on the digital and radial joints ; the latter joint is furnished moderately with hairs and bristles, and is longer and stronger than the cubital joint, and of a roundish or tumid form, particularly in front. The digital joint is long, equal in length to that of the radial and cubital together ; its extremity is narrow and elongate, resembling the digital joints of the genus *Tegenaria* ; its broadest portion is but little, if at all, broader than the radial joint. The palpal organs are simple, of a deep rich brown colour, and have a somewhat prominent though short, black, corneous, spiny projection near their outer extremity. The *abdomen* is hairy, and of a dull yellow-brown colour both above and below, and is marked above by two longitudinal, irregularly dentated, narrowish, black, converging bands on each side of the median line. From the outer angles of these bands oblique black broken lateral lines run backwards. The space between the longitudinal bands comprises the usual characteristic marking forwards ; this marking has a prominent point on either side, and is bifid at its hinder extremity ; following this, towards the spinners, are several obtusely angular lines, the angles directed forwards. Within the apex of each of these angular lines, as well as at the prominent points, and at the angles of the bifid extremity of the above marking, and also within each outer angle of the dentated longitudinal band is a tuft of nearly white hairs ; in fact, these all together form roughly three longitudinal rows of whitish conspicuous spots or markings on the upperside of the abdomen, which is also laterally marked with irregular oblique lines of white hairs, especially forwards ; on the underside of the abdomen the hairs are thickly mingled with some short black papillæform ones, giving it a closely speckled appearance, especially in the median line ; the underside has also some short white hairs mixed with the rest, giving it a hoary look. In some specimens of the female and of the immature male, the legs were yellowish, distinctly banded with deep brown ; the female resembled the male in size, colour, and markings. Adults and immature specimens of both sexes were contained in a valuable collection of spiders made in February 1869, in Wicken Fen, near Cambridge, and kindly forwarded to me for examination by Mr. W. Farren, of Cambridge, after whom I have named this very interesting and distinct new species.

*LYCOSA DE GREYII*, n. sp. (Pl. 54. no. 3.)

Male adult, length  $4\frac{1}{2}$  lines.

*Cephalothorax* oval, caput slightly produced and truncate before ; colour brownish yellow, with two broad dark yellow-brown longitudinal bands, one on either side of the median line ; the inner margins of these bands approach each other towards their hinder extremities, and their fore extremities unite at the eyes ; the three spaces left by these bands are thus :—first a central longitudinal one, broader before than behind, and with some angular points emanating from it on either side near the middle ; this space comprises forwards a broad and somewhat spear-headed marking of dark yellow-brown, the point deep black-brown, directed backwards, and formed by the normal longitudinal central indentation ; beside this central space there is a marginal lateral one on either side, thickly clothed with bright silvery-white hairs, which give it a conspicuous appearance ;



the fore and upper part of the cephalothorax is furnished with fine, longish, prominent hairs.

*Eyes* in normal position; the four hinder ones form a square whose hinder side is broader than its fore side; the other four form a transverse line below and in front of the rest; the two central eyes of this line are larger than the laterals, and are further from each other than each is from the lateral eye on its side.

*Legs* moderately long, strong; their relative length is 4, 1, 2, 3; they are furnished tolerably thickly with longish slender prominent hairs, and some longish but not very strong black spines; the colour of the legs is brownish yellow, the tibiae and metatarsi of the first two pairs (especially of the first) being strongly suffused with deep brown tinged with reddish.

*Palpi* moderately long, strong, hairy, similar in colour to the legs; the radial joint is considerably longer than the cubital, and curved; the digital joint is long and strong, of a pointed oval form, equal in length to the radial and cubital together; its colour is deep blackish brown tinged with red; the palpal organs occupy little more than half of the cavity of the lower side; they are well developed but simple in structure, of a deep reddish brown colour, and have one or two small black curved projecting corneous points at their fore extremity.

*Falces* long, strong, vertical, prominent near their base in front, of a deep brown colour tinged with red, and furnished with prominent hairs.

*Maxillæ* yellow brown, paler at their inner extremities, strong, straight, considerably enlarged at the extremities, where they are rounded on their *outer*, and obliquely truncate on their *inner* sides.

*Labium* oblong, rounded at the apex; its colour is dark yellow brown, the apex being paler.

*Sternum* somewhat heart-shaped; the transverse section of the fore extremity is somewhat hollow, and its breadth there less than in the middle; its colour is dark yellow-brown, with a faint longitudinal central line on its fore half.

*Abdomen* oval, roundly truncate before, and bluffish behind, where it is broader than in front; it is clothed with prominent fine hairs; its colour is dark yellow-brown mottled obscurely with yellowish. The fore part of the upperside has the normal fusiform band, which is not very large, but of a clear brownish yellow colour, very slightly enlarged laterally about its middle, and pointed at its hinder extremity, nearly parallel with which on either side is a conspicuous bright bluish-silvery dot, followed by several others at intervals towards the spinners, forming two parallel rows; of these dots four are more conspicuous than the rest, and form nearly a square immediately succeeding the fusiform band; between this square and the spinners are some obscure transverse curved yellowish lines; the sides of the abdomen are more or less clothed with bluish-silvery bright hairs, which, concentrating forwards, form a conspicuous short white band on either side of the fore extremity. An adult male of this fine and handsome species (which appears to be new to science) was forwarded to me by the Hon. Thomas de Grey (of Merton Hall, near Thetford, Norfolk), by whom it was captured in that neighbourhood, in June 1869, and in compliment to whom I have conferred upon it its specific name. It is allied to *L. pis-*



*catoria* and *L. piratica*, but is much larger, and easily distinguished by the conspicuous broad white margins of the cephalothorax and the white sides of the abdomen.

#### LYCOSA MONTICOLA.

*Araneus monticolus*, Clerck, Svenska Spindlar, p. 91, pl. 4. tab. 5. fig. 1.

*Lycosa monticola*, Westr. Ar. Suecicæ, p. 487; Thorell, Rec. Crit. p. 50.

Adults and immature examples of both sexes of this spider were captured by myself in 1859, at Southport, Lancashire, and more recently near Ben Nevis, in Scotland, and (but very rarely) at Bloxworth, Dorsetshire. It is not easy to distinguish it from *Lycosa exigua* (Bl.), except by the structure of the palpal organs; there are, however, differences in colour and markings, which become very tangible after the examination of numerous specimens.

#### LYCOSA MINIATA.

*Lycosa miniata*, Koch, Die Arachn. Band xiv. p. 196, pl. 503. figs. 1406, 1407, 1408.

*Lycosa nivalis*, Camb. Zoologist, 1860, p. 6895.

Abundant on the sand hills at Southport, Lancashire, where it was first found by myself in 1859; lately I have received it from the immediate neighbourhood of Liverpool, from the Rev. H. H. Higgins. Although nearly allied to *L. nivalis* (Koch), it is quite a distinct species.

#### LYCOSA BARBIPES.

*Lycosa barbipes*, Sundevall, A. o. 1832, p. 184. 11, 14.

— *armillata*, Walck. Ins. Apt. tom. i. p. 317.

— *clavipes*, Koch, Die Arachn. Band xiv. p. 190, pl. 502. figs. 1403, 1404.

— *armillata*, Camb., Zool. for 1861, p. 7555.

An adult male was captured by myself on the Hursley Downs, near Winchester, in June 1860. It is easily distinguished from all other species known to me, by the gouty tibial joints of the first pair of legs in the adult male. It appears to be a widely dispersed European species, but, so far as I am aware, nowhere common; I have received it from Central Germany, and have captured it at Baveno, on the Lago Maggiore, in Italy.

#### LYCOSA FABRILIS.

*Lycosa fabrilis*, Koch, Die Arachn. Band xiv. p. 168, pl. 498. figs. 1389–1392; Walck. Ins. Apt. tom. i. p. 306, No. 14.

An adult male of this fine spider was captured by myself on Bloxworth Heath, in October 1868. It may be at once distinguished from all other recorded British *Lycosæ* by the velvety black underside of the abdomen; in other respects it much resembles *L. andrenivora* (Bl.), and it frequents similar situations, but is much larger, and more conspicuously and distinctly marked.



## Family SALTICIDES.

## Genus SALTICUS.

## SALTICUS AFFINITATUS, n. sp.

Male adult, length  $\frac{1}{8}$  of an inch.

This spider is closely allied to *Salticus histrionicus* (Koch), but is much smaller.

The *cephalothorax* is much more abrupt in the hind slope; it is black, the upper part covered with short shining white hairs, the sides with yellowish brown ones, and the margins are broadly white.

*Abdomen* short, oval, and very convex compared with that of *histrionicus*; the upper part is black, with a curved band at the extremity forwards, and three short oblique ones on either side of the hinder half of a dull yellowish colour; all these, however, are nearly obscured (except when in spirit) by the sides being clothed with numerous short, white, shining hairs; the upper part is likewise so clothed, but more sparingly; the underside is yellow-brown, sparingly clothed with short white hairs, and with a paler yellow longitudinal band on either side.

*Legs* pale yellow, with some indistinct brownish bands and maculæ.

*Palpi* of the same colour as the legs; radial joint but one-half the length of the cubital, and having a longish projection on the outer side, nearly straight but not so stout, and rather more pointed than in *Salticus scenicus*, but less so than in *S. histrionicus*. Palpal organs much like those of *scenicus*, and simple in structure; they have a large, prominent, semitransparent lobe running rather on one side, from the base to the end of the digital joint. This lobe is most prominent near the base. From the parts of the mouth numerous long bristly blackish and grey hairs issue, and project even beyond the extremity of the falces, which in this species are developed similarly to those of *S. scenicus* and *S. histrionicus*. Though very nearly allied to *S. histrionicus*, it may easily be distinguished, not only by size, but by the lateral stripes being less oblique, and confined to the sides, and by the *whole* spider being more or less clothed with short shining white hairs, as well as by the form of the radial joints of the palpi, and by the structure of the palpal organs. An adult male was captured by myself among heath at Bloxworth in the summer of 1860.

M. Eugène Simon\* supposes, though doubtfully, that the specimen here described may be the male of *Callietherus zebraneus*, Koch; this sex, however, of that species has not yet been described, and the typical females, according to M. Koch's figures and description, differ from *S. affinitatus* not only in size but in markings; I have therefore thought it less likely to lead to confusion to describe the latter as a new species than to include it, somewhat at random, among the synonyms of *C. zebraneus*.

## SALTICUS ÆQUIPES, n. sp. (Pl. 54. no. 4.)

*Salticus æquipes*, Cambr. MS.

*Attus æqualipes*, Monographie des Attides d'Europe, par M. Eug. Simon, p. 145.

Male adult, length  $\frac{1}{10}$  of an inch.

*Cephalothorax* large; the caput slopes forwards, projects considerably, and is of a black

\* Monographie des esp. europ. de la Famille des Attides, par Eug. Simon, p. 186, note 1. Paris 1869.



colour, furnished with pale yellowish and some blackish bristly hairs; the *hinder part* of the cephalothorax is slightly elevated, and then slopes rather abruptly to the abdomen; its colour is reddish yellow-brown, margins black, and it is divided longitudinally by a dark blackish brown band, broadest near the abdomen and bifid at the caput; an irregular zigzag blackish longitudinal band of dusky black occupies the sides, commencing at the hinder part, but not reaching as far as the caput; the *clypeus* slopes considerably backwards.

*Eyes* in the form of a square occupying nearly the whole area of the caput; the middle ones of the anterior row are far the largest of the eight, those of the second row smallest, and situated midway on either side in a line between the laterals of the anterior row and the eyes of the third row.

*Legs.* Relative length 4, 3, 1, 2, but little difference between them; they are moderately long, stout, and hairy, especially the tibiæ of the first pair; and a few (4?) fine semi-sessile spines are on the undersides of the tibiæ and metatarsi. Colour pale yellow; femora rather darker; they are distinctly banded with brown-black, except those of the first pair, the *femora* of which are deeply clouded with black, and are, as also the next three joints, jet-black throughout on the inner sides. The spines on the undersides of the tibiæ and metatarsi are, I think, confined to the first, third, and fourth pairs of legs; but this is not certain, as the spider from which the description was made had been gummed on card, and thus the armature of the legs was not as visible as it would otherwise have been.

*Palpi* short, strong, pale yellow; digital joint large, oval; palpal organs dark yellowish-brown, highly developed and prominent, but simple; they have a small black corneous point halfway up on the inner side, and a shortish, stout, curved corneous process on their outer side, curving over them towards their extremity, and an excessively minute spiral spine quite at their extremity; there is a small pointed projection at the extremities of the radial joints, which are also fringed on their uppersides with some longish hairs.

*Falces* moderate in length and strength; greatly inclined towards the maxillæ, and consequently quite hidden when the spider is looked at from above; they are of the same colour as the cephalothorax.

*Sternum* yellowish, broadly edged with dusky, especially towards the hinder part.

*Maxillæ* moderately long, very broad and massive, squarish at their extremities, and nearly meeting over the *labium*, which is short, semicircular, and, with the maxillæ, of a pale yellowish colour.

*Abdomen* moderate in size; underside yellowish, with a broad, somewhat curved transverse band tinged with reddish near the spinners. Spiracular plates well defined, and of a clearer colour than the rest; the upperside is blackish brown tinged with yellow, from numerous yellowish hairs; on each side of the median line of the fore half are two elongate yellow spots, of which the hinder ones are the longest, and obliquely directed outwards; these are succeeded by a more slender angulated bar or chevron, with its angle directed forwards, of the same colour, and dilated at the extremity into a sort of spot or patch; this is followed by one or two other, shorter, angular lines similar in colour, but with the angles rounded off, forming in fact *curved* lines; at the fore extremity are some stiff black hairs springing from below, and curving upwards and backwards. An adult



male and an immature female of this species were forwarded to me by Mr. Morris Young, of Paisley, by whom they were captured near that town, in the early part of 1866. The female was very young, but appeared to resemble the male in all points of colour and markings; the nearly equal length of the legs, and their distinct banding with black, as well as the pattern on the cephalothorax and abdomen, are very characteristic. The species is allied to *Salticus reticulatus* (Blackw.).

**SALTICUS EXPERS, n. sp.** (Pl. 54. no. 5.)

Genus *Heliophanus*, Koch.

*Heliophanus expers*, Monogr. des Attides d'Europe, par Eugène Simon, p. 232.

Length  $2\frac{1}{4}$  lines.

*Cephalothorax* large and black, sparingly furnished with short greenish-yellow hairs; a white spot is formed by white hairs behind each eye of the third row; a few bristly black hairs on the upperside, directed forward.

*Legs* deep brown, approaching black. Tarsi whitish yellow, metatarsi of fore pairs also light-coloured; relative length 1, 4, 3, 2; furnished with hairs and a few fine black spines on the metatarsi of the hinder pairs, and a few curved bristly hairs in a row on the uppersides of the femora.

*Palpi* of the same colour as the legs; upperside furnished with white scale-like hairs; the humeral joint has a strong projection underneath, nearly perpendicular, curving a little inwards towards its extremity, where it is crescent-formed or bifid, the two limbs being nearly parallel, and not differing greatly in length; the hinder one is the least strong, and rather the shortest; the radial joint has a small, sharp, curved, spiny process on its outer side, and is very slightly produced on its underside. The palpal organs are not very complicated; they are well developed, and project in an irregular form backward beneath the radial joint, as well as in a straight pointed form backward on the inner side.

The *abdomen* is black, sparingly furnished with short greenish golden-yellow hairs. A curved band of white hairs surrounds the fore extremity, and there is a broken, ragged, longitudinal band of white hairs on either side of the median line forward, each followed by another short one near the spinners; there is a white spot also on either side *below*, near the spinners.

An adult male of this spider was found among specimens of *Heliophanus cupreus* (Bl.) captured at Bloxworth. From that species, however, it differs notably in the *bifid extremity* of the projection beneath the humeral joint; of the male palpus in *cupreus* it is *one-pointed*; it differs also from others (having likewise a *bifid* extremity to this projection) in the relative length, strength, and direction of the *limbs* of the bifid portion, as well as in the size and direction of the projection itself.

**SALTICUS SALTATOR.** (Pl. 54. no. 6.)

*Salticus floricola*, Blackw. Brit. and Ir. Spiders, pt. i. p. 55, pl. iii. fig. 30; Camb. Zool. for 1862, p. 7945.

*Attus saltator*, Monographie des Attides d'Europe, par M. Eugène Simon, p. 145.

Since the description of this spider appeared in Mr. Blackwall's work (*loc. cit. supra*)



I have had opportunities of comparing it with specimens of *Salticus floricola* (Koch) from the fine collection of Dr. L. Koch, of Nuremberg; the result is, that the present species proves to be entirely distinct from *S. floricola*, with which Mr. Blackwall supposed it to be identical. It is much smaller, and differs also in the structure of the palpi and palpal organs. The description given by Mr. Blackwall of the adult male leaves nothing to be desired in that respect; but the figure given (pl. iii. fig. 30) affords little assistance to the collector or student. The female differs little from the male, except in being less distinctly and brightly marked. There are several varieties of this species; in the more common variety the abdomen has the pale, angular, transverse lines or chevrons more distinct. The large size and brightness of the two white spots or, rather, patches on the hinder part, contrasted with the darker portion, makes this little spider a very conspicuous object to the collector's eye. Its activity has been noticed (Zool. 1862, p. 7945): its jumps are like those of a flea or a grasshopper; and the only way to capture it, without great risk of injury, is to place a hoop-net, held in one hand, on one side of it, and then to guide or drive it in, as it were, with the other hand. From the net it is safely and easily either bottled or boxed. In fact this is the best way to capture all active spiders, especially those of this large family (Salticidae), whose colours and markings, chiefly depending on hairs and hairy pubescence, are very liable to injury if touched with the fingers.

Excepting the single specimen from which Mr. Blackwall's description was made, and which was captured by myself in Lancashire, it has only been taken on Bloxworth heath, where it is not at all rare in some parts. It is as yet unknown on the Continent.

#### SALTICUS SCENICUS.

*Calliethera scenica*, Koch, Die Arachn. Band xiii. p. 37, pl. 439. figs. 1106, 1107.

*Salticus scenicus*, Zoologist for 1863, p. 8597.

*Attus scenicus*, Westring's Aran. Suecicæ, p. 546.

*Callietherus scenicus*, Monogr. des Attides d'Europe, par M. Eugène Simon, p. 181. (Expunge his reference, however, to Blackwall.)

This species is found occasionally on walls, but generally on posts and palings. The species described and figured in 'Brit. and Ir. Spiders,' by Mr Blackwall, is the *Calliethera histrionica* of Koch, 'Die Arachn.' Band xiii. p. 42, pl. 439. figs. 1110, 1111. Independently of differences in colour and markings, the palpus of the male presents well-marked differences of structure. I have found it at Oxford not unfrequently; at Bloxworth it is equally common with *S. histrionicus*; and it seems to be generally dispersed over the south of England.

#### SALTICUS HISTRIONICUS.

*Calliethera histrionica*, Koch, Die Arach. Band xiii. p. 42, pl. 439. figs. 1110, 1111.

*Attus histrionicus*, Westr. Ar. Suecicæ, p. 545.

*Salticus scenicus*, Bl. Brit. and Ir. Spiders, part i. p. 47, pl. iii. fig. 24; Cambridge, Zool. for 1859, p. 6495.

*Callietherus histrionicus*, Monographie des Attides d'Europe, par Eugène Simon, p. 184.

The note upon *Salticus scenicus*, above, will explain this notice of *S. histrionicus*.



## SALTICUS PRATINCOLA.

*Enophrus pratincola*, Koch, die Arachn. Bd. xiv. p. 32, tab. 473. fig. 1299.

*Saltus terebratus*, Camb. Zoologist for 1863, p. 8597.

— *sparsus*, Bl. Brit. and Ir. Spiders, part i. p. 49, pl. iii. fig. 25; Camb. Zool. for 1861, p. 7556.

*Attus pratincola*, Monographie des Attides d'Europe, par Eugène Simon, p. 78. (N.B. Note 1 to p. 80 of M. Simon's Monographie should follow his description of *A. pratincola*, to which species, not to *Att. terebratus*, it is applicable.)

I have found this species in abundance on the walls of a house in the parish of Hursley, near Winchester, as well as occasionally in other localities. On first meeting with it at Southampton, in 1862, it was supposed to be *S. terebratus* (Koch); but having received examples both of *terebratus* and *pratincola* from Dr. Koch, I find it belongs to the latter species.

I am inclined to think that it is identical with the *Salticus sparsus* of Blackwall: examples of this latter were received from Mr. Blackwall himself, and are certainly only very dark varieties of *S. pratincola* in which nearly all of the markings have become obliterated; no difference could be discovered in the structure of the male palpi.

## SALTICUS FLAVIPES.

*Heliophanus flavipes*, Koch, die Arachn. Bd. xiv. p. 64, tab. 477. figs. 1320, 1321.

— — — — — "*anglicus*," Monographie des Attides d'Europe, par Eugène Simon, pp. 215, 216.

This species is not unfrequent in early summer at Bloxworth, where I first captured it in 1860. It may be seen actively moving about on pathways, and on grass and low herbage in woods in bright sunshine; nearly allied to *S. cupreus* (Bl.), it may easily be distinguished by its unicolorous legs as well as by the *bifid* projection upon the humeral joints of the male palpi; its colours and markings are also less bright and varied than in *S. cupreus*. From *Salticus expers* (suprà, p. 401) it may be known by the absence of white spots and markings, as well as by its smaller size and the form of the bifid projection above mentioned.

Mr. Blackwall has sent me this species from North Wales.

## Fam. THOMISIDES.

## Genus THOMISUS.

THOMISUS WESTWOODII, n. sp. (Pl. 54. no. 7.)

Male, length two lines, or  $\frac{1}{8}$  of an inch.

*Cephalothorax* broad, short, round-oval, very slightly compressed laterally at the caput, except at the immediate locality of the eyes; arched over pretty regularly, though rather flatly, from margin to margin; hind slope rounded and not very abrupt; it is furnished sparingly with black bristly hairs, principally some strong curved prominent ones on the sides and fore part of the caput. Colour yellow-brown; the margins have a broad stripe of deep rich red-brown, a broad longitudinal band of which also runs from behind each hind lateral eye to the hinder part of the thorax, leaving a broad central



band of yellow-brown, which contains the normal spade-shaped marking; this marking is red-brown and defined (narrowly forwards, and broadly at the hinder extremity) with whitish-yellow, the red-brown portion is gradually prolonged quite through the yellow part into a sharp point; this red-brown portion is sometimes divided longitudinally by a darker brown line, and marked occasionally with yellow; there is a transverse patch of yellow between the fore and hind central eyes; and the longitudinal band (between the marginal band and the red-brown one above it) has generally a broken, ill-defined series of slight yellow markings.

*Eyes* eight, in two parallel curved rows on the fore part of the caput, the front row is the shortest. In size and relative position the eyes are similar to those of *Thomisus audax* (Koch) and *T. lanio* (Koch), and similarly situated on yellowish tubercles, of which those supporting the lateral eyes are the strongest; those of the hinder row are equidistant from each other; the two central eyes of the front row are rather further from each other than each is from the lateral one on its side; and the space between them is equal to that between each and the hind central one on its side.

*Legs*, relative length 1, 2, 4, 3, the first and second long, fourth and third short, the third slightly the shortest. Femora and genua of the first and second pairs of a deep rich red-brown colour, the rest of their joints yellowish. The two hinder pairs are yellowish, with a very few spots of red-brown and a slight marking here and there of whitish. They are furnished with hairs and spines, the latter similarly disposed to those of *Thomisus lanio* (Koch); the tarsi end with two strong curved pectinated claws.

*Palpi* short, strong; humeral joint reddish-brown; cubital and radial yellowish-brown; digital rather paler than these two; a single strong prominent black bristle at the upper extremity of the humeral joint, two or three on the upperside of the cubital, several on the upperside of the radial joints, and two or three shorter ones on the digital.

The radial joint has two projections from its extremity; one on the outer side is short, blunt-pointed, and applied closely to the base of the digital joint; the other beneath is very large, prominent, and rather rounded at its extremity. The digital joint has a slight curved prominence on its outer margin, near the base of which the extremity of the lateral projection of the radial joint applies.

Palpal organs well developed, but less complicated than in *Thomisus lanio*. Near their centre are two short prominent curved corneous projections, one of which is obtuse and slightly enlarged at its extremity, the other sharp-pointed; palpal organs surrounded, just within the margin of the digital joint, by a strong corneous spine, which commences near the base, on the inner side, terminating in a sharp filiform point in contact with the prominence above named on the outer margin of the digital joint.

*Falces* strong, moderately long, subconical, of a red-brown colour, with a broad transverse band of whitish-yellow about their middle, which is edged behind with darker red-brown.

*Maxillæ, labium, and sternum.* These do not differ in structure from those of *Thomisus lanio*; their colour is reddish yellow-brown; the labium is the darkest, and the sternum is freckled with dark red-brown.



*Abdomen* oval, about equal in length to the cephalothorax, depressed, roundly truncate in front, where it projects considerably over the base of the cephalothorax; it is sparingly furnished with short bristly hairs; the upperside is of a deep rich red chocolate-brown colour approaching maroon; it is bordered all round with a clear well-defined stripe of cream-white, and a broad longitudinal band of the same colour occupies the central line; this band is strongly dentated from the middle to the spinners; the two principal of the hinder dentations, however, may more correctly be described as transverse slightly curved stripes of cream-white; these stripes generally terminate just short of the white border above mentioned, and are more or less perfectly connected with the central band; the five normal depressions are difficult to be seen readily; the cream-white central band has a double longitudinal row of dark red-brown spots, and is more or less suffused with yellow-brown. The sides (including the cream-white border of the upperside) are longitudinally wrinkled, and the wrinkles are spotted with dark spots or depressed points; the underside is pale, freckled with light chocolate-brown and white.

An adult male of this fine and distinctly marked spider was captured by myself in Bagley Wood, near Oxford, in May, 1866\*; and two examples of it have been met with near Bradford, Yorkshire, by R. H. Meade, Esq., who kindly submitted them to my inspection. I have since received specimens of it from Dr. Koch, of Nuremberg, under the name of *Thomisus (Xysticus) audax*, from which, however, it is remarkably distinct. I have given it the specific name of *Westwoodii*, to testify my appreciation of the great courtesy and assistance I have received from Professor Westwood in the prosecution of my arachnological studies at various times in the "Hope" Department of the University Museum at Oxford †.

THOMISUS SANCTUARIUS, n. sp. (Pl. 54. no. 8.)

Male adult, length 1 to  $1\frac{1}{4}$  lines.

This species is allied both to *T. trux* (Bl.) and *T. versutus* (Bl.), but may at once be distinguished by its much smaller size and more sombre hue; more nearly allied to *T. claveatus* (Walck.), it is also smaller than that species, but differs from it in colour, and from it and all other species known to me in the structure of the palpi, though nearly resembling those above mentioned in general structure and form. Its cephalothorax is of a brownish-black colour, obscurely mottled with yellowish, and narrowly margined with white. A broadish longitudinal yellow band occupies the median line, commencing behind the eyes, where it is somewhat *bifid* or notched, and running backwards to the hind slope, which is of the same colour; this band is bisected longitudinally by a dark brown-black line, and has a darkish marking at its fore extremity corresponding with

\* Since the above was written, I have received an immature male of this species from Mr. W. Farren, of Cambridge, found in Wicken Fen; also examples of the female from Mr. R. H. Meade, by whom they were captured at Newport Pagnell, near Bicester (Oxfordshire). In pattern, on the cephalothorax and abdomen, these are strikingly like the male; and by the hinder extremity of the abdomen being very considerably broader than the fore extremity, they may be easily distinguished from *Thomisus cristatus*.

† I have also very lately received this species from Sweden, from Dr. T. Thorell (of Upsala), who labelled them as the *Thomisus (Xysticus) ulmi* of Hahn, of which, however, the female only has been described by that author.



the normal spade-shaped marking. The cephalothorax has on its upperside (mostly in front) some short strong hairs, rather enlarged, or clubbed, at their extremities, though not so strongly clavate as those of *T. clavatus*. The external eyes of the foremost row are far the largest of the eight.

*Legs* moderately long and strong; the first two pairs are armed with strong spines of different lengths; they are of a dull brownish-yellow colour; the femora brown-black, those of the two first pairs being the darkest.

*Palpi* not very long, of a yellow-brown colour, suffused with blackish, the radial and digital joints being the darkest; the former of these is the shorter, but stouter, of the two, and has two projections at its anterior extremity—one on the outer side, broad, strong, bluff, and rounded at its extremity, the other beneath (on the underside) less strong, curved, and prominent. The palpal organs are well developed, not complex, and have a strong pointed filiform spine curved round their outer sides in a circular form.

*Abdomen* short, oval in form, rather narrower before (where it is truncate) than behind; its colour on the upperside is dark yellow-brown, obscurely mottled with a deeper hue; it has the five normal circular depressed spots, also the longitudinal central fusiform band on its anterior half more or less clearly defined by a deep brownish-black line; and there are faint indications of some whitish-yellow transverse curved bars, or lines, between the hinder extremity of this band and the spinners. The margins and sides of the abdomen are marked and spotted with white; and it has a few short slightly clavate hairs scattered over its upper surface; the underside is of a dull brownish-yellow colour.

Three adult males of this species were taken by myself on the new stone-work of the chancel of Bloxworth Church (while being rebuilt) about the middle of September, 1869.

#### THOMISUS CAMBRIDGII. (Pl. 54. no. 9, a, e, f, g.)

*Thomisus Cambridgii*, Bl. Brit. and Ir. Spiders, part i. p. 81, pl. iv. fig. 47 (♀).

Male adult, length 3 lines, breadth of cephalothorax behind  $1\frac{1}{2}$  line.

*Cephalothorax* broad and round in the thoracic region, compressed towards the caput, which is short, and has the cephalic suture but slightly defined. In general respects the cephalothorax is similar to those of the typical *Thomisi*; it slopes gradually from the highest point of the thorax (where the hind slope ends) to the eyes. It is glossy, and its colour is red-brown, irregularly marked and streaked on the sides with yellow; there are two patches of deeper red-brown, one on either side of the commencement of the hind slope, and a broad longitudinal band of yellow down the centre; this band includes the four central eyes and the characteristic Thomisal spade-shaped marking, which is well defined and sharp-pointed behind, where its margins are not straight, but hollow, swelling out towards the middle, and gathering in again a little near the eyes. This marking is of a red-brown colour, defined on the sides by yellow lines, and enlarged behind longitudinally by a broad border of yellowish-white, preserving the same form as the spade-marking itself; this marking is divided longitudinally by a line which is yellow behind, and becomes deep red-brown and bifid forwards, and ends between the two central posterior eyes. Length of the clypeus not much more than half the



distance between the central eyes; the cephalothorax is very sparingly furnished with short hairs and some short black bristles, on the clypeus and sides of the caput directed forwards.

*Eyes* eight, in normal position. They are in two curved rows on the fore part of the caput, the curves directed forwards, forming a crescent; the four central ones describe nearly a square, whose transverse diameter is rather less than the longitudinal, which is exactly equal to the distance between each hind central eye and the lateral one on its side. The four eyes of the hinder row and the central ones of the front row are equal in size; the laterals of the front row are considerably larger, and are all seated on tubercles, though those of the four central eyes are very slight.

*Legs* long and strong; relative length 2=1, 3=4, but little difference in length between 2 & 1 and 3 & 4; femoral and genual joints deep red-brown, obscurely mottled with yellowish; the latter have a more or less perfect longitudinal yellowish-white streak on the outer side; this streak is continued down the tibiæ, which, with the metatarsi and tarsi, are of a paler yellowish red-brown. There are four longitudinal rows of semisessile dark black-brown spines on the tibiæ, two on the under part and one on either side near the upper part, and a single row on the upperside of all the femora, except those of the first pair, where there are several rows towards the outer extremity; the metatarsi have two rows of longer and paler-coloured spines underneath; the tarsi are furnished with hairs, and two terminal curved and pectinated claws.

*Palpi* short and strong; cubital joint enlarged and oblique at the extremity; radial joint shorter than the cubital, and produced on the outer side into a tapering projection, which adheres closely to the side of the digital joint, and is thus not so easily perceived; the extremity of this projection is blunt, and furnished with a short pointed spine.

Near the underside of the radial joint is a second projection, perpendicular, as long as, or longer than, the joint itself, strong, somewhat irregular in form, and with the extremity enlarged and sharply hollow on the side facing the lateral projection; these joints are furnished with black bristly hairs.

Digital joint broad, oval, pointed at the extremity, convex, furnished with hairs on the upperside, and with a prominent semitransparent pointed projection near the extremity of the lateral projection of the radial joint; palpal organs prominent, but not very complicated; a long black spine, commencing on the inner side near the base, runs round nearly the entire outer margin; and from the centre issue two strong black spines slightly curved, projecting perpendicularly, and with their points in opposition to each other, like the blades of a pair of scissors; at the base of these spines is a short, strong, corneous projection. The colour of the palpi is red-brown, the radial and digital joints being much the darkest.

*Falces* moderate in length, strong, conical, and perpendicular; their colour is red-brown mottled with yellow.

*Maxillæ* long, and very slightly inclined towards the labium.

*Sternum* long-oval, pointed behind, of a dark red-brown colour, mottled obscurely with yellowish.

*Abdomen* oval, projecting greatly over the base of the cephalothorax, truncate before,



enlarged laterally near the middle, and blunt-pointed behind. The upperside is of a deep rich red-brown colour, very sparingly furnished with short bristly hairs, and irregularly bordered with yellow, most conspicuously so near the fore part. An obscure streak of paler red-brown (yellowish near the fore margin) divides the abdomen longitudinally, ending with two confluent short yellow streaks near the spinners, where it also joins with the marginal yellow border; the hinder half of the abdomen has (besides the above) four transverse yellow streaks, or dashes, two and two, issuing from either side of the longitudinal division, but not reaching quite to the margins. Probably some variation exists in different specimens in the colour and continuity of these abdominal markings. The underside is more thickly furnished with short bristly hairs than the upperside; the specimen described from was wrinkled and less deep in colour beneath than on the upperside. The five characteristic depressed spots on the upperside are visible, but not so conspicuous as in *T. cristatus*.

This species is very closely allied to *Thomisus bifasciatus*, from which the male differs in being darker and more richly coloured, and in the structure of the palpi and palpal organs. For the purpose of comparison, figures are given (Pl. 54. no. 9, figs. *e, f, g*) of the palpi and palpal organs of *Thomisus bifasciatus*. One female and one male only have yet been obtained, though the locality in which these were found has been closely searched, off and on, for some years. The female was captured in September 1857, on Bloxworth Heath, and is figured and described by Mr. Blackwall in Part I., 'Brit. and Irish Spiders,' pl. iv. fig. 47, p. 81. The male from which the above description has been made was captured near the same spot as the female, in the month of May 1854, and was for several years mistaken for *Thomisus bifasciatus*. The figures given will show at once the differences in palpal structure between *T. Cambridgii* and *T. bifasciatus*.

#### THOMISUS PALLIDUS. (Pl. 54. no. 10.)

*Thomisus pallidus*, Blackw. Brit. and Ir. Spid. p. 82, pl. iv. fig. 48 (♀); Cambridge, Zool. for 1861, p. 7557.

The female only of this rare and distinct *Thomisus* has hitherto been described. The male (of which but two examples, both adult, have come under my notice during a space of 15 years) is sufficiently like the female to require no lengthened description. Its general colour is yellow, of a more or less deep tinge, overlaid and mixed with whitish, and, like the female, the abdomen is marked, though not very thickly, with some black spots on the upperside. The *palpi*, which form the specially distinctive character of the species, are short and strong; the radial joint is broader, but shorter, than the cubital, and has several projections from its extremity; one in front towards the outer side is broad, but blunt-pointed, and has its extremity in close proximity to the base of the digital joint; another of about equal length with the first, and obtusely pointed at its *extremity* (which is nearly black, and appears like a corneous addition), is very prominent, and situated on the *outer* side of the radial joint; beneath these two, towards the *underside* is the third, of larger size and of a crescent-shape, the hinder limb (next to the digital joint, and closely adhering to it) being the largest, and the other limb of a



curved form; this last projection might almost be described as two, or the first-mentioned projection might be described as crescent-shaped, or, with equal propriety, there might be said to be *three* projections besides the dark-tipped one. The radial joint has also two prominent bristly spines on the inner side; digital joint large, oval, and pointed at its extremity; the palpal organs are well developed but not very complex; two semi-transparent prominences occupy a position near their centre, and two contiguous filiform tortuous spines issue from near the fore extremity and run backwards, forming a prominent and somewhat S-shaped coil over the surface of the palpal organs. The specimen above described was captured by myself on Bloxworth Heath in September 1860, at the roots of heather; one of its palpi was in course of reproduction after deprivation caused by some accident, and presented a remarkable stage of development. Another specimen was sent me for examination in 1861 by Mr. Wintle, of Gloucester, by whom it was captured near that city. It is nearly allied to *Thomisus versutus* (Bl.); but, independently of its paler colouring, the structure of the palpi and palpal organs distinguishes it readily.

The length of the adult male is one eighth of an inch.

#### THOMISUS HORRIDUS.

*Aranea horrida*, Fabr. Entom. Syst. p. 411. no. 16.

*Thomisus truncatus*, Walek. Ins. Apt. tom. i. p. 515.

*Thomisus horridus*, Koch, Die Arach. Bd. iv. p. 49, tab. 123. fig. 280.

Two adult females of this species were forwarded to me in 1864 by the late Mr. Richard Beck, of 31, Cornhill, London, by whom they were captured during the preceding year in the neighbourhood (I believe) of London.

#### Genus PHILODROMUS.

#### PHILODROMUS PRÆDATUS, n. sp. (Pl. 54. no. 11.)

##### Male adult.

In size, form, colour, and general appearance this species closely resembles *P. cespiticolus* and *P. aureolus*; but it may readily be distinguished from both by the structure of the radial joints of the palpi. The markings also of the present species are less distinct (when seen in spirit of wine), and the pattern on the cephalothorax is also slightly different from that of those two species, the form of the abdomen is also more robust. The figures given will explain these differences more readily than any lengthened description. Perhaps when more specimens of *P. prædatus* have been obtained some other special characters in colour and markings may be obtained. In order to examine the palpi of these species satisfactorily it is absolutely necessary to remove them from the Spider and gum them carefully on a slip of card, with the palpal organs, *i. e.* the underside uppermost; the form of the projections at the extremity of the underside of the radial joint will then be easily seen with an ordinarily strong magnifying glass.

A single adult male of *Philodromus prædatus* was captured by myself, in July 1866, at Bloxworth.



## Fam. DRASSIDES.

## Genus DRASSUS.

## DRASSUS ANGLICUS. (Pl. 54. no. 12.)

*Drassus lucifugus*, female, Blackw. Brit. & Ir. Spiders, p. 105, pl. vi. fig. 62.

Male adult, length  $2\frac{3}{4}$  lines.

*Cephalothorax* oval, rather broad and somewhat truncate behind, slightly compressed at the caput, whose fore margin is a little curved; the hind slope is rather abrupt; the surface of the caput in the median line inclines slightly forward near the eyes; colour dark brown, narrowly margined with black, and thinly furnished with fine dark hairs; some fine bristles project forwards from the front of the caput. The junction of the caput and thorax is not very distinct, except at its hinder extremity above, where it is marked by two converging black lines forming a V-shaped marking, the apex of the V directed backward; the angle of the V is divided longitudinally by a slight groove, to which the lateral grooves of the thorax converge; these lateral grooves are almost obsolete.

*Eyes* eight, in two rows on the fore part of the caput; the hinder row is rather the longest, and curves away slightly from the front row, which is nearly straight; thus the space between the lateral eyes is greater than that between the fore central eyes and the corresponding ones of the hinder row. The hind central eyes are oval, obliquely placed, and nearer to each other than each is to the hind lateral on its side.

*Legs* moderately long and strong; their colour is similar to that of the cephalothorax; the tibiæ, tarsi, and metatarsi are rather the darkest and furnished with blackish hairs, some few of which are rather more bristly than the rest and longer, and rise perpendicularly from the upper surface of all the joints; these are longest on the femora of the fourth pair; the third and fourth pairs have their tibiæ and metatarsi furnished with longish spines, the tibiæ only on the underside, but on the metatarsi they form three irregular rings; short prominent hairs are thickly grouped on the lower surface of the tarsi and metatarsi, especially on the tarsi of the first and second pairs.

*Palpi* of moderate length and strength; cubital joint short and nodiform; radial broader, but about equal in length to the cubital; it has a long, strong, straight-pointed, tapering projection from its outer extremity; this projection reaches to about one third of the length of the digital joint, which is very large and of a long oval shape; the palpi are similar to the legs in colour, the radial and digital joints much the darkest, and the projection on the former approaches a deep black-brown; the palpal organs are well developed, and consist of several strong corneous lobes and processes. They are of a deep red-brown colour towards their hinder extremity, and nearly white about their centre.

*Falces* moderately long and strong, perpendicular, subconical, slightly prominent near the base in front, and similar in colour to the cephalothorax.

*Maxillæ*. These reach to the extremity of the falces, they are strongly compressed inwardly, and curved over the labium, almost meeting at their extremities.

*Labium* elongate oval, somewhat pointed at the apex, and truncate at the junction with the sternum. It and the maxillæ are similar to the falces in colour, and furnished



thinly with hairs, as is also the sternum, which is heart-shaped, and with slight depressions near the articulations of the legs.

*Abdomen* oval, tolerably arched above, projects slightly over the base of the cephalothorax; it is thickly dotted with hairs, and of a sooty-black satiny appearance; it is also thinly furnished with erect black hairs, evenly distributed, and giving the Spider a speckled look in spirit of wine. From beneath the fore part a tuft of numerous long black bristly hairs curve upwards and slightly back over the upper fore margin; the branchial opercula are large and of a dull yellow colour, the space between them dark-brown; on the upperside of the abdomen are two divergent curved rows of slight dark depressions, three in each row; the inferior spinners are long, prominent, and cylindrical, and their colour is dark-brown. In the female (which otherwise resembles the male), the extremity of the inferior spinners has several small prominent nipples, or silk-tubes; these were not observable in the above-described male.

The female is considerably larger than the male, though there is some variation in the size of different individuals of both sexes. An adult female of this species, captured by myself on Bloxworth Heath in 1853, is described and figured in *Brit. & Ir. Spiders*, p. 105, pl. vi. fig. 62, as *D. lucifugus*, Walck., *D. melanogaster*, Latr., *Pythonissa lucifuga*, Koch. The figure, however, is chiefly taken from Koch, *Die Arachn.* pl. 194. fig. 469. Whether or not this species is the one alluded to by Dr. Leach is not certain; I think that it probably is. A comparison, however, of it, as well as others, both males and females, of the same species, since captured in the same locality, with typical specimens of *Pythonissa lucifuga*, C. Koch, has proved it to be very distinct from that species, which is a much larger, richer-coloured one, and differs remarkably in the palpi and palpal organs of the male, though nearly resembling it in the disposition of the eyes. The *D. melanogaster*, Latr. (*D. lucifugus* of Walck.), seems to be the same species as the *Pythonissa lucifuga* of C. Koch. Dr. Ludwig Koch, who has examined the specimen above described, considers it to be a species new to science, and has requested to be allowed to include it in a work he has now in the press, on the family Drassides, under the name *Pythonissa anglica*.

The group *Pythonissa*, C. Koch (to which, by the disposition of its eyes and the extremely curved and compressed form of the maxillæ, this species belongs), is a very well-marked group; but whether their structural peculiarities warrant the formation of a genus distinct from *Drassus* may be questioned. Previously to having made any researches in Egypt and Syria I inclined to the opinion that the distinctions between *Drassus* and *Pythonissa* were only of subgeneric value; but in Egypt and Syria I have discovered a great number of *new* species of this group; and a careful comparison of them with those hitherto known convinces me that "*Pythonissa*" will stand as a good and well-characterized genus, of which *Drassus anglicus* is the only as yet certainly known British species. The group seems to have its head quarters in Palestine and Syria, becoming rarer towards the west and north. I have received several species also from Bombay. Dr. Koch will include in his work on the Drassides all the numerous new species of this family discovered by myself in Egypt and Syria, as well as others from Bombay (received from Captain Julian Hobson), and from Sydney, Australia (sent me by Mr. H. H. B.



Bradley). Several males and females of *D. anglicus* have been discovered by myself under stones, bits of dry cow-dung, and among moss, on Bloxworth Heath; and immature specimens are occasionally seen crossing bare places among the heath in sunshine.

*DRASSUS SCINTILLANS*, n. sp. (Pl. 54. no. 12 A.)

Male adult, length 2 lines.

*Cephalothorax* oblong, rather prolonged at the caput, truncate at the fore margin, somewhat depressed longitudinally on the sides above the margins; normal furrows fairly marked; the fore part of caput slopes a little forward, following the even and slightly rounded rim of the thoracic profile; the height of the clypeus is about equal to the space between the outer eyes of the front row, and greater than the space between the fore central and hind central pairs of eyes. Colour dark-brown, tinged with yellow, and reflecting metallic tints; some white sessile scaly hairs show plainly the direction of the thoracic grooves; and there are a few blackish bristly hairs directed forwards in the region of the eyes.

*Eyes* eight, on black spots; small, but unequal in size, in two concentric curved rows, the curves directed backwards. The front row is rather shorter and a little less curved than the hinder row; the outer eyes of the front row are the largest of the eight; next in size are the outer ones of the hinder row, then the fore centrals, and the hind centrals are the smallest; the space between the hind centrals is greater than that between the fore centrals, which is slightly less than that between each of these and the hind central on its side; the space between the two outer eyes on either side of both rows is very nearly equal.

*Legs* long and, except the femora, rather slender; relative length 4, 1, 2, 3; those of the first two pairs are of a yellowish white colour, except the femora, which are black-brown; the two hinder pairs are brown with a yellow tinge, the femora being the darkest; all are furnished with hairs, of which some (especially on the tibiæ and metatarsi of the first two pairs) are long, slender, and nearly erect; others, of a scaly kind, reflect green, golden, and violet tints; there are a few spines on the tibiæ and metatarsi of the two hinder pairs, and two small spines at the extremity of the tibiæ (on the underside) of the first two pairs; all the tarsi are thickly clothed with short hairs on the underside, those of the two hinder pairs being papillæform.

*Falces* long, powerful, vertical, prominent near the base in front, similar to the cephalothorax in colour, and furnished with some long, bristly, dark, prominent hairs in front.

*Maxillæ* long and strong, broad and gibbous near the base, and depressed near the middle, hollow in their outer margins, round-pointed at their extremities, and slightly inclined to the *labium*, which is of an oblong form, rounded at the apex: these parts are of a yellowish brown colour, furnished with bristly hairs, the labium being darkest in colour.

*Sternum* large, heart-shaped, dark brown in colour, clothed with white sessile hairs.

*Abdomen* narrow, oblong, constricted transversely above near the middle, of a blackish colour, furnished with scaly hairs reflecting metallic tints of green, golden, and violet; the transverse constriction is conspicuously marked with white hairs; the spinners are rather long and prominent, of a black colour, tipped with white hairs.

*Palpi* rather long and strong, blackish-brown in colour, furnished with hairs; cubital



and radial joints equal in length, the former curved and clavate; the latter has a rather prominent, nearly straight, shortish and bluntish-pointed projection at the extremity on the outer side. The digital joint is long-pointed, oval, and equal in length to the radial joint; palpal organs simple and well-developed, consisting chiefly of one large and rather prominent oval pale-coloured lobe, with a red-brown band-like marking running from the middle of the outer side round its base, and a very minute sharp-pointed corneous prominence near its extremity.

An adult male and some immature males and females of this brilliant Spider were captured by myself beneath stones at Portland in July 1860, and are, Mr. Blackwall thinks, *D. fulgens* of Walck.; the structure, however, of the palpal organs does not agree with those parts of *D. fulgens* as figured and described by Dr. L. Koch, in 'Arachniden-Familie der Drassiden,' zweites Heft, tab. iv. figs. 52-54. And this last author is of opinion that it is an undescribed species.

#### DRASSUS ELECTUS.

*Melanophora electa*, Koch, Die Arachn. Bd. vi. p. 83, tab. 200. fig. 490.

*Drassus pumilus*, Bl. Brit. & Ir. Spiders, part i. p. 108, pl. vi. fig. 65; Camb. Zool. for 1860, p. 6896.

Having examined specimens of both *Melanophora pumila* and *M. electa*, received from Dr. Koch, and compared them with examples of the species described by Mr. Blackwall and recorded by myself, there seems no doubt that these latter are the *Melanophora electa* of C. Koch (Die Arachn. Bd. vi. p. 83).

#### DRASSUS PALLIARDII.

*Leiocranum palliardii*, L. Koch.

*Agelena gracilipes*, Bl. Brit. & Ir. Spiders, p. 162, pl. x. fig. 104.

An immature female of this species was captured by myself on Bloxworth Heath in the summer of 1866, and is identical with the two species mentioned above as synonymous; it is very nearly allied to *Drassus praelongipes*, Camb. Ann. & Mag. Nat. Hist., but may easily be distinguished by the absence of the characteristic pattern on the abdomen of that species. Though included here in the genus *Drassus*, it is rightly, I think, separated from it by Dr. L. Koch.

#### Genus CLUBIONA.

##### CLUBIONA PALLENS.

*Clubiona pallens*, Koch, Die Arachn. Bd. vi. p. 19, pl. 185. figs. 443, 444.

— *diversa*, Camb. Zoologist for 1862, p. 7959.

This species was supposed to be undescribed when I described it under the specific name "diversa." A comparison of it, however, with examples of *C. pallens*, received from Dr. L. Koch, of Nürnberg, proves it to be identical with this latter species. Adults of both sexes have been obtained at Bloxworth, though very rarely; and I received an adult male of it in 1866 from Mr. Morris Young, by whom it was captured near Paisley, Scotland.



## CLUBIONA SUBTILIS.

*Clubiona subtilis*, L. Koch, Die Arachn. Fam. der Drassiden, p. 351, pl. xiv. figs. 229–231.

— *pallens*, Bl. Ann. & Mag. Nat. Hist. 2nd ser. vol. xiv. p. 30; Brit. & Ir. Spiders, p. 130, fig. 82.

The *Clubiona pallens* of Blackwall proving to be a different species from *C. pallens* of Koch, and it having been since described by Dr. L. Koch under the specific name of “*subtilis*,” I have here recorded it under that name.

It seems to be a very common Spider in marshy ground in the Fens of Cambridgeshire, whence I received great numbers of both sexes of it from Mr. W. Farren last spring; and I have also found it abundantly in similar situations in this neighbourhood.

## CLUBIONA LUTESCENS.

*Clubiona lutescens*, Westr. Aran. Suecicæ, p. 394.

— *assimilata*, Camb. Zool. for 1862, p. 7953.

— *lutescens*, L. Koch, Die Arachn. Fam. der Drassiden, p. 336, pl. xiii. figs. 217–219.

This species having been previously described by Mr. Westring under the name “*lutescens*,” I here record it under that specific appellation. In addition to the examples mentioned in Zool. (*loc. cit. sup.*), I have since received it from various parts of England.

## CLUBIONA PHRAGMITIS.

*Clubiona phragmitis*, Koch, Die Arachn. Bd. x. p. 134, tab. 360. figs. 846, 847.

— *deinognatha*, Camb. Zool. for 1862, p. 7957.

— *phragmitis*, L. Koch, Die Arachn. Fam. der Drassiden, p. 315, pl. xiii. figs. 202–204.

Having examined and carefully compared with my own specimens of *C. deinognatha* (Camb.) examples of *C. phragmitis* (Koch), I am convinced that the two species are identical; and therefore the latter name has the priority.

## Fam. CINIFLONIDÆ.

## Gen. ERGATIS.

## ERGATIS UNCINATA.

*Dictyna uncinata*, Westr. Aran. Suecicæ, p. 385.

*Ergatis arborea*, Camb. Zool. for 1862, p. 7960.

Not having at that time seen Mr. Westring's works, I was unaware of his having already described, under the specific name of *uncinata*, my *Ergatis arborea*. I have, since the notice of it in the ‘Zoologist,’ received it from various parts of England.

## ERGATIS VARIABILIS.

*Dictyna variabilis*, Koch, Die Arachn. Bd. iii. p. 29, pl. 83. fig. 187.

I am indebted to Mr. Parfitt, of Exeter, for the opportunity of recording this addition to our list of British Spiders. Adults of both sexes were contained in a collection made by that gentleman in the neighbourhood of Exeter in the summer of 1869. I have a suspicion that eventually the *Ergatis pallens* of Blackw. (Brit. & Ir. Spid. p. 148, pl. x.



fig. 94) will prove to be only a variety of *Ergatis variabilis*, which is an exceedingly variable species in its colour and markings.

### Genus ULOBORUS, Dugès.

*Veleda*, Blackw.

#### ULOBORUS WALCKENAERIUS.

*Uloborus walckenaerius*, Dugès, Règne Animal de Cuvier, pl. 10. fig. 41; Walck. Ins. Apt. tom. ii. p. 228, pl. 20. fig. 1; Hahn, Die Arachn. Bd. i. p. 122, pl. 35. fig. 62; Latr. Gen. Crust. et Ins. vol. i. pp. 109, 110; Guérin, Dict. Class. d'Hist. Nat. 5, t. xvi. p. 458.

*Veleda lineata*, Bl. Ann. & Mag. Nat. Hist. 3rd ser. vol. iii. p. 96; Brit. & Irish Spiders, part i. p. 150, pl. x. fig. 96.

I am unable to discover any distinction between examples of *Uloborus walckenaerius* received from Dr. Koch, of Nürnberg, examples of the same species captured by myself in Palestine, and the typical specimens upon which Mr. Blackwall founded his genus and species *Veleda lineata*. Mr. Blackwall admits that these specimens possess many characteristics in common with spiders of the genus *Uloborus*, but separates them from that genus on account of their possessing a fourth pair of spinners and calamistra, inferring that, as *Uloborus* was stated to construct a snare on the same plan as spiders of the family Epeïrides, therefore it did not possess these peculiarities.

The examples, however, that I found in Palestine were in such snares as above mentioned, and certainly do possess calamistra and a fourth pair of spinners; this is also the case with the examples forwarded to me from Germany by Dr. Koch. It appears to me, therefore, that these facts cast great doubt not only upon the scientific propriety of including *Uloborus* in the family Ciniflonides, but also upon the tenability of that family, which is based upon the possession of a fourth pair of spinners and calamistra. These peculiarities of structure seem to me to have at most *generic* importance, and perhaps are only of *specific* value, though this last remains to be proved.

The whole question of *family* relationship among Spiders is a very difficult one, and, paradoxical as it may sound, it is far easier to *establish a family* than to *characterize it*; *i. e.* it is easier to *form* a natural group of genera than to define shortly and succinctly the characters by which the different genera are united.

### Fam. AGELENIDES.

#### Genus AGELENA.

AGELENA PROXIMA, n. sp. (Pl. 54. no. 13.)

Male adult, length  $\frac{1}{2}$  of an inch; female rather larger.

This species bears a close resemblance to the *Agelena brunnea* of Blackwall; and many specimens of it submitted to Mr. B. for examination several years ago were pronounced by him to be of that species. Subsequent and close examination of its palpi (which differ in structure from those of *Agelena brunnea*) has convinced me that it is a distinct, though closely allied, species. It may always be recognized from *A. brunnea* by its constantly



smaller size, and in general by the greater distinctness of the abdominal pattern, which has also in many specimens a longitudinal central pale line on the fore half of its upper side, not existing, as far as I have observed, in *A. brunnea*. The projection at the outer extremity of the radial joints of the palpi is also shorter, stouter, and straighter than in *A. brunnea*; and the palpal organs also differ in their structure from those of that species.

The present species is abundant at heath-roots and among grass and rubbish in hedges &c. at Bloxworth, while *Agelena brunnea* is very rare. Egg cocoons, resembling in form that figured in 'British and Irish Spiders,' part i. pl. xii. fig. 102, are also common in the same localities. I find them attached to the stems of grass and rushes, sometimes beautifully white and clean, but generally covered with a crust of mud. I have hatched young spiders from some of these cocoons, but have never succeeded in rearing them to a sufficiently mature state to be able to decide their species, though sufficiently so to see that their genus is the same as that of the species now in question. Dr. Koch, of Nuremberg, to whom I have submitted adult specimens of *A. proxima*, agrees with me as to its distinctness from *A. brunnea* (*Agræca linotina*, Koch), and says he has found the female lately near that city. The figures given will explain better than any lengthened description the differences above mentioned between the two species.

Dr. Koch includes both these species in his genus *Agræca* of the family Drassides, in which I am inclined to agree; certainly they should be separated from the genus *Agelena*.

#### Genus TEGENARIA.

##### TEGENARIA INTRICATA.

*Tegenaria intricata*, Koch, Die Arachn. Bd. viii. p. 29, pl. 261. figs. 610, 611.

— *domestica*, Blackw. Brit. & Ir. Spiders, p. 163, pl. xi. fig. 105.

Upon a careful examination I am inclined to agree with Dr. L. Koch that the *Teegenaria domestica*, Koch, is the true *T. domestica*, Latr. Undoubtedly the British species known as *T. domestica* is the *T. intricata* of Koch (*loc. cit. sup.*), which latter name should therefore replace the specific name by which we have hitherto known it.

#### Genus THERIDION.

##### THERIDION INSTABILE, n. sp. (Pl. 55. no. 14.)

Male adult, length  $\frac{1}{12}$  of an inch.

*Cephalothorax* brightish yellow, with a broad longitudinal band of a blackish colour extending from the eyes to the hinder margin, towards which it narrows gradually. In some specimens it is slightly constricted at the junction of the caput and thorax. Caput well defined, rather elevated, projecting forwards, and with a few longish bristly hairs on its upperside directed forwards. The height of the clypeus exceeds the space between the central pairs of eyes of the front and hinder rows, and projects beyond the perpendicular line of the caput.

*Eyes* eight, nearly equal in size, the foremost ones of the side pairs slightly the smallest; the space between those of the central pair of the hinder row very little greater than between each of these and the hinder eye of the lateral pair on its side; those of



the lateral pairs are contiguous and seated obliquely on a small tubercle; the four central eyes nearly form a square, the distance from front to back being slightly less than from side to side, and the front side very slightly shorter than the hinder one; those of the fore central pair are dark-coloured; all the other six have a bright pearly lustre.

*Legs* long and moderately strong, the first pair much the longest; the second and fourth pairs are nearly equal, the fourth slightly the longest (?), and the third pair is the shortest; relative length 1, 4, 2, 3. They are well furnished with hairs, and in place of spines the tibial and genual joints have a few erect hairs or bristles; general colour the same as that of the cephalothorax, though slightly deeper in some specimens.

*Palpi* moderately long and strong, of the same colour as the legs; cubital and radial joints short; the latter is produced at its extremity on the outer side, where it is furnished with six, or more, black longish bristly hairs in a row round the margin; one, or more, longish bristly hairs also spring from the upperside of the cubital joint; digital joint hairy, oval, and of moderate size; palpal organs prominent and not very complicated; they have several irregular corneous projections at their extremity.

*Falces* long, greatly divergent, especially at their extremities, towards which there is a strong bluntish tooth-like process on the inner side of each falx; the fangs are very long and strong.

*Maxillæ* long, strong, nearly straight, considerably inclining over the labium, and obliquely truncated laterally on their outer extremities.

*Labium* triangular, rounded at the apex.

*Sternum* broad, heart-shaped, and, with the falces, maxillæ, and labium, rather paler-coloured than the legs, and sparingly furnished with a few blackish hairs.

*Abdomen* oval, moderately convex, and projecting over the base of the cephalothorax; very thinly clothed with longish hairs, and of a pale yellowish colour, thickly freckled with small white spots, or blotches, on the upperside; on each side of the median line is a row of black spots, or blotches, often diffused and confluent, and then forming an irregularly dentated central band between them, narrower at each end than in the middle; the sides have a few black spots, or irregular blotches; these are sometimes a mere longitudinal suffusion of colour, and sometimes entirely obsolete; similarly the underside has a large squarish black blotch towards the spinners, round which are also a few black spots, sometimes confluent and sometimes obsolete.

The female resembles the male, except in the caput not being quite so elevated, in the abdomen being of a globular form, and in the first pair of legs being proportionally shorter. The spots on the sides of the abdomen in some female specimens form two or three oblique lines, and the falces in that sex are also straight and shorter than in the male.

This species is nearly allied to *Theridion lineatum*, but is very much smaller, and is apparently never coloured with bright carmine on the abdomen as is the case occasionally in that species; the legs are also proportionally longer and stronger; and whereas the falces in the male of *Th. lineatum* vary very considerably in their length in different specimens, those of the present species vary, if at all, very slightly. The pattern on the abdomen is liable to considerable variation by the confluence or suffusion of the black spots, or by their being sometimes more or less obsolete. Both sexes were discovered by myself in



tolerable abundance at the base of rough sedgy grass and rushes in a swamp at Bloxworth in May 1863, among the stems of which it spins an irregular web.

THERIDION FAMILIARE, n. sp. (Pl. 55. no. 15.)

Male adult, length  $\frac{1}{2}$  of an inch (of which the cephalothorax is about half). Relative length of the legs 1, 2, 4, 3.

*Cephalothorax* broader behind than before; slightly prominent at the eyes; a strong longitudinal indentation in the median line of the hinder part, and some small furrows on the sides, converging towards the centre. Colour, dull orange-yellow; just behind the eyes is a broad spade-shaped patch of dusky brown, the point directed backwards; the lateral furrows and margins are also dusky-coloured.

*Eyes* eight, in two rows, curving from each other, the four central ones forming a square; the two foremost eyes of the square are very slightly further from each other than those of the hinder pair; those of the side pairs are contiguous to each other; all are seated on tubercles; those of the fore central pair are black, and the largest of the eight; the rest are pearly white, with black edges.

*Legs* of the same colour as the cephalothorax, and banded more or less distinctly with dusky red-brown in the males; those of the first pair are much the longest and rather the stoutest, then the second pair, and the third pair the shortest: they are sparingly clothed with hairs and a few slender spines.

*Palpi* moderately long and strong, of the same colour as the cephalothorax; cubital and radial joints short, and with several bristly hairs on the upperside directed forwards. The radial joint is the shortest, it is considerably produced at its extremity on the outer side, and is furnished on the margins with some long, strong, curved bristly hairs; digital joint oval, comprising the palpal organs, which are prominent, not complex, and with one or two small corneous reddish processes at their extremity.

*Falces* straight, neither very long nor powerful; profile outline hollow.

*Maxillæ* long, strong, obliquely truncated at the extremity on the outer side, strongly inclined towards the labium, which is broad at the base and bluntly triangular at the apex. These parts, with the falces, are of the same colour as the palpi.

*Sternum* broad and convex, of a yellowish colour, suffused with dusky.

*Abdomen* short, oval, convex, projecting slightly over the base of the cephalothorax. Colour dusky yellowish-drab, more or less spotted with small white blotches; a broad longitudinal band edged more or less broadly and irregularly with black, occupies the median line, tapering gradually from the fore part to the spinners; this band is dentated on the sides, slightly at first, but more frequently and strongly towards the hinder part; it is generally of a lighter colour, and more suffused with white blotches than the rest of the abdomen; the sides have a broad longitudinal patch of blackish brown, broadest forwards, and from one to three rows of black spots running from the dentations of the median band obliquely downwards. The underside is black, and very prominent and convex near the spiracular plates.

The *spinners* are encircled with blackish. The female is rather larger than the male, and her abdomen is more convex and projects more over the base of the cephalothorax;



but in colour and markings there is but little difference; in some males the markings of the abdomen are almost obliterated by a general dusky smoky suffusion.

This species, which is very closely allied to *Theridion denticulatum*, differs from it constantly in colour and markings, and is also smaller; it also seems to be entirely a house spider. I have found it abundantly for several years in unused rooms, where it spins irregular webs in corners and angles, but have never yet met with it out of doors, whereas *Th. denticulatum* is common out of doors in the same locality, and is seldom met with in any other locality.

*THERIDION BLACKWALLII*, n. sp.. (Pl. 55. no. 16.)

Male adult, length  $\frac{1}{10}$  of an inch.

*Cephalothorax* short, narrower in front than behind, where it is almost circular; it is moderately convex above, prominent at the eyes, and with a strong indentation at the junction of the caput and thoracic segment. Colour bright yellow-brown; the margins and upper part of caput (occiput especially) and the region of the front row of eyes are nearly black. Some strong, bristly, prominent black hairs among the eyes and on the clypeus, which is slightly impressed directly below the eyes, and a little prominent directly above the insertion of the falces; the clypeus exceeds in height the space between the fore and hind central pairs of eyes.

*Eyes* eight; four, in two pairs, forming almost a square in the centre, and two on each side contiguous to each other, and placed obliquely on a tubercle; those of the hind central pair are smaller and rather nearer together than those of the fore central pair, which are black, the rest being pearly white.

*Legs* rather short and moderately strong. Relative length 1, 4, 2, 3; but the absolute difference is not very great between 1 and 4; they are sparingly furnished with hairs, and their colour is yellow, banded faintly, but broadly, with orange-brown.

*Palpi* moderately long; the bulb formed by the digital joint and palpal organs is of great size, exceeding the humeral joint in length; the cubital joint is bent and somewhat clavate at its fore extremity, which is furnished with a long, prominent bristle; the radial joint is short, but produced on its outer extremity, which is furnished with some bristly hairs. The palpal organs, which are directed outwards, are well developed and prominent, but not very complex; a slender filiform red-brown spine issues from their outer extremity, and, curving completely round, rests on their surface, having in contact with it a strong fillet of some diaphanous whitish membranous substance; and at their inner extremity is a small black-pointed corneous projection. In colour the palpi are yellow-brown, the digital joint being much the darkest.

*Falces* rather long, perpendicular, about equal in length to the facial space, slender, but a little prominent near their base in front. They are similar in colour to the cephalothorax, and, as far as could be observed, destitute of teeth on their inner surface.

*Maxillæ* moderately long, strong, of an oblong form, and inclined towards the labium, which is short, broad, and semicircular; these parts are a little darker in colour than the falces.

*Sternum* broad, heart-shaped, and of a dark yellow-brown colour.



*Abdomen* oval, very convex above, and projecting a little over the base of the cephalothorax; it is very sparingly furnished with hairs; its upperside is nearly black, and separated from the sides by a pale band more or less suffused with white cretaceous spots; this pale band surrounds about two thirds of the upperside forward, and then continues backward as a single median dentated band to the spinners, just above which is a conspicuous white spot; there are also two other large whitish spots at the fore extremity, one on either side near together; the sides are pale, with a short lateral black band forward; the underside is strongly suffused with dull black. Spinners pale dull yellow; a leading character in the abdomen is the upper surface being covered pretty thickly with very small shining yellow-brown tubercles.

An adult male of this species was received from Mr. William Farren (who captured it in Wicken Fen, near Cambridge, in February 1869. It is allied to *Theridion inornatum* in general structure, but differs in size, colour, and markings. The tubercles on the abdomen, as well as the great size of the palpal bulb and the structure of the palpal organs, will serve to distinguish the present from all others known to me. In naming it after Mr. Blackwall, I wish to offer a small tribute of respect to one who has ever with the readiest kindness placed all his extensive knowledge on arachnology, as well as his collections, at my service.

**THERIDION STICTUM.** (Pl. 55. no. 17.)

*Theridion stictum*, Camb. Ann. & Mag. Nat. Hist. 3rd ser. vol. vii. p. 432; Blackw. Brit. & Ir. Spiders, part ii. p. 196, pl. xiv. fig. 126 (female).

Male adult, length  $1\frac{1}{4}$  line.

*Cephalothorax* short, oval, rather longer than broad, tolerably convex above; ocular region of the caput elevated and prominent; clypeus of considerable height, margin prominent and rounded; an indentation near the commencement of the hind slope at the upper junction of the caput and thoracic segments; the whole surface of the cephalothorax finely rugulose and covered pretty thickly with depressed punctuations, from each of which issues a very short strong black spine or pointed granulation. These are disposed in lines, which form a regular pattern, defining the form of the caput and the course of the thoracic segments, and mostly converge to the median indentation; a very few short dark hairs are disposed on the surface of the cephalothorax. Colour rich mahogany-red; caput rather the darkest.

*Eyes* eight, in two transverse rows on the summit and sides of the prominence of the caput; they are large and subequal; those of the side pairs are the smallest and the central anteriors slightly the largest of the eight; the first row is rather the shortest, and curved; the hinder row is straight. The four central eyes form nearly a square, of which the fore side is slightly longer than the hinder side, and the sides are rather the shortest. Each eye is placed on a tubercle; those of the lateral pairs are contiguous to each other, and obliquely seated on a strong tubercle. The four eyes of the hinder row are equidistant from each other, as also are those of the front row.

*Legs* moderately long and strong; relative length 1, 4, 2 (?), 3, the second and fourth pairs differ very slightly in length; their colour is bright orange-yellow tinged with red,



and they are furnished with hairs, some of which are erect and others sessile; of each kind there is a conspicuous row on the uppersides of the femora of the first two pairs; beneath the femora (chiefly of the two first pairs) are some deep red-brown granulations similar to those on the cephalothorax.

*Palpi* long and strong. Colour yellow tinged with sooty; digital joint darkest; they are very sparingly furnished with hairs, mostly so on the digital joint; humeral joint curved and gradually enlarging towards the extremity; cubital curved, prominent above and strongly clavate at the extremity; radial shorter than the cubital, spreading out at the extremity, and fringed near the margin with longish hairs; digital joint large, rounded behind, long, pointed at the extremity, on the inner side of which is a prominent and conspicuous projection giving it a bifid appearance; palpal organs well developed, prominent and complicated, consisting of several conspicuous corneous projections and spines of irregular form.

*Falces* considerably shorter than the clypeus and not very strong, perpendicular, but rather retiring beneath the clypeus; similar in colour and granulous punctures to the cephalothorax.

*Maxillæ* moderately long and strong, obliquely truncate at their extremity on the outer side, much inclined towards and nearly meeting over the *labium*, which is short and semicircular; these parts are similar in colour to the falces, the labium being rather darker.

*Sternum* large, heart-shaped, moderately convex, similar in colour to the cephalothorax, and thickly studded with similar granulous punctures, and a few shortish hairs.

*Abdomen* short, oval, convex, nearly globular and glossy; it does not project much over the base of the cephalothorax, and is furnished sparingly with short dark hairs. Its colour is pale brownish-yellow; a long irregular patch on the sides, and two large blotches on either side of the fore extremity, a space beneath the fore extremity of the upper part, and the extremity towards the spinners are of a dark blackish-mahogany colour; the upperside is divided longitudinally by a pale band, and irregularly marked with whitish markings, some spots of which are also visible on other portions of the upperside, especially between and outside the dark blotches at the fore extremity, and in a line beneath the lateral dark patches. Four conspicuous round depressions of a dark yellow-brown colour, form nearly a square occupying the centre of the upperside; the two hinder depressions are larger and rather further apart than the two fore ones; spiracular plates large, convex, shining; underside dark black-mahogany-coloured; a transverse yellow bar, above which are two oblique ones, forming an open angle directed forwards, mark the position of the sexual organs. Spinners very short, and of a pale dull yellow colour: they are situated on a pale patch surrounded by a margin of deep mahogany-colour.

Adult females of this rare and pretty spider have been taken at intervals on Bloxworth Heath, at the roots of grass and heath, from the year 1860; but the closest search has failed to produce more than the single male above described. It is allied closely both to *Theridion guttatum* (Walck.) and *Theridion quadripunctatum* (Walck.), but is easily distinguished from both by size, colour, and the peculiar granulated punctures on the cephalothorax &c., and also by the structure of the palpi and palpal organs.



## THERIDION VENUSTUM.

*Theridion venustum*, Walck. Ins. Apt. tom. ii. p. 316, no. 23.

A very young specimen (female) of a *Theridion*, which I feel little doubt belongs to the above species, was forwarded to me by Mr. Parfitt, of Exeter, by whom it was captured near that city in April 1869. This is its first record as a British species.

## THERIDION MELANOGASTER.

*Atea melanogaster*, Koch, Die Arachn. Bd. xi. p. 143, pl. 392. figs. 941, 942.

*Theridion congener*, Camb. Zoologist for 1863, p. 8576.

In describing this as a *Theridion* in 1863, I was unaware that it had been previously described as an *Atea* (fam. Epeirides) by Koch (*loc. cit. sup.*). Although in several respects a rather anomalous species of *Theridion*, its wide separation from the family Epeirides is very marked both in its structure and habits.

## THERIDION CORACINUM.

*Theridion coracinum*, Koch, Die Arachn. Bd. viii. p. 84, pl. 276. fig. 655.

An adult male of this species (new to Britain) was captured by myself among heath near Bloxworth in May 1863. It must not be confounded with a very similar species (lately recorded in Wales by Mr. Blackwall), *Theridion triste* (Koch), from which it is easily distinguished by the tarsal and metatarsal joints of the legs: excepting these, the whole of *T. coracinum* is jet-black; these joints were, in the example recorded, *white*. Koch describes them as ochre-yellow; but *his* example was that of the female, mine was of the male.

## LINYPHIA IMPIGRA, n. sp. (Pl. 55. no. 18.)

Male adult, length  $\frac{1}{6}$  of an inch (2 lines).

Relative length of legs 1, 4, 2, 3.

*Cephalothorax* oval, rather shorter than the abdomen, neither raised nor prominent in the ocular region, nor abruptly sloping at the hinder part; clypeus prominent, a considerable indentation in the median line of the hinder part, marked by a longitudinal blackish line slightly dilated in the middle. Sides marked with furrows converging to this indentation, and slightly suffused with dusky colour. Colour dark orange-yellow; a few hairs in the ocular region.

*Eyes* eight, in four pairs, moderate in size; all on tubercular black spots. Those of the hinder pair widest apart and largest of the eight, those of the front pair almost touching, those of the side pairs touch each other, and the hinder one is the smallest of the eight.

*Legs* long, tolerably stout, sparingly clothed with short hairs and a few short semi-erect black spines. In two individuals the relative lengths of the legs were 1, 4, 2, 3; the first, second, and fourth pairs differ but very little in length. Colour clear bright orange-yellow.

*Palpi* short and not very strong, of the same colour as the legs; tibial joint brownish and furnished with hairs; it is a little longer, and much stronger, than the cubital, and



rather gibbous on the inner side forwards; digital joint dark-coloured, hairy, and rather large, comprising the palpal organs; these are prominent, complicated, and have a long black spine, which, issuing out of a corneous process, emerges from their extremity, and curves back with a large, bold sweep round their outer side to the hinder part near the radial joint.

*Falces* long, strong, divergent at their extremity, slightly prominent towards the base, strongly inclined towards the maxillæ, and of a dark yellowish-brown colour.

*Maxillæ* moderate in length, strong and straight.

*Labium* broad, short, rather rounded at the apex.

*Sternum* heart-shaped, and, with the labium and maxillæ, of a dark-brown colour.

*Abdomen* long-oval, tolerably convex above, and projecting considerably over the base of the cephalothorax; it is very sparingly furnished with hairs; and its colour is glossy black, with two dull white spots on each side of the median line near the forward extremity, and two bright white spots similarly placed just above the spinners. In spirit of wine a faint trace of a longitudinal, tapering, slender band commencing near the cephalothorax and with a longitudinal row of largish spots on each side, all of a darker hue than the rest of the abdomen, could be seen.

Two adult males of this very distinct and conspicuous species were captured by myself among sedgy grass in a swamp at Bloxworth in May 1863. It is allied to *L. pratensis* and *L. fuliginea*, but is easily distinguished from both.

#### LINYPHIA CIRCUMCINCTA, n. sp.

Female adult, length 2 lines ( $\frac{1}{8}$  of an inch).

Relative length of legs 1, 4, 2, 3.

*Cephalothorax* short, broad, oval; cephalic region well defined, but not elevated or prominent; clypeus slightly prominent, a strong indentation in the median line of the hinder part is denoted by a black line dilated at the middle of the depression and running into the cephalic region, where it divides into two; the sides are marked with convergent dusky furrows. Colour, palish dull-yellow.

*Eyes* eight, in four pairs, all on black spots slightly tuberculated; those of the hinder pair widest apart and largest of the eight; those of the side pairs touch each other; those of the front pair are close together but not touching, and are the smallest of the eight.

*Legs* longish, moderately robust, rather paler and clearer-coloured than the cephalothorax, very sparingly furnished with hairs, and a few fine semierect spines.

*Palpi* short, slender, of the same colour as the legs, and furnished with hairs and fine spines.

*Falces* of the same colour as the legs, moderate in length and strength, rather prominent towards the base on the front, very slightly divergent at the extremity, where their colour is rather deeper.

*Maxillæ* long, strong, straight, and of a dark-brown colour. *Labium* coloured like the maxillæ; moderate in length, rounded and prominent at the apex.

*Sternum* broad heart-shaped, of a dark-brown colour, margined with black, and furnished with some long fine hairs.



*Abdomen* oval, projecting over the base of the cephalothorax, very convex, and much elevated forwards. Upperside white with a central tapering brown band, commencing near the cephalothorax and continued more or less distinctly to the spinners, just above which it is at times enlarged into spots; the latter part of the band is sometimes a mere line ending with a conspicuous dark spot; on each side of this band is a longitudinal row of brown spots varying in size and conspicuity in different examples, in some almost entirely wanting, in others more marked towards the spinners than forwards; these spots are generally joined to the median band by fine oblique dark lines; below these rows on each side is a broad band of brown running backwards towards the spinners, strongest and best-defined forwards, and becoming more diffuse and less defined as it runs back; the under margin, however, is generally clear and well defined, and makes the white below form a very distinct white band, dividing the upper from the lower side of the abdomen. Underside dark brown, more or less regularly mottled and mixed with white; the best-defined of the white markings is a circular line of spots in front of each spiracular plate, and seven or eight well-defined spots forming a horseshoe round the spinners (the open part of the shoe being on the underside). In one specimen the upper margin of the underside towards the spinners was marked with some oblique bars of a darker brown, encroaching upon the white of the upperside. Sexual organs hairy, prominent, but simple in form, with no very conspicuous opening or epigyne.

Adult and immature females of this species were captured by myself among sedgy grass in a swamp at Bloxworth in May, 1863. I could not succeed in discovering the male. It is something like *L. trilineata* in colour and markings, but differs exceedingly in size and also in the relative position of the eyes. It is also allied to *Linyphia albula* (Camb.).

LINYPHIA APPROXIMATA, n. sp. (Pl. 55. no. 19.)

Male adult, length  $\frac{1}{9}$  of an inch. Relative length of legs 1, 2, 4, 3.

*Cephalothorax* oval, flattish; cephalic region but little higher than the rest; it is indented in the median line of the hinder part, and has converging furrows on the sides; it is of a yellowish colour, slightly clouded with dusky; and the furrows and lateral margins in some specimens are indicated by indistinct sooty lines.

*Eyes* eight, in four pairs, or two transverse rows; they are on black spots; those of each side pair are seated on a tubercle close together, but not touching; those of the front pair are the smallest of the eight and are much nearer together than those of the hinder pair, which are rather the largest of the eight; the front row is nearly straight; the hinder row slightly curved from the front. The clypeus projects beyond the eyes, and is higher than the distance between the front and hinder pairs of eyes.

*Legs* dingy yellow, rather brighter in colour than the cephalothorax; those of the first pair are slightly longer than those of the second, which last are but little longer than those of the fourth; they are sparingly furnished with hairs, and a few fine semierect spines.

*Palpi* short and of the same colour as the legs; radial joint rather longer and much stronger than the cubital, slightly elongated in front and, with the digital joint, furnished



with bristly hairs; digital joint irregular in form and (comprising the palpal organs) very large, nearly equalling in length the whole of the rest of the palpus; palpal organs reddish-brown, very prominent, complicated, with a short slender spine at their extremity, curved in a circular form and in contact with a small mass of membranous matter.

*Falces* moderately long and strong, rather gibbous in front near their insertion, and diverging laterally at their extremities; similar to the cephalothorax in colour.

*Maxillæ* long, strong, broad and rounded at their extremity, slightly inclined to the labium, similar in colour to the falces.

*Labium* short, rounded at the apex, similar in colour to the *sternum*, which is broad, heartshaped, sparingly furnished with hairs, and of a yellow-brown colour, strongly suffused with dusky black.

*Abdomen* oval, about equal in length to the cephalothorax; its colour is nearly black; the sides and upper extremity forwards are sometimes paler; a series of five, six, or seven strong angular markings, with the vertices directed forwards, and of a pale whitish colour, occupies the median line of the upperside; these markings diminish in size as they approach the spinners; the first of them is often indistinct and sometimes obsolete, merging into a general paleness of the upperside near the front extremity: in some specimens these angular marks are interrupted at the angles.

The female differs from the male only in being rather larger and in the usual structure of the palpi; her sexual organs are slightly prominent, but present no marked peculiarity in form. This species is closely allied both to *Linyphia pulla* (Bl.) and *L. meadii* (Bl.) and also to *L. pullata* (Camb.); it may easily be distinguished from *L. pulla* by the much larger size of the digital joints of the palpi and palpal organs, and by the structure of the latter, as well as by the pattern on the upperside of the abdomen. From *L. meadii* (the adult male of which I have never seen) the female may readily be distinguished by the absence of the large prominent process connected with the sexual organs, which is very characteristic of the female of *L. meadii*. *L. approximata* is larger than *L. pullata*, but resembles it in the general form of the digital joint of the palpi and palpal organs, which last, however, in *L. pullata* want the slender circularly curved spine at their extremity.

*Linyphia approximata* was found abundantly at the end of May, 1863, among grass and sedge in a marshy spot at Bloxworth, low down among the stems of which it spins an irregular web.

#### LINYPHIA FURTIVA, n. sp. (Pl. 55. no. 20.)

Male adult, length  $\frac{1}{8}$  of an inch (or 2 lines). Relative length of legs 1, 4, 2, 3.

*Cephalothorax* longish-oval, squared at the eyes; rises gradually from the hinder part to the eyes, where it slightly projects over the clypeus, which is of considerable extent. A small longitudinal indentation occupies the median line of the hinder part; and some slight furrows on the sides converge to this indentation. Colour dark-brown with a yellowish tinge; ocular space furnished with some bristly hairs.

*Eyes* eight, in four pairs; those of the hinder pair are considerably wider apart than those of the front pair, and the largest of the eight; those of the side pairs are contiguous, and, as well as the front pair, placed upon tubercles; all are seated on black spots.



*Legs* long, moderately robust; relative length 1, 4, 2, 3; those of the first pair are very little longer than those of the fourth; they are sparingly furnished with hairs, and a few short fine erect and semierect spines. Colour clear yellow-brown, with a darker longitudinal suffusion on the femoral joints of some specimens.

*Palpi* moderately long; cubital joints short and far less strong than the radials, which are furnished with many strong bristly black hairs, especially towards the outer sides; digital joints very large and hairy; they comprise the palpal organs, which are very prominent and complex, with corneous lobes and processes; they are of a red-brown colour, the digital joint brownish-black, and the other joints greenish-brown.

*Falces* straight, not very strong, about equal in length to the facial space, and strongly inclined to the maxillæ; they are of the same colour as the cephalothorax.

*Maxillæ* short, strong, slightly curved towards the labium, which is short, semicircular, and with the maxillæ of the same colour as the legs.

*Sternum* of a dark-brown colour, and furnished with longish hairs.

*Abdomen* oblong, depressed or constricted across the middle, very sparingly clothed with hair. Colour black; underside divided from the upper by a row of irregular spots or patches of white, which run completely round the upper margin; the two foremost spots occupy either side of the median line towards the upper end, and are in some specimens very conspicuous. The upperside has a broad patch of yellowish-brown (mottled with minute spots of white) towards its foremost end; this patch is succeeded by and united to two or three broad curvi-angular lines (the vertices of the angles directed forwards) of the same colour, also mottled with white; or, if this be taken as the ground-colour of the upperside, the curvi-angular lines must be described as black with the extremities enlarged, so as in some specimens to form the conspicuous rows of longitudinal *black* blotches; in some specimens the brownish-yellow colour occupies the larger part of the upperside of the abdomen, and has the appearance of a large patch strongly dentated on the sides; and the alternate indentations form a row of black irregular spots on each side. The female is similar in colour and marking to the male; her abdomen, however, is larger and more convex; the digital, radial, and cubital joints of the palpi in this sex are furnished with long black spiny hairs; and the sexual organs are large, prominent, and with a large kidney-shaped opening deeply indented on the sides.

I have captured this species frequently under the projecting heathy and rooty edges of gravel-pits at Bloxworth, Dorset, where it forms a horizontal sheet of web, in which it waits for its prey in an inverted position. It is very closely allied to *Neriene marginata*, both in size, colours, and habits, but may easily be distinguished by the much larger digital joint and palpal organs of the male, and by the far less regularly angulated pattern on the abdomen. The female also may be distinguished from the female of *N. marginata* by the greater size and prominence of the sexual organs, and the larger and less-circular opening into them.

#### LINYPHIA FINITIMA, n. sp.

Male adult, length  $\frac{1}{10}$  of an inch.

*Cephalothorax* short, oval, slightly compressed laterally before, and not particularly



convex above; the normal grooves and furrows are not very strongly marked, except the indentation on the hind slope, which is broad and deep; the centre of the caput is slightly gibbous and rounded, sloping a little both fore and aft; clypeus low, its height not exceeding the diameter of one of the fore central eyes. Colour pale dull yellow; margins black, and a blackish angular or arrow-head marking with its point directed backwards at the occiput, showing the junction of the caput and thorax.

*Eyes* on slightly tubercular black spots, in four pairs, and not greatly differing from each other in size; those of the front central pair are the smallest and darkest of the eight, and are near together, but not touching; those of each lateral pair are placed obliquely and touch each other; the space between the hind centrals is equal to that between each of them and the lateral one on its side of the front row; each of the hind centrals, in fact, forms with the two of the front row nearest to it an equilateral triangle.

*Legs* long, rather slender; relative length 4, 1, 2, 3, furnished sparingly with hairs, and a few fine spines on their uppersides. Colour pale yellow; *palpi* short, similar to the legs in colour, except the digital joint, which has a brown tinge, and the palpal organs, which are red-brown. The cubital and radial joints are both short and about equal in length; the former has on its upperside forward a single long, strong, curved, prominent tapering bristle; the radial has a few inconspicuous hairs on its upperside, and spreads out slightly at its extremity, principally on the inner side. Digital joint large, of a somewhat irregular form, broader before than behind, being produced into a sort of lobe on either side forward, and with a small conical protuberance at its base on the upperside near the radial joint; palpal organs well developed, prominent, complicated, consisting of various lobes and corneous spiny projections.

*Falces* moderately long, not very powerful, vertical, divergent, armed with several longish teeth on the inner side at the extremity; similar in colour to the cephalothorax.

*Maxillæ* strong, not very long, slightly inclined towards the labium; the outer margin rounds gradually from near the base to the inner extremity.

*Labium* short, semicircular, and, with the maxillæ, of the same colour as the falces.

*Sternum* broad, heart-shaped, furnished with hairs, similar in colour to the labium &c.

*Abdomen* narrow, oval, moderately convex above, furnished sparingly with short hairs; it is of a dull whitish yellow, mottled on the upperside with white cretaceous-looking spots, or small blotches, principally in the median line, where they form a sort of pattern. Near the fore margin is a conspicuous subtriangular black patch pointing forward, its sides, which are longer than its base, are hollow; there are faint traces on the hind portion and on the sides of other black lines and spots, but no pattern discernible; perhaps other specimens would show some variety in this respect. This species, of which only a single specimen has come under my notice, was forwarded to me by the late Mr. Richard Beck, of Cornhill, London, among many other interesting spiders captured in the neighbourhood of London, and appears to me to be undescribed. It is allied to *L. longidens*, but easily distinguished by having the specific characters which denote that species much less strongly marked; it is also much smaller in size.

LINYPHIA CONFUSA\*, n. sp. (Pl. 55. no. 21, a, b, c, d, f, g.)

\* See note on this species at the conclusion of this paper.



This species so exactly resembles *L. minuta*, Bl. Brit. & Irish Spiders, part ii. p. 218, in size, form, general appearance, markings, and habitat, that the description given by Mr. Blackwall of the latter applies equally closely to the one under consideration, except in two or three respects. First, the dark annulation of the legs *generally* present in *L. minuta* is seldom strongly marked in *L. confusa*, and most commonly absent altogether. Secondly, the palpi in the male differ slightly in the form of the digital joint and structure of the palpal organs, as shown in the figures of those parts of each species, and *remarkably* in the form and armature of the cubital joint of the palpi. In *L. minuta* (Pl. 55. no. 21 *e*) this joint has a small tubercular prominence near the fore extremity of its upperside, whence springs a slightly sinuous strong spiny bristle of equal strength throughout its length and obtuse at the end, or rather suddenly ending in a point. In *L. confusa* the cubital joint has no prominence on the upperside; but a fine-pointed tapering bristle, sometimes nearly straight, sometimes slightly sinuous, replaces the strong spiny one in *L. minuta*; this difference is observable at a glance, and is very characteristic of the species.

It is difficult to distinguish the females of the two species; but a slight difference exists in the structure of their respective external sexual organs (epigyne). A variety of the male of both species is not unfrequent, in which the abdomen almost entirely wants the dark markings.

*L. confusa* is abundant in the south of England inside old buildings, in their outer sheltered corners, among lichens, ivy, and in the interstices of the bark of trees, while *L. minuta* is very rare, but found in similar localities in the north of England and in North Wales. *L. minuta* appears to be the common species, and *L. confusa* the rare one, and consequently it was overlooked by Mr. Blackwall. It was, however, contained among specimens of *L. minuta* forwarded by Mr. Blackwall to the artist to be figured in his work on British and Irish Spiders, part ii, plate xv.

#### LINYPHIA CINGULIPES, n. sp. (Pl. 55. no. 22.)

Female adult, length 2 lines ( $\frac{1}{8}$  of an inch).

*Cephalothorax* oval, not very convex above, of a dull greenish yellow-brown colour, marked with converging lines of a deeper hue following the normal grooves and indentations; ocular region very slightly prominent; clypeus prominent below, and slightly exceeding in height the length of space occupied by the four central eyes.

*Eyes* in four pairs, or two transverse curved rows, of which the hinder one is rather the least curved; they are seated on black spots; those of each lateral pair are contiguous to each other and placed on a small tubercle; those of the fore central pair are rather the largest of the eight, and the space between them is less than that between those of the hind central pair, though the transverse space occupied by each of these pairs is nearly equal; the spaces between those of the hind central pair and between each of those of the fore central pair and the fore lateral on its side are about equal, and an equal space separates each fore central eye from the hind central on its side.

*Palpi* moderately long, furnished with hairs, bristles, and a few spines. Colour dull greenish-brown.



*Legs* moderately long and strong. Relative length 4, 1, 2, 3, furnished with hairs and a few fine longish black spines. Colour pale yellow with a greenish tinge, broadly and distinctly banded (except the tarsi) with brownish-black.

*Falces* long, strong, vertical, slightly divergent at the extremities, and a little prominent near their base in front. Similar in colour to the cephalothorax.

*Maxillæ* strong, straight, parallel, and rounded at the extremities; rather paler in colour than the falces, and yellowish at the extremities.

*Labium* short, semicircular, similar in colour to the cephalothorax.

*Sternum* heart-shaped, and of a deep blackish-brown colour.

*Abdomen* oval, very convex above, especially in front, and projects over the base of the cephalothorax; it is of a dull greenish yellow-white, clothed sparingly with dark hairs; a broadish longitudinal black band runs backwards to the spinners from near the fore extremity, and contains two somewhat triangular whitish markings forwards, each divided longitudinally by a black line; in continuance of the same longitudinal line towards the spinners are several more or less angular whitish lines, the angles directed forward; the sides are irregularly marked with blackish, and the underside is completely black.

The sexual aperture is furnished with a strong prominent *epigyne*, furnished on the exterior side with coarse longish hairs; its extremity is of a dark red-brown colour; and inside it has a short curved process or ovipositor.

A single adult female of this species (which appears to me to be undescribed) was contained in a collection of Spiders made by Mr. William Farren, of Cambridge, in Wicken Fen, near that town, in February 1869.

#### LINYPHIA EXPERTA, n. sp. (Pl. 55. no. 23.)

Male adult, length  $\frac{1}{8}$  of an inch (or  $1\frac{1}{2}$  line).

*Cephalothorax* broad, oval, slightly compressed laterally in front, where it is somewhat roundly truncated; the sides of the thoracic region are a little depressed and sloping slightly forward at the eyes; caput rather rounded; the normal indentations are well marked, especially that on the hinder slope, which is gradual; margins black; clypeus perpendicular, its height is greater than the space from the front to the hind central pairs of eyes, inclusive of the eyes themselves, and about equal to the space between the fore lateral eyes; the surface of the cephalothorax is glossy, of a yellow-brown colour, and has a very few vertical dark hairs upon the caput.

*Eyes* on slightly tuberculate black spots, in four pairs, or two transverse rows; those of the lower row are in a straight line, and the hinder row is slightly curved; those of the fore central pair are the smallest of the eight and almost touch each other; each is distant from the lateral one of the same row nearest to it by rather more than its own diameter; the same distance separates each from the hind central eye opposite to it; those of the hind row are equidistant from each other, the space between them being equal to that between each corresponding fore and hind central eye; those of the lateral pairs are placed obliquely and very nearly touch each other; these last are of a pearly-white colour; the hind centrals are tinged with bluish grey, the fore centrals being darker.



*Legs* long and slender, of a yellowish brown colour, sparingly furnished with hairs and a very few short fine bristly spines; the tibiæ and metatarsi of the first and second pairs are slightly darker in colour than the rest; and the tibiæ of the first, second, and fourth pairs are equal in length to their respective femora; each tarsus ends with three curved claws.

*Palpi* short, similar in colour to the legs; the radial and cubital joints are about equal in length and clavate; the radial is slightly prominent behind, and somewhat obtusely produced in front at its extremity; both of these joints have a single, long, strong, tapering bristle projecting from near the extremity of their uppersides respectively; besides these the palpi are furnished with a few ordinary and less conspicuous hairs. Digital joint oval, not very large, about equal in length to the radial and cubital together; it has a lobe or prominence about the middle of the outer margin; palpal organs well developed, prominent, and rather complex, consisting of corneous spiny processes, from one of which, situate near their base on the inner side, extending and projecting prominently backwards and outwards is a conspicuous and slender process, nearly straight, semitransparent, and tipped with a sort of tuft of black bristles.

*Falces* long, strong, vertical, slightly exceeding the facial space in length, darker in colour than the cephalothorax, furnished with a few bristly hairs in front, and having several strong teeth on the inner surfaces at their extremities.

*Maxillæ* rather paler in colour than the falces, moderately long, strong, nearly straight, but rounded on the outer margins.

*Labium* rather darker in colour than the maxillæ, short, somewhat broader at the base than at the apex, which is flattened, though in a rounding form.

*Sternum* heart-shaped, of a dark blackish-brown colour, and hairy.

*Abdomen* longish oval and glossy; it projects a little over the base of the cephalothorax, is sparingly furnished with short hairs, and is of a dull black colour, showing (but only when in spirit of wine) a few obscure pale spots and transverse lines. The spinners and spiracular plates are of a pale luteous colour.

This species, resembling many of the genus *Erigone* in size, colour, and general appearance, may yet be easily distinguished from any other recorded species by the transparent process, tipped with black bristles, issuing outwards from the inner base of the palpal organs, as well as by other minor differences. It was captured by myself one night in December 1867, in the village schoolroom at Bloxworth, into which it may very probably have been brought with the turf and sticks ordinarily used for fuel.

**LINYPHIA LONGIPES, n. sp.** (Pl. 55. no. 24.)

Male adult, length  $\frac{1}{12}$  of an inch (or 1 line).

*Cephalothorax* broad, oval, compressed on the sides forward; colour dark brown. Normal indentations and furrows well marked, and, together with the margins, of a dusky black colour. The clypeus is impressed near the eyes, but rather prominent on its lower margin, and is equal in height to the space between the outer eyes of the front row; the hind junction of the caput and thorax is slightly depressed.

*Eyes* in four pairs, on black spots; those of the fore central pair are the smallest of



the eight, and near together; those of the hind central pair are a little wider apart than each is from the lateral of the same row on its side, the distance between them being equal to that between each and the one opposite to it of the front central pair; the hind row is curved, the front row straight; the eyes of each lateral pair are seated obliquely on a slight tubercle.

*Legs* long, slender, furnished with hairs and a few fine spines; colour dark yellow-brown; relative length 4, 1, 2, 3.

*Palpi* not very long; radial and cubital joints of equal length; the former is rather gibbous or nodiform, it is furnished with a few bristly hairs above, and is slightly produced towards its inner side; the digital joint has a prominent lobe on its outer side forward; the palpal organs are prominent and complex, consisting of corneous processes, of which one, of a curved form, is rather prominent at their base on the outer side, and a slender black spine coils round their extremity.

*Falces* moderately long and strong, slightly inclined to the maxillæ, and a little hollowed on the outer margins; they are similar in colour to the cephalothorax, and are furnished with bristly hairs.

*Maxillæ* moderately long, broad at the base, obliquely rounding to the inner extremities; they are slightly inclined to the *labium*, which is short, broad, and somewhat flatly rounded at the apex. These parts are similar in colour to the falces, the labium, however, being rather darker.

*Sternum* heart-shaped, furnished with hairs, and of a blackish hue.

*Abdomen* oviform, black, and furnished with short hairs; when in spirit of wine, a few pale lines and spots, arranged somewhat symmetrically, are visible; spinners and spiracular plates pale greenish black.

The female is rather larger than the male, and resembles it in colour and general characters; but her legs are shorter. Specimens of this species were captured by myself among dwarf plants and herbage in the sand hills, near Southport, in Lancashire, in 1859, but were overlooked, until more recently I found it abundantly at Bloxworth, spinning an irregular web among stems of grass and rubbish. It is closely allied in the structure of its palpi to *L. circumspecta* (Blackw.), but it is easily distinguished by being rather larger, and never having any trace of the characteristic pattern on the abdomen, which is always, as far as I have observed, visible in that species.

It may easily be distinguished from *Nerience* (*Erigone*) *rurestris* (Westr.) (the *Nerience gracilis* of Blackwall), to which it bears some resemblance, by the spines on the legs as well as by its rather larger size, the greater length but rather less strength of the falces, and its generally duller hue. Possibly it may be identical with *Linyphia parvula* (Westr.), to which it is, at all events, very nearly allied, but from which I am inclined to believe it is distinct.

#### LINYPHIA INCONSPICUA, n. sp.

Male adult, length  $\frac{1}{17}$  of an inch.

This spider is very nearly allied to *L. ericæa* (Bl.), but is, I think, distinct from that species.



The cephalothorax (which has a narrow blackish margin), legs, falces, and maxillæ are of a pale yellow colour, the sternum slightly suffused with blackish, and the abdomen, which projects a little over the base of the cephalothorax, is of a pale whitish brown colour above, reticulated with a darker hue, forming a sort of central longitudinal pale narrow band, pointed at its hinder part, reaching nearly to the spinners, and sending forth lateral pale lines; the underside is suffused with black, and the spiracular plates are pale yellow.

The *cephalothorax* is similar in form to that of *L. ericæa* and *L. circumspecta*; the eyes are on large and almost confluent black spots. They are rather large in comparison with the size of the spider; those of the hind central pair are further from each other than each is from the end one of the hind row on its side; those of each lateral pair are contiguous, and placed slightly obliquely on a small tubercle; those of the fore central pair are close together, and smaller and darker than the rest; each of these is within half of its diameter of the lateral of the same row on its side, and is distant about once and a half its diameter, or less, from the hind central eye opposite to it.

*Legs* long and slender; relative length 1, 2, 4, 3, and furnished with ordinary hairs and longish slender spines.

*Palpi* short; the radial joint is much stronger than the cubital, being produced or spread out a little in front at its extremity; it has a few longish dark bristly hairs, of which one on its upperside forward is most conspicuous. Digital joint moderate in size, with a small lobe on its outer side; palpal organs rather complex, with a curved corneous process near their base on the outer side, having a short fine spiny black point, almost touching the outer extremity of the radial joint. These organs are tinged in parts with red brown.

*Maxillæ* short, strong, curved, and almost meeting over the labium, which is short and round at the apex.

The female is larger and darker than the male; her abdomen projects greatly over the cephalothorax; and the relative length of the legs appears to differ in that sex, the fourth pair being equal to, if not slightly longer than, the first, and certainly longer than the second; her external sexual organs are prominent, and project backwards, but have no very perceptible *epigyne* (or ovipositor) connected with them, in this respect differing from *L. ericæa* (Bl.), and more resembling *L. circumspecta*, from which, however, the *male* is easily recognized by the absence of any black filiform spine coiled round the extremity of the palpal organs.

An adult male and females of this spider were captured by myself among herbage in a wood at Bloxworth, Dorset, in April 1867.

#### LINYPHIA OBLITA, n. sp.

Male adult, length 1 line ( $\frac{1}{12}$  of an inch).

This obscure species, of which it is very difficult to give any easily recognizable specific difference from *Neriene pallipes* (Camb.), described p. 437, *post*, is yet, I think, certainly distinct from it. It is larger and darker in colour, and its cephalothorax has a kind of angular dark patch at the junction of the caput and thorax; its falces are rather longer,



and are a little divergent at their extremity; and the eyes of the hind row are equidistant from each other; the maxillæ also appear to be less inclined towards the labium than in *N. pallipes*. The palpal organs have a strong curved corneous process at their base on the outer side, closely adhering to them; and the abdomen is rather more perceptibly clothed with fine hairs than that of *N. pallipes*. An adult male was beaten from a furze-bush at Bloxworth in the summer of 1863.

LINYPHIA ? OBLONGA, n. sp.

Female adult, length  $\frac{1}{16}$  of an inch.

In general form this spider is of a flattened oblong, the abdomen being rather broader behind than in front; and in its mode of running the whole body is kept very closely adhering to the surface upon which it runs.

The *cephalothorax* is of a pale yellowish brown colour and semitransparent. The normal grooves and indentations are visible, but not strongly marked; and there is a very slight depression at the junction of the caput and thorax; the height of the clypeus is greater than the space occupied by the four central eyes.

*Eyes* very small, not differing much in size; they are seated on small black spots, and are all of a pearly-white colour; the two central ones of the hinder row are nearer together than each is to the end one of the same row on its side; the fore centrals are close together, and those of each lateral pair are very obliquely placed on a small tubercle; the space between the hind centrals is about equal to that between each and the fore central opposite to it.

*Legs* rather long, slender; relative length 4, 1, 2, 3; they are furnished with hairs and a few slender spines, and are of the same colour as the cephalothorax, the tibiæ and metatarsi being sometimes suffused with yellow-brown.

*Palpi* moderately long, similar in colour and armature to the legs.

*Falces* moderately long, powerful, inclined to the maxillæ, and similar in colour to the cephalothorax; no teeth could be discerned on their inner surface.

*Maxillæ* strong, rather inclined to the *labium*, which is short and semicircular; these parts, as well as the sternum, are also similar in colour to the cephalothorax.

*Abdomen* oblong, longer than the cephalothorax, over which it projects a little, flattish above, rather broader behind than in front, of a dull greenish yellow suffused with black brown, marked somewhat regularly with pale lines and spots, similar to those in many species of *Neriene* (Bl.), but, like them, these markings are chiefly visible when in spirit of wine; it is glossy, and very slightly clothed with a few fine hairs; the underside is less suffused with black brown than the upperside. The sexual organs are not very prominent, but conspicuous by being marked, and their apertures margined, with deep red brown; the aperture is small, and nearly round in form.

Adult females of this spider (considered to be a *Linyphia* by Dr. Koch) are not infrequent in May and June upon iron railings at Bloxworth, Dorset; it may easily be distinguished from most other species by its oblong flattened form, as well as by the minuteness of its eyes, and (which is also unusual) the fore central eyes being of a pearly-white colour like the rest. I have not yet succeeded in detecting the male, which, when



found, would, I imagine, certainly furnish some peculiar specific characters. Notwithstanding the fine spines on the legs, it seems to me that this species, from its form, relative length of legs, and form of maxillæ, should be placed among the species of the genus *Neriene*.

LINYPHIA MICROPHTHALMA, n. sp. (Pl. 56. no. 25.)

Male adult, length 1 line.

*Cephalothorax* oval, moderately convex above, glossy and smooth. Caput not constricted laterally; normal furrows defining the junction of the caput with the thorax and thoracic segments shallow and slight; hind slope long and gradual. There are some prominent hairs on the clypeus, the lower margin of which is rounded and projecting; the height of the clypeus is slightly greater than the length of the space occupied by the four central eyes; the caput slopes in a rounding form just behind the eyes to the summit, which is on a line even with the thorax. Colour brownish yellow.

*Eyes* eight, in two transverse rows on the upper fore margin of the caput, curving from each other, *very small*, subequal; the fore centrals are the smallest, very near together, but not touching each other; all have slight rims of black; the hind centrals are very little nearer together than each is to the lateral on its side, but further apart than each is from the fore central on its side; the laterals are contiguous, and placed obliquely on a very slight tubercle; the distance between each fore central eye and the lateral of the same row on its side is equal to that between it and the hind central on its side.

*Legs* rather long, tolerably stout; relative length 4, 1, 2, 3; those of the fourth pair are only a little longer than those of the first. Colour yellow; furnished with hairs and a few longish slender spines.

*Falces* long, moderately strong, and slightly divergent; their profile, lobed from the front, is sinuous, or at first slightly prominent, and then hollowed out near the middle; they are very slightly inclined towards the sternum, and each falx is furnished with three teeth towards its extremity on the inner side; of these teeth the two nearest the extremity are considerably longer and more prominent than the other; in colour the falces are similar to the cephalothorax.

*Palpi* slender, not very long, except the digital joint, which is large and strong; they are similar to the legs in colour; humeral joint curved; cubital joint short, slight, and curved; radial joint equal in length to the cubital, but much stouter, enlarged towards the margin, though with no special projections. These last two joints are furnished with a few bristly hairs on their outer sides. Digital joint equal in length to the humeral, and with a prominence near the base on the outer margin rather darker-coloured than the rest of the palpus, and furnished with bristly hairs on the upperside. Palpal organs prominent and complex; a large curved corneous piece, with a notch near its extremity, projects from their base on the outer side (similar to that in many others of the *Linyphie*), and a short duplicated black spine in a coil at their extremity.

*Maxillæ* moderately long, stout, slightly inclined toward the *labium*, which is short and semicircular; these parts, as well as the sternum, which is large and heart-shaped, are rather darker in colour than the cephalothorax.



*Abdomen* longish oval, not very convex above, slightly projecting over the base of the cephalothorax; colour yellowish, suffused slightly with sooty brown, and furnished sparingly with pale yellowish hairs. An adult male was received from the late Mr. Richard Beck, by whom it was captured in the neighbourhood of London in 1864.

It is closely allied to *Linyphia decens*, n. sp. (described p. 436, *post*), but differs in colour and other respects, resembling it chiefly in the smallness of the eyes.

LINYPHIA PALLIDA, n. sp. (Pl. 56. no. 26.)

Male adult; length  $\frac{1}{12}$  of an inch (or 1 line).

*Cephalothorax*. Caput well defined by a strongish constriction at its junction with the thorax; it is not raised above the thorax except in a gradually rising line from the hinder part of the cephalothorax to the eyes; the surface is very minutely punctured with fine impressed dots. The thorax is indented on the sides, and has a broad shallow depression in the hinder part; colour dusky yellow, with an orange tinge; clypeus prominent, and its height equal to the space occupied by the two central pairs of eyes.

*Eyes* eight, in two transverse rows on the fore part of caput; front row shortest, and nearly straight. Space between the eyes of the central pair in the hinder row rather greater than that between each and the end one of the row on its side; those of the side pairs are contiguous, and on a tubercle; those of the central pair in the front row are also on tubercles, contiguous, and rather the smallest of the eight; the central eyes of the hinder row are about equal in size to the lateral eyes of the front row; all are edged with black.

*Legs* long, rather slender; relative length (male) 4, 1, 2, 3, (female) 1, 2, 4, 3, but little difference between those of the first, third, and fourth pairs; they are furnished with hairs and spines, and a few spine-like bristles on the uppersides of the femoral joints; in colour the same as the cephalothorax.

*Palpi* short, not very strong; cubital and radial joints about equal in length; the radial is the stoutest, and has some long, strong, bristly hairs on the upperside; a strong bristle on the upperside of the cubital joint; digital joint, and the palpal organs, large; the latter highly developed and complicated, with corneous pieces and projections, the two most prominent of which are one on the outer side, the other close behind, underneath the extremity of the radial joint, against which its upper end abuts. The figure will give a better idea of these pieces than it is possible to give by any description. The palpi are furnished with hairs, and are of the same colour as the legs; palpal organs yellow-brown, mixed with a deeper colour.

*Falces* moderately strong, straight, prominent at the base on the upperside; looked at from the front, slightly hollowed (in external profile) toward the fangs.

*Maxillæ* strong, much inclined toward the *labium*, which is short, semicircular, and flattened at the top. These last three parts are of the same colour as the cephalothorax.

*Sternum* broad, heart-shaped, constricted at the hinder end, smooth, and shining, furnished with a very few erect hairs; colour yellowish, thickly mottled with dusky.



*Abdomen.* Colour light-yellowish drab, very thinly clothed with hairs; in one specimen some dusky transverse slightly angular lines were visible on the hinder half; a few of these near the spinners and on the underside were more conspicuous than the rest. On the underside, before each spiracular plate, is a patch of a yellow-brown colour.

The female resembles the male in colour; but the relative length of legs is different, as noticed above; the abdomen also is much larger and more arched on the upperside, and the falces are more divergent; a large, strong, prominent, perpendicular and rather complex process is connected with the sexual organs, by which it may easily be distinguished from the greater number of allied species.

Two adults of each sex were captured, at heath-roots, at Bloxworth, in March 1867. Its general similarity in colouring and form &c. to some others (among which to *L. decens*, n. sp., next described), makes it difficult to give a very distinctive description of this species; but from most others the eyes at once distinguish it, as well as the peculiar form of the corneous pieces connected with the palpal organs.

LINYPHIA DECENS, n. sp. (Pl. 56. no. 27.)

Male adult, length  $\frac{1}{12}$  of an inch (1 line).

*Cephalothorax* oval; the caput is not raised above the rest of the surface; looked at from the front it forms a segment of a circle, and in profile it slopes slightly forwards at the eyes. Divisional line of caput and thorax very indistinctly marked. Clypeus projects considerably; its height is more than equal to double the distance between the two central pairs of eyes of the upper and lower rows. The cephalothorax is finely, completely, and thickly punctured on its surface; the lateral grooves are slight, as also the longitudinal indentation on the hinder slope. A very few fine bristly hairs are on the caput just behind the eyes, some longer converging ones on the clypeus, and several very short ones on the hinder slope. Colour of cephalothorax yellow-brown.

*Eyes* eight, in four pairs, forming two rows, which extend quite across the caput; all have more or less complete black rims; those of the central pair of the front row seated on a slight tubercle, are very minute, much the smallest of the eight; the remaining six are small, but not very unequal in size; those of each side pair are contiguous, and placed obliquely on a slight tubercle; the fore ones are slightly larger than the hinder ones; the space between those of the central pair in the hinder row is double of that between each and the hinder eye of the lateral pair on its side, and *equal* to the space between the central pairs of each row.

*Legs* long, moderately robust, femora of the fourth pair the strongest; they are paler and clearer-coloured than the cephalothorax; relative length 4, 1, 2, 3; sparingly furnished with hairs and a very few slender spines, viz. one on the upperside of the fore extremity of each of the genual joints, and two on the upperside of each of the tibial joints; those on the hinder pairs are the longest and strongest, those on the fore pairs are but little more than fine bristly hairs.

*Palpi* short and of the same colour as the legs; the radial and cubital joints are about the same length, the former stout and slightly protuberant or produced at the extremity in front, round which it has a single row of bristly hairs projecting over the base of the



digital joints, and two longer and stronger curved bristles on the outer sides; digital joint large, sparingly furnished with longish bristly hairs; a large lobe, ending in a blunt projection towards its base, on the outer side. Palpal organs prominent and complicated; a strong curved corneous process projects outwards at their base (this process has a slight notch on the inner margin near its extremity), and two curved spines at their extremity, rather on the inner side; one of these spines lies within the other, and is far the slenderer of the two; there is also a small conically pointed projection at the extremity of these organs.

*Falces* long, strong, very slightly divergent, slightly hollowed on the outer margin, and of the same colour as the cephalothorax; their articulation is plainly seen beneath the clypeus, which gives it the appearance at first sight of a vandyked junction between the falces and clypeus.

*Maxillæ* strong, almost meeting over the labium, which is short and semicircular.

*Sternum* heart-shaped, sparingly furnished with a few blackish hairs, and (together with the labium and maxillæ) of the same colour as the legs.

*Abdomen* long oval, about the same length as the cephalothorax, over which it projects slightly; it is of a pale drab-yellow colour, sparingly but regularly and conspicuously clothed with blackish-brown hairs.

Found at the roots of heath at Bloxworth in the spring of 1862.

LINYPHIA DECOLOR?. (Pl. 56. no. 28.)

*Linyphia decolor*, Westr. Aran. Suecicæ, p. 131?

Adults of both sexes of a *Linyphia*, considered by Dr. L. Koch to be the *L. decolor* of Westr., were captured by myself among moss and dead leaves in a wood at Bloxworth in April and May 1861.

#### Genus NERIENE.

NERIENE PALLIPES, n. sp.

Male adult, length  $\frac{1}{17}$  of an inch.

*Cephalothorax* oval; caput confluent with the thorax, the division only visible by the normal furrows, which are scarcely visibly marked; profile of the clypeus confluent in an even curving line with the upper part of the caput, whence the former is very prominent at its lower margin; the caput has some bristly prominent hairs upon it; colour yellowish brown, finely punctuose when seen under a lens; margin bordered with a blackish line. The height of the clypeus is equal to the space occupied by the fore and hind central pair of eyes.

*Eyes* eight, small, not differing much in size; in four pairs or two rows, and seated on small black spots; the upper row is the most curved, and longest, those of the hind central pair are rather nearer together than each is to the lateral one on its side; those of the fore central pair are close together and dark-coloured; each of these is equally distant from the lateral one of the same row on its side, and from that of the hind central pair opposite to itself; those of each lateral pair are contiguous, and placed slightly obliquely on a small tubercle.



*Legs* moderately long and strong; relative length 4, 1, 2, 3; colour pale dull yellowish, furnished with hairs and slender spines.

*Palpi* small, similar in colour to the legs; the cubital joint has a few short fine bristly hairs on its upperside forwards; the radial has a good many longer and strong ones, especially on its outer side forwards; this joint is about equal in length to the cubital, but is much stronger, and produced slightly in an obtuse form in front; the digital joint is not very large; it is hairy, and with a prominent lobe on its outer side; palpal organs prominent and complicated, with corneous spiny processes. These in the specimen described from, were forced out of natural position by the inflation (from the action of the spirit of wine) of some membranous substance connected with them.

*Falces* moderate in length and strength, slightly inclined to the maxillæ; these latter are strong, somewhat curvilinear on their outer sides, and inclined to the labium, which is short and semicircular; these parts, together with the sternum, are of the same colour as the cephalothorax.

*Abdomen* oval, glossy, very thinly furnished with short hairs, and of a dull black colour, spinners pale whitish brown.

Dr. L. Koch considers this to be a *Linyphia*, owing to the spines on the legs; but a careful examination of the numerous species of the genera *Linyphia* and *Neriene* (*Erigone*, Westr. ad partem) shows that it is impossible to hold to the armature of the legs merely as an unvarying and valid generic character.

The specimens above described were captured by myself upon low bushes in a wood at Bloxworth, Dorset, in July 1860. Its small size will distinguish it from numerous others of the genus; it is very closely allied to *Linyphia oblita* (described p. 432, *ante*) in general form, size, and also in appearance, but differs in the structure of the palpal organs as well as in the length of the falces and in the much darker colour of the cephalothorax, which also differs in profile. The female is rather larger, but resembles the male in colour and general characters.

#### NERIENE DECORA, n. sp.

Male adult, length 1 line (or  $\frac{1}{12}$  of an inch).

This species is very closely allied to *Neriene subtilis* (Camb. Zool. 1863, p. 8584) and *N. innotabilis* (Camb. Zool. 1863, p. 8582), both in size, general structure, and appearance. From *N. subtilis* it may be distinguished by the conical enlargement on the outer side of the digital joint of the palpi being far less prominent, as also by the legs wanting the black-brown tinge usually visible on the tibiæ and metatarsi, and also on the cephalothorax of *subtilis*; in *decora* the cephalothorax and legs (except the genual joints, which are paler) are of a uniform reddish yellow-brown, and the abdomen is glossy and of a black-brown colour, with pale lines and markings visible in spirit of wine; these markings in both species form a regular pattern, consisting of a longitudinal narrow band, from the outer sides of which pale, lateral, oblique, and slightly curved lines issue. From *N. innotabilis* it differs in the eyes being smaller, and those of the hind central pair being further removed from the hind lateral on its side; in *innotabilis* these are almost close together—in fact, but little further from each other than are those of the lateral pairs;



in *decora* the eyes of the hind row are equidistant. The digital joints of the palpi also in *decora* are in a pointed form, prominent at their base, the prominence in each palpus being almost in contact with the inner extremity of the radial joint (a similar prominence exists in *N. subtilis*); the palpal organs of all three species (although their complex structure defies accurate description) are yet visibly different in structure upon a close examination with a lens.

Two specimens of *N. decora* were captured by myself at the roots of grass and low plants at Formby Hall, near Liverpool, in the summer of 1859.

*NERIENE MOLLIS*, n. sp.

Male adult, length  $\frac{1}{16}$  of an inch.

The only specimen of this minute and obscure species that has come under my notice had evidently not long undergone its final moult, and hence its colours were far paler than they would have been at a later period. Still it appears to be distinct from any species I am acquainted with, although presenting no *very marked* distinctive specific characters. In the specimen alluded to, the cephalothorax is of a pale yellow, margined finely with blackish; the legs are nearly white, furnished with hairs and a few very fine spines, and the *abdomen* pale dull yellowish brown, slightly suffused with dull black on the underside. The cephalothorax has its fore part very slightly compressed on its sides forwards; and the height of the clypeus is equal to the length of the space occupied by the fore and hind central pairs of eyes; the junction of the caput and thorax is slightly depressed, and the ordinary furrows and indentations are well marked.

*Eyes* eight, on black spots, rather closely grouped in two equally divergent curved rows, forming an oval space; those of the hind central pair are slightly the largest, those of the fore central pair slightly the smallest of the eight; those of each lateral pair are, in the slightest possible degree, obliquely placed on a small tubercle; the distance between each of the fore central pair and that of the hind central pair opposite to it is greater than that between the two hind central eyes; the spaces between the several eyes of the hinder row scarcely differ in length.

*Palpi* short; the radial joint is stronger than the cubital, rounded at the extremity on the upper margin; a single dark bristle issues from the front of the latter, and several bristly hairs from the front of the former; digital joint roundish oval. Palpal organs rather complex, consisting of corneous spiny processes fitting pretty compactly together.

*Falces* rather long, vertical, straight, moderately strong.

The small size of this spider will, perhaps, sufficiently distinguish it from most other species; but from *Neriene gracilis* (Bl.), to which it seems very nearly allied, it may be distinguished by the greater length, and less strength at the base, of the falces, and by the form of the radial and digital joints of the palpi.

The above specimen was contained in a small collection of spiders sent me by the late Mr. Richard Beck, and was, I believe, captured in the neighbourhood of London.



*NERIENE EXCISA*, n. sp. (Pl. 56. no. 29.)

Length  $\frac{1}{10}$  of an inch.

*Cephalothorax* broad, oval; caput gibbous behind the eyes, leaving the eyes on a sort of shelf or platform in front of the gibbosity, which forms a low broad eminence somewhat pointed forwards, and nearly flat at the top; this eminence melts away, without any strong line of demarcation, into the sides and hinder part of the caput, and so into the thorax. The normal grooves on the sides and hinder part of the cephalothorax are visible, but not very strongly marked. The clypeus is about equal in height to the distance from the middle anterior to the posterior eyes, including the diameter of the eyes themselves; it is perpendicular, but slightly impressed just above the falces; a few short hairs at the fore part of the eminence are directed forwards; colour dark brown, shining, but, seen in a strong light and with a lens, minutely punctuose.

*Eyes* eight, in two nearly straight rows, the front row very slightly curved forwards; they are nearly equal in size; the fore ones of the side pairs are, if any thing, slightly the largest; the centre ones of the hinder row are rather nearer together than each is to the end one on its side; those of the front pair are nearly contiguous, and distant from the hind pair about a diameter; those of the lateral pairs are close together on a black tubercle, and placed obliquely.

*Legs* moderately long and strong, of a pale yellowish colour, sparingly furnished with fine sessile hairs, among which are a very few stronger and more erect ones.

*Palpi* similar in colour to the legs, moderate in length and strength; humeral joint curved towards the falces; cubital slightly larger at the extremity than at the base; radial joint shorter than the cubital, and considerably broader at the extremity than at the base, and with two projections from its extremity; one beneath it is short and bluntish-pointed, and the other, on the upperside, is long, prominent, ending in a sharpish point, to which it tapers gradually; its extremity is slightly curved outwards and upwards; this latter projection is pale-coloured and semidiaphanous; the extremity of the radial joint has some longish fine bristly hairs, some of which form a row towards the outer side of the fore margin; the digital joint is hairy; the palpal bulb is not very large, the palpal organs are moderately prominent and complicated, with two or more black spines at their extremity, one of which (stronger than the rest, and curved) projects conspicuously.

*Falces* long, not very powerful, slightly divergent, armed with long, strongish, sharp teeth on the inner margin, and there are some bristly hairs towards the extremity on the front and sides; the colour of the falces is the same as that of the cephalothorax.

*Maxillæ* long, strong, nearly touching over the labium; in colour like the legs.

*Labium* shortish, semicircular.

*Sternum* very broad, strong, and heart-shaped, similar to the cephalothorax in colour.

*Abdomen* short, broad, oval, hairy, and of a sooty black colour.

An adult male of this very distinct species was forwarded to me, among others, in 1866, by Mr. Morris Young, of Paisley, by whom it was captured near that town. It may easily be distinguished from all others allied to it by occipital eminences (such as *N. apicata* (Bl.), *N. elevata* (Camb.), *N. gibbosa* (Bl.), *N. tuberosa* (Bl.), and others described



in Westring's 'Araneæ Suecicæ'), by the peculiar form and character of that portion of its cephalothorax; the radial joints of the palpi also furnish a very distinguishing character.

*NERIENE ARUNDINETI*, n. sp.

*Nerienne arundineti*, L. Koch in MSS.

Female adult, length  $\frac{1}{10}$  of an inch.

In form and colour this spider closely resembles *N. livida*, Bl., but may easily be distinguished by its much smaller size, and by its abdomen being blacker, wanting the pale markings and red-brown impressed dots on its upperside, as well as by its abdomen being more perceptibly clothed with long prominent pale hairs. From its size it might at first sight be thought to be the female of *N. neglecta* (Camb.) described *post*, which it also resembles in colouring; but a careful examination shows that the relative position of the eyes of the hind row is different in that species; the two central ones of that row are further from each other than each is from the end one of the same row on its side, while in the present species the four eyes of that row are equidistant from each other. The *falces* also of the present species have not the depression at their upper extremities or on the inner side which exists in *N. livida* and also, though in a more circumscribed form, in *N. neglecta*. The external sexual organs were rather obscured by some foreign substance adhering to them; but they did not appear to present anything remarkable in size or form, though probably, if free from obscuration, they would be found to be specifically characteristic.

The only specimen that has come under my notice was captured by myself at Bloxworth, in a marshy place, in 1866; and Dr. L. Koch says it is identical with a species he finds near Nürnberg, and to which he has in his MS. notes given the specific name "*arundineti*," which I have therefore adopted.

*NERIENE CLARKII*, n. sp. (Pl. 56. no. 30.)

Male adult, length  $\frac{1}{11}$  of an inch.

*Cephalothorax* short, broad-oval, smooth; colour yellowish brown; the furrows defining the caput and thoracic segments tolerably defined and dusky, as also is the normal longitudinal depression of the hinder part. The profile forms a slightly sinuous line, arching a little from the eyes to the occiput, then dipping a very little in a hollow line to the abdomen. Clypeus higher than the length of the space occupied by the four central eyes; it is nearly perpendicular, and very slightly, if at all, prominent.

*Eyes* eight, in two transverse rows just above and below the fore margin of the caput; hind row straight, front row very slightly curved, the curve directed forward; they are nearly equal in size, the middle anteriors being rather the smallest; those of the hinder row are equidistant from each other, and the middle ones of the front row are rather nearer together than each is to the end one on its side. Those of the lateral pairs are nearly contiguous, and are seated on a common black tubercle; the middle posteriors are edged



with black; all are of a pearly-white colour except the middle anteriors, which are dusky; the middle anteriors and posteriors are very near to each other, the distance between them being about equal to that between the two former.

*Legs* not very long, moderately stout, rather lighter-coloured than the cephalothorax; they are sparingly furnished with hairs; but the armature of the legs had suffered by the spider having been gummed on card, though it did not appear to present any remarkable difference from the ordinary types of the genus. Relative length 1, 4, 3, 2.

*Palpi* moderately long, slender, not more than half the thickness of the femora of the first pair of legs; humeral joints slightly sinuous, curved towards the falces, and furnished on the outer sides with several fine bristly hairs along the entire length; cubital joint short, very little larger at the extremity than near the humeral joint; it is a little curved and very slightly gibbous on the upperside near the extremity. The radial joint is very short, not nearly so long as the cubital, but dilated on each side, the outer dilatation much the largest and longest, and ending in a bluntish point; both dilatations are furnished with long hairs, especially at the extremities, and in a row round their outer margins. Digital joint very large; the palpal bulb (*i. e.* the digital joint and palpal organs together) forms a large, broad, stout, oval mass, its length equal to that of the humeral joint, or more than double that of the cubital and radial together; the great size of this joint, combined with the comparative weakness of the rest of the palpus, is very striking and characteristic. The palpal organs are highly developed, prominent, and complicated, showing several spines and corneous processes difficult to be described, the most tangible apparently being a long, slender, filiform, black spine, issuing from beneath the digital joint about the middle of the outer side, embracing and curving over the palpal organs toward their extremity, and another similar spine issuing from nearer the extremity of the digital joint, and curving over the palpal organs in a parallel direction to the other spine. The colour of the palpi is the same as that of the cephalothorax; that of the palpal organs is mixed with rich red brown.

*Falces* moderately strong, double as long as the height of the clypeus, straight, outer margin very slightly hollow, impressed in front towards the extremities, as if pinched in, slightly toothed at the extremities, which are nearly square; but this part was partially obscured by the gum with which the spider had been fixed on card. Their colour is rather deeper than that of the cephalothorax.

*Maxillæ* strong, long, curved, and slightly leaning towards the labium, which is broad, short, and roundish-pointed at the apex.

*Sternum* broad, heart-shaped, and, with the maxillæ and labium, similar in colour to the cephalothorax.

*Abdomen* strongly convex above, and equal in length to the cephalothorax, over which it projects considerably; it is broader behind than in front, very sparingly furnished with dark hairs; colour dull blackish, freckled with numerous pale spots, especially on the sides, where they form lines converging towards the middle of the upperside; on each side of the median line forward are three largish impressed dots of a brighter yellow; these dots and spots (sufficiently apparent in spirit of wine) would probably be



indistinct in the living specimen; the plates of the spiracles are large, and of the same colour as the legs.

An adult male of this spider (which is allied to *N. livida*, Bl., but easily distinguished by the unusually large proportions of the palpal bulb) was forwarded to me in 1864 by my lamented friend the late Rev. Hamlet Clark, by whom it was captured near Dover, and after whom I have specifically named it. An adult example of the same species has also been (in 1866) sent me by Mr. Morris Young, who captured it near Paisley, Scotland.

*NERIENE NEGLECTA*, n. sp. (Pl. 56. no. 31, *a, b, c, d, e.*)

Male adult, length  $\frac{1}{2}$  of an inch.

*Cephalothorax* flattish, scarcely compressed on the sides forwards; caput very slightly sloping from the occiput to the eyes; normal furrows and hind indentation well defined; very smooth and glossy; indentation defining the caput strong on either side below the occiput; clypeus nearly vertical, and visibly less in height than the length of the space occupied by the four central eyes; colour yellow-brown; a few bristly hairs in the median line, directed forwards.

*Eyes* eight, in two rows slightly curved from each other, forming a regular oval patch on the fore part of the caput; all are seated on slightly tuberculate black spots, and are nearly equal in size; the middle anteriors are slightly the smallest; and the middle posteriors are a little further from each other than each is from the end one on its side; the middle anteriors are nearer together than each is to its end one, but are not contiguous; those of each lateral pair are contiguous and rather obliquely placed, thus making the front row shorter than the hinder one; the distance between one of the middle posterior, and its opposite anterior is no more than a diameter of the former; all are pearly white, except the middle anteriors, which are dark.

*Legs* moderately long, tolerably strong, fairly furnished with longish fine hairs; colour pale yellowish; relative length 1, 4, 3, 2.

*Palpi* moderate in length and strength; of the same colour as the legs, except the radial and digital joints, which are rather darker; humeral joint curved towards the falces; the cubital and radial joints do not differ much in length; both are clavate and strongly bent forward; the radial is more clavate than the cubital, and has the outer side considerably, broadly, and obtusely produced, and furnished with a few long bristly hairs, which extend to the extremity of the palpal organs; the inner side is also slightly produced, and furnished with shorter hairs; the digital is strongly convex near the base, rather pointed-oval in form, and hairy.

Palpal organs well developed, not very complicated, consisting of several corneous and spiny processes, of which one projects perpendicularly from near their middle, and is nearly straight, acute, and of a pale diaphanous appearance, and another, more obtuse and cylindrical, projects horizontally from the extremity; the convex sides of the digitals are turned toward each other.

*Falces* long, strong, straight, perpendicular, rather gibbous near the base, compressed



or pinched in near their extremities, slightly rugulose in front below the point at which they are gibbous. I could not observe any teeth on the inner surface.

*Maxillæ* long, strong, and straight, inclined towards the labium, which is blunt, short, and semicircular. These parts, as well as the falces, are of the same colour as the cephalothorax.

*Abdomen* blackish brown, freckled with obscure spots of pale yellowish, of which four, larger than the rest and impressed, form a square near the middle of the upperside. They are probably not visible except in spirit of wine; the abdomen is furnished with a few coarsish hairs.

The specimen described was captured at Bloxworth among moss, in 1863. It is closely allied to *N. livida*, Bl.\*, but differs in being one-half less in size, and in colour, besides differing considerably in the structure of the palpal organs. Its general appearance, however, is that of a dwarf pale specimen of *N. livida*. Another specimen, rather smaller than the one described, but, I think, specifically identical, was received, among others, from Mr. M. Young, of Paisley, by whom it was captured near that town in 1866.

NERIENE LATEBRICOLA, n. sp. (Pl. 56. no. 32.)

Male adult, length  $\frac{1}{16}$  of an inch.

*Cephalothorax* broad-oval and glossy; lateral margins forward scarcely at all compressed; caput arched, and sloping slightly from the summit forward and backward. A longitudinal row of several fine bristles, directed forward, springs from the median line of the caput. Colour light yellowish brown. The division of the caput from the thorax, the lateral furrows, and normal median depression of the hinder part are indistinct, but visible; the clypeus is equal in height to the length of the space between the middle anterior and posterior pairs of eyes.

*Eyes* eight, on very slight tubercles, and with narrow black rims; they are disposed in two slightly curved rows, occupying a narrow transverse oval space just above and below the fore margin of the caput, and are nearly equal in size; the laterals of the front row are perhaps slightly the largest, and those of the hinder row are about equidistant from each other; the middle anteriors are contiguous to each other; those of each lateral pair are nearly so, being divided by a black line only, and are placed obliquely; the middle anteriors are dark-coloured, the rest pearly white.

*Legs* not very long, moderately strong, furnished with a few hairs, and here and there an erect (or nearly so) fine bristle. The colour of the legs is of a deeper hue than the cephalothorax, and tinged with red-brown, though paler at the articulations of the joints. Relative length 4, 1, 2, 3, the actual difference in length being but little.

*Palpi* of moderate length and strength, and of the same colour as the legs; the cubital and radial joints are about equal in length, the latter is the strongest, and projects from its upperside, near to the cubital joint, a long, strong, slightly sinuous, bluntish-pointed projection; the length of this projection is nearly equal to the united lengths of both cubital and radial joints; it rises perpendicularly at first, and then curves forward, and is of a deep red-brown colour. Digital joint large and hairy, about equal in length

\* Figs. *f, g, h*, no. 31, Pl. 56. are of *Nerience livida* (Bl.),



to the humeral joint; it is of an oval shape. Palpal organs well developed, not very complex, a dark red-brown curved process curving over their hinder portion. Underneath they appear to be divided longitudinally, the outer division being much the largest, and ending with a slightly curved, prominent, sharp, dark red-brown spine, the inner division ending with a small pale pointed process.

*Falces* strong, moderately long, profile curved outward; they have some short bristles in front, and apparently a small dark tubercle or blunt tooth just on the inner side forward; but the *maxillæ*, *labium*, and *sternum* did not present any notable divergence from the generic type.

*Abdomen* dusky brown, with a greenish-yellow tinge, much arched, projecting greatly over the cephalothorax, and sparingly furnished with short hairs. When seen through spirit of wine, numerous pale lines and regularly disposed spots on the sides, formed a series of long narrow angles or points, in a sort of vandyked pattern, the points coming up over the upperside. Spinners paler-coloured than the rest of the abdomen. The adult female differed from the male in the cephalothorax being smaller in comparison with the abdomen, which is far more globular, and the pattern above mentioned more distinct. Spiracular plates dusky black; sexual organs rather prominent, and of a dark red-brown colour; the radial joint of the palpus in the female is much longer than the cubital, whereas in the male it is about equal.

Adults of both sexes of this spider were sent me by Mr. Morris Young, of Paisley, by whom they were captured near that city in the spring of 1866; and shortly afterwards I discovered it abundantly among moss in a wood at Bloxworth. It is allied to *Neriene parva*, Bl.; but the form of the radial joints of the palpi readily distinguishes the male from many other species yet known to me.

NERIENE FUGAX, n. sp. (Pl. 56. no. 33.)

Male adult, length  $\frac{1}{3}$  of an inch.

*Cephalothorax* rather narrow, oval, slightly compressed on the sides forward, and not very convex above; two small, but well-marked longitudinal indentations run backward from each lateral eye of the hinder row. The clypeus projects a little at the lower margin, and is equal in height to the space between the lateral eyes of the front row, or the space occupied by the fore and hind central pairs; the profile line of caput and fore part of thorax is nearly straight, and the hind slope is gradual; the fore part of the caput slopes very slightly forward; it is glossy, but under a lens minutely impressed with small punctures; the normal furrows and indentations are visible, but not strongly marked; colour deep rich brown.

*Eyes* eight, in two curved rows on the fore slope of the caput; the hinder row is the longest and most curved; those of the fore central pair are rather the smallest; the rest do not differ much in size; the space between the fore and hind central pairs is greater than that between those of the hind central pair; all four of the front row are equidistant from each other, and very near together; those of the hind central pair are rather further from each other than each is from the lateral of the same row on its side; those of each lateral pair are placed obliquely on a slight tubercle, and touch each other. The legs are



not very long, but strong, especially the femoral joints, which are gibbous near their base on the upperside, and thence lessen gradually to their extremity. They are furnished with hairs and a few slender bristles. Relative length 4, 1, 2, 3. Colour bright yellowish red-brown, except the femoral joints, which are pale yellow.

*Palpi* short; cubital joints curved, clavate, and longer than the radials, which are very short and have three projections from their extremities—one beneath another on the outer side, the third in front; this is the longest, and terminates in a red-brown, shining, straight, corneous point, pointing outward over the base of the digital joint. Digital joint large, roundish, oval, rather protuberant near its base on the outer side; palpal organs highly developed and complicated, with numerous spines and processes, one of a curved form lies just beneath the projection on the outer side of the radial joint; on their outer side, near the extremity, is a curved black spine, whose base is enlarged in a somewhat globular form; it is in contact with a corneous process, and projects prominently beneath their extremity on the outer side; the colour of the palpi is yellowish, that of the digital joints brown, and that of the palpal organs is mixed with red-brown.

*Falces* strong, not very long, about equal in length to the height of the facial space; they are straight, but slightly divergent, and are obliquely and rather roundly truncated on their inner extremities, near which are a few fine teeth; the falces are rather paler in colour than the cephalothorax.

*Maxillæ* moderate in length and strength, and inclined to the labium, which is semi-circular. These parts are similar to the falces in colour.

*Sternum* elongate, heart-shaped, furnished with hairs, and of a dark yellow-brown colour.

*Abdomen* elongate-oval and rather flattened; it projects slightly over the base of the cephalothorax, and is glossy, and sparingly clothed with fine pale hairs; its colour is greenish black, obscurely freckled and marked with yellowish spots and pale lines, of which last several on the hinder half are somewhat curved and transverse; four depressed dots, forming a quadrangle near the middle of the upperside, have a red-brown tinge. The underside has two widely separated parallel longitudinal broken lines, running backward from each spiracular plate. All these markings are scarcely visible except in spirit of wine.

*Spinners* short; yellow, tinged with red-brown, and furrowed by a yellowish patch, of which the portion beneath them has a red tinge; the spiracular plates also yellowish, tinged with red behind.

A single adult female was rather smaller in size, but similar in other respects; her sexual organs were peculiar in form, and had two roundish dark red-brown patches connected with them on their forward side.

An adult example of each sex of this species (which in colour and markings is allied to *N. livida*) were discovered by myself in April 1867, among moss in a wood at Bloxworth, Dorset. The species is peculiar from its rather flattened and elongate form, as well as by the structure of its palpi. The relative position of the front row of eyes is also unprecedented, as far as I am aware, in this group, being all equally close together.



## NERIENE INCISA, n. sp. (Pl. 57. no. 34.)

Female adult, length  $\frac{1}{7}$  of an inch.

The entire fore part of this spider is of an orange-yellow colour. The eyes are rather closely grouped on the fore part of the caput; but in respect to generic characters there is no departure from the usual type. The cephalothorax is small; and a remarkable structural peculiarity in it distinguishes it at once from any other species known to me—that is, the strong notch or depression at the junction of the caput and thorax. This is especially observable when looked at in profile, and leaves the caput in appearance much elevated, which in reality is not the case, it being only on a level with the thorax at the commencement of the hind slope.

The *falces* are small, prominent in front near their base, and slightly projecting forward; they have a few fine bristles on their inner surface forward; the legs are moderately long and strong, and are furnished rather plentifully with longish fine hairs, and one or two slender erect bristles on their uppersides. *Palpi* furnished with rather stronger hairs, and a prominent bristle at the extremity of the upperside of the cubital joint.

*Abdomen* large, oviform, convex above, and projecting a little over the base of the cephalothorax. It is glossy, and of a dull black colour, clothed sparingly with hairs; spinners rather prominent, and (together with the spiracular plates) of a pale luteous colour. Sexual organs rather tumid, and with a short semicircular corneous-edged epigyne projecting backward from them.

An adult female of this species was captured by myself under a stone at Hendre House, Llanrwst, N. Wales, in April 1860. Hoping to meet with the male, I have hitherto left it undescribed. I have since received an example of it (also a female) from the neighbourhood of Paris, kindly sent me among many other interesting species by M. Eugène Simon, an enthusiastic araneologist. It bears great resemblance in size, colour, and general appearance to the female of *N. rubripes*, a species I also captured at the same time and in the same situations.

## NERIENE FORMIDABILIS, n. sp.

Male adult, length *very* nearly  $\frac{1}{5}$ th of an inch.

This species, which is the largest of the genus that has yet come under my notice, is evidently nearly allied to *N. Huthwaitii* (Camb.), of which the female is at present undescribed. The position of the eyes and form of the falces, however, lead me to think it is *not* the female of that species. The present species has the cephalothorax of a dark yellow-brown colour; it is of a long oval form, a little compressed laterally forward, where, however, it is still broad and massive; the profile shows no depression at the junction of the caput and thorax, but follows a rather convex curved line from the eyes to the hind slope, which is long and gradual, with a broad shallow indentation; the other normal grooves and furrows are well defined; the height of the clypeus (which is perpendicular) equals the length of the space occupied by the fore and hind central pairs of eyes. The space between these eyes is equal to that between each hind central eye and the external one of the front row on its side, and also equal to that between each



fore central eye and the lateral one of the same row on its side; those of the hind central pair are nearer together than each is to the lateral of the same row on its side. The eyes do not differ greatly in size; those of the front central pair are slightly the smallest and darkest, and near together, but not touching; those of each lateral pair are placed a little obliquely on a small tubercle.

*Legs and palpi* bright brownish yellow, rather strong and moderately long. Relative length 4, 1, 2, 3, the former sparingly furnished with *hairs* only, the latter also with spines, especially on the radial and digital joints; the form of the genual joints is the same as in *N. livida*. The *falces* are powerful and moderately long, prominent near the base in front, and rather so on the outer sides; they are a little impressed near the extremity on the inner side, having their surface toward the outer side a little rough in appearance, caused by some rows of very short but rather strong bristles, each of which appears to proceed from a very minute tubercle or granulation; they are straight, but inclined a very little inward to the *maxillæ*, and are armed with a row of strong sharp teeth on their inner sides at the extremities. Colour dark yellow-brown, tinged with red.

*Maxillæ* rather long, and a little darker in colour than the cephalothorax; they are strong, straight, rounded at the extremities on the outer sides, and inclined to the *labium*, which is short, semicircular, and of a deep bistre-brown colour, pale at the apex.

*Sternum* of the same colour as the cephalothorax, but tinged with darker brown, and furnished with a few long erect hairs.

*Abdomen* large, oval, broader behind than before; moderately convex above, and projecting a good deal over the base of the cephalothorax. It is of a deep black-brown colour, clothed pretty thickly with prominent but fine hairs; and its hinder part for a short space has the appearance of being spanned by numerous transverse, slightly curved, parallel pale lines; but whether this was caused by the cuticle of the abdomen having become shrunken into wrinkles, or not, could not be satisfactorily ascertained.

Spiracular plates large and of a yellowish colour; the external sexual organs are simple, their orifice small, edged with deep red-brown, and of a transverse oval form.

This species, which may readily be known from most others of the genus by its size, was captured at Bloxworth, and, until lately, overlooked among specimens of *N. livida*, from which, however, its *falces* at once distinguish it, these being (in the present species) but very *slightly excavated* or, rather, indented near the extremities on the inner side, while in *N. livida* they are extensively so. In *N. Huthwaitii* the *falces* are rather longer, and divergent at their extremities. The *clypeus* also in that species is higher, and the eyes of the hind row are more nearly equidistant from each other.

#### NERIENE ASPERA, n. sp.

Female adult, length  $\frac{1}{11}$  of an inch.

This species resembles *N. oblonga* in form and general appearance, but it is larger, darker in colour, the fore part of the cephalothorax, the *falces*, *maxillæ*, and *labium* being strongly tinged with reddish yellow-brown; the eyes also are larger and more closely grouped together, though those of the hinder row are relatively in a similar posi-



tion; but those of the front row are equidistant from each other (the two central eyes of this row being nearly as far apart as the centrals of the hinder row), and dark-coloured; the two rows are near together; the clypeus is less in height than that of *N. oblonga*, not exceeding the length of the space occupied by the fore central eyes; the *legs* are stouter, and destitute of spines, and the terminal tarsal claws are rather conspicuous; the *abdomen* is furnished, but not very thickly, with rather strong, prominent dark hairs, giving it a bristly appearance; the sexual organs are externally of a red-brown colour, the aperture small and of a transverse oval form. A single specimen only of this species has yet come before me; it was captured in a similar situation and at the same time of the year as *N. oblonga*, from which, however, it may easily be distinguished by the characters above given.

*NERIENE HISPIDA*, n. sp.

Female adult, length  $\frac{1}{8}$  of an inch.

This species, in general colour, resembles very closely *Nerienne livida*; it is, however, smaller and stouter in appearance, but may at once be distinguished by the rugulose appearance of the front of the falces, which are powerful, straight, and vertical. This rugulosity occupies nearly the whole front surface, excepting a patch at their base and another at their extremity, where there is no flattish excavation as in *N. livida*. The abdomen also is blacker and rougher, with short, strong, prominent hairs, and has not the spots and markings (which are characteristic of that species) so visible in spirit of wine; it also projects greatly over the base of the cephalothorax; the two central eyes of the hind row are nearer together than each is to the lateral on its side; and the four central eyes form very nearly a square, its fore side a little the shortest, those of the fore central pair being wider apart than is usual in this genus. These last are rather the smallest and darkest of the eight. The height of the clypeus is equal to the length of the space occupied by the four central eyes.

The genual joints of the legs are slightly prominent behind, and rather on their inner sides, in a somewhat angular form; and from each prominence proceeds a spine-like bristle; besides this, the legs have numerous hairs upon them, differing, however, in length, strength, and direction, but none approaching so nearly to a spine as that above mentioned. In this form of the genual joints it also resembles *N. livida*. Its cephalothorax has a few short bristles on the caput, and is glossy, and of a dark yellowish-brown colour, deepest in front, where it resembles that of the falces, maxillæ, and labium; and the sternum is still darker. The legs are strong, moderately long, and their relative length is 4, 1, 2, 3; in colour they are similar to the cephalothorax, the femora being rather paler.

Adult females of this species were captured by myself under stones at Portland, in October 1860, and have been since then named and described in MS.; but the publication has been delayed hitherto in hopes of first getting the male.

Dr. L. Koch thinks it is the *Erigone robusta* of Westring. The description, however, of that species in M. Westring's work omits any mention of the rugulosity of the falces,



which so close an observer as he was would hardly have overlooked. I am therefore inclined to think it distinct, though closely allied.

*NERIENE APERTA*, n. sp.

Female adult, length  $\frac{1}{16}$  of an inch.

The cephalothorax, legs, falces, maxillæ, labium, and sternum of this species are of a yellow-brown colour, slightly tinged with red, the sternum being rather the darkest. The *abdomen* is of a dull black, tinged with yellowish, and furnished sparingly with hairs; there are some obscure pale lines and markings on the upperside; and two longitudinal parallel lines on the inner side are visible in spirit of wine. The eyes do not differ much in size; those of the hinder row (which is more curved than the front row) are equidistant from each other; the fore centrals are contiguous to each other, and each is separated from the fore lateral one on its side by no more than half its own diameter; the fore centrals are of a yellowish colour, the laterals being pearly white, and the hind centrals bluish gray.

*Cephalothorax* but slightly compressed laterally in front. Caput rather rounded above, and a little higher behind the eyes than it is in the ocular region itself; but no depression existed at the junction of the caput with the thorax; the clypeus is fully equal in height to the length of the space occupied by the fore and hind central pairs of eyes.

The *maxillæ* and *labium* do not differ in structure from the usual generic types.

The *legs* are rather long, and not very strong; their relative length is 4, 1, 2, 3, and they are furnished with hairs above of different lengths and strength.

The leading character which distinguishes it from every other one resembling it in size, general colour, and structure that I have as yet observed, is the large somewhat circular orifice to the sexual organs. These organs are externally rather tumid, and of a red-brown colour.

The specimen above described was captured by myself among moss at Bloxworth, in April 1866; it belongs evidently to the "*livida*" group, but may easily be distinguished by its small size and by the size and form of its sexual aperture.

*NERIENE SUNDEVALLII*.

*Erigone Sundevallii*, Westr. *Araneæ Suecicæ*, p. 290.

I have met with this remarkable spider among moss and herbage in woods and damp places at Bloxworth on various occasions in the months of April, May, and June, during several years past. It may be distinguished from all its congeners by a double row of strong curved spines beneath the legs of the first two pairs. This is its first record as a British species.

Genus *WALCKENAËRA*.

*WALCKENAËRA MEADII*, n. sp. (Pl. 57. no. 36.)

Male adult, length  $1\frac{1}{2}$  lines.

*Cephalothorax* small, oval, narrowest and very slightly compressed laterally at the caput; this portion is but very slightly elevated, its upper part is round, and thence it runs by an even slope to near the abdomen; the ordinary grooves and indentations are



well defined. In colour the cephalothorax is of a glossy black brown. The *clypeus* is somewhat protuberant and prominent; and its height exceeds the length of the space occupied by the fore and hind central pairs of eyes, about equalling that between the fore eyes of each lateral pair. A longish narrow longitudinal indentation runs backwards from each hind lateral eye.

*Eyes* in four pairs, on the front and summit of the caput; they do not differ much in size; those of each lateral pair are seated rather obliquely on a tubercle; those of the fore central pair are the smallest of the eight, and near together, but not contiguous; those of the hind central pair are rather further apart than those of the fore central pair; and the space between these two pairs is about equal to that occupied by the eyes of the fore central one, and rather greater than that between each of the four central eyes and the fore lateral on its side. The four pairs thus occupy a longish transverse oval space.

*Legs* moderately long; relative length 4, 1, 2, 3; strong, of a bright orange-yellow colour, furnished sparingly with hairs.

*Palpi* rather short; cubital joint rather largest at its fore extremity, which is a little produced in front; radial joint very short, but strong, and spreading out on all sides; mostly so rather on the outer side in front, where it is furnished with a tuft of bristly hairs; digital joint short, broad at the base, and blunt-pointed at the extremity. Palpal organs fairly developed, prominent, but not very complex; they have a strong black spine, curved in a circular form, on their outer extremity; and from within its curvature there projects downward a strongish yellow red-brown, black-tipped, sharp-pointed corneous process. Amongst and in connexion with these is some whitish semitransparent membranous substance. In colour the palpi resemble the legs, except the radial and digital joints, which are strongly suffused with dull black.

*Falces* strong, conical, vertical, and prominent near the base in front; their fangs are long and curved; and there are some longish sharp teeth near their inner extremity.

*Maxillæ* long, strong, roundly and obliquely truncate on the outer extremity, and inclined towards the labium, which is short and semicircular. These parts, with the falces, are similar in colour to the cephalothorax, the maxillæ, however, being tinged with yellowish towards their extremities.

*Sternum* broad, heart-shaped, black and glossy, and furnished sparingly with some erect hairs.

*Abdomen* rather large, oval, flattened-convex above, and projecting over the base of the cephalothorax; it is of a glossy black, furnished sparingly with very short hairs. Four impressed red-brown dots or punctures occupy the centre of the upperside; these dots form a square whose anterior side is rather the shortest. On the underside two longitudinal rows of pale dots run backwards from the plates of the spiracles (which are yellowish in colour) and converge to the spinners; near the centre of the space included by these lines are four other impressed red-brown dots, rather smaller than those on the upperside, and forming a smaller though similarly shaped figure. The spinners are brownish, with a yellow tinge.

An immature female resembled the male in colours and markings. An adult male, and immature examples of both sexes, were contained in a collection of Spiders made by



Mr. William Farren, of Cambridge, in Wicken Fen, near that place, in February 1869; and I have great pleasure in naming it after my earliest instructor in araneology, R. H. Meade, Esq., of Bradford, Yorkshire. This species comes very near to some species of Mr Blackwall's genus *Neriene*, and would group along with *W. depressa* and others closely allied.

WALCKENAËRA FORTUITA, n. sp. (Pl. 57. no. 37.)

Male adult, length  $\frac{3}{4}$  of a line (or  $\frac{1}{16}$  of an inch).

This species seems to be nearly allied to *W. bicolor* (Bl.); but in the absence of any examples of that species, or of any figures of its structural peculiarities, I am inclined to think it is distinct. The caput, scarcely elevated above the rest of the cephalothorax, has its upper part rounded; the clypeus (which a little exceeds in height the length of the space occupied by the two central pairs of eyes) is a little prominent; and a narrow longitudinal indentation runs backward from each lateral pair of eyes.

The *eyes* are rather closely grouped together on the fore part of the caput, where they form two transverse rows, the lower one the shortest and straight, the upper one curved, the curve directed backwards; they do not differ greatly in size; those of the front central pair are slightly the smallest; those of each lateral pair are seated a little obliquely on a small tubercle; the space between those of the hind central pair is a little greater than that between each and the lateral eye of the same row on its side.

The *falces* are strong, vertical, conical and a little divergent; they are armed with a few minute teeth near their inner extremities. The *maxillæ* and *labium* present no deviation from the ordinary generic type. All these parts, together with the sternum, are of a dark brown colour tinged with yellowish.

The *legs* are rather slender and not very long; they are a little lighter-coloured than the cephalothorax, and are furnished with hairs; among these are a very few slender erect ones, of a bristly nature and of different lengths, on their uppersides; the legs do not differ much in their length, which is relatively 1, 4, 2, 3.

*Palpi* short, moderately strong and hairy, similar in colour to the legs; the radial and cubital joints are of equal length; but the cubital is much the strongest, being enlarged at its extremity (chiefly in front and behind); the upper margin of the extremity is uneven or irregular, but presents no marked prominences or projections; the digital joint is rather darker than the rest, moderate in size, of oval form, and slightly protuberant near the base on the inner side. The palpal organs are well developed, rather complex, and have apparently a slender filiform convoluted spine enveloped in membrane connected with their surface.

*Abdomen* oval, moderately convex above, slightly clothed with hairs of a blackish colour, shining, with some obscure pale markings, and on the hinder part of the upper-side some transverse curved lines of the same nature.

In colour and general character an adult female differed in no respect from the adult male, except that in the former sex the clypeus was rather less in height.

Three males and one female were taken by myself among grass and other herbage near the Basingstoke Railway Station, Hants, in June 1869.



WALCKENAËRA SCABROSA, n. sp. (Pl. 57. no. 38.)

Male adult, length  $\frac{1}{4}$  of an inch.

*Cephalothorax* short, broad, smooth and shining, apparently without punctures; caput convexly elevated, but to no great extent, the highest elevation being behind the eyes; divisional line between caput and thorax strong, containing a deepish indentation on each side towards the hinder part; lateral grooves distinct; colour dark yellow-brown, margins black; posterior indentation strong. Height of clypeus once and a half the length of the space between the two central pairs of eyes; it is furnished with very short bristly hairs on the lower margin, and projects but very slightly, if at all, beyond the perpendicular of the front row of eyes; but no part of it recedes, as in the *Linyphiæ*: in fact it is, if any thing, *slightly prominent* a little below the eyes.

*Eyes* eight, in four pairs or two transverse rows; they are small, those of the central pair in the hinder row being slightly the largest, the rest nearly of the same size; those of the side pairs are seated on a slight tubercle and contiguous to each other; those of the central pair (in the front row) are nearly contiguous; those of the two central pairs form a square with the fore side shortest; the space between those of the central pair in the hinder row is the same as that between each and the hinder one of the lateral pair on its side, and also the same as that between each of the central front pair and the fore one of the lateral pair on its side.

*Legs* strong, moderate in length; relative length 4, 1, 2, 3; furnished with short strong hairs; genual joints rather tumid on the upperside. Colour the same as that of the cephalothorax.

*Palpi* short, moderately strong, rather paler than the legs; humeral joints much curved towards the falces; cubital joint short, but rather longer and stronger than the radial, which is slightly produced in front, and terminates with two small pointed projections, the larger of which is rather on the inner side; digital joint very large, with a strong lobe on the outer side about the middle; in length it is equal to, if not exceeding, all the rest of the palpus. Palpal organs very prominent, highly developed, and complicated. A circularly curved strong corneous process lies at their hinder extremity close to the extremity of the radial joint; and another strong corneous black spine commences about the middle of the outer side, and, coiling round the palpal organs, terminates with another coil at their extremity. The digital joint is much darker-coloured than the rest; and the palpal organs are of a dark red-brown.

*Falces* small, straight, and much inclined towards the maxillæ. The *maxillæ* are short, strong, and inclined towards the labium. *Labium* very short, semicircular. These last two parts, together with the sternum, which is broad, heart-shaped, and without punctures, are rather paler in colour than the legs, and are sparingly clothed with hairs.

*Abdomen* broad, nearly round, convexly flattened, considerably projecting over the base of the cephalothorax; it is black, coriaceous, minutely and thickly indented with small punctures, and sparingly clothed with short hairs. After immersion in spirit of wine, the cuticle on the upperside assumes a shield-like appearance.

This species, which is closely allied to *W. depressa* (Bl.), may easily be distinguished



by the much larger digital joint and longer and stronger coiled spine connected with the palpal organs. A single specimen was found by myself among heath at Bloxworth, in May 1863. It is also closely allied to *Erigone brevipes*, Westr., of which the male has not been described. Since the above description was made, I have found several examples of *W. scabrosa* (male) among moss (in April 1869) at Bloxworth Rectory.

WALCKENAËRA DICEROS, n. sp. (Pl. 57. no. 39.)

Male adult, length  $\frac{1}{25}$  of an inch.

*Cephalothorax* broad, almost circular, rather narrower in front than behind, about half the length of the whole spider; very slightly elevated in the ocular region, but no frontal eminence properly so called; the lateral furrows are but slightly defined; a broadish longitudinal indentation occupies the median line of the hinder part; and a deep one commences behind each lateral pair of eyes, and, running obliquely back, dilates and terminates towards the hinder part of the occiput, which is divided from the thorax by a deepish groove.

*Eyes* in four pairs; unequal in size; those of the front pair are the smallest; those of the hinder pair are margined with black and considerably the widest apart; those of the front and lateral pairs are respectively near together, but do not touch each other, and are seated on black tubercles; in the middle of the forehead, immediately in front of each eye of the hinder pair is a small tubercle, from which rises a conspicuous blackish hornlike projection directed forwards and slightly outwards, and a little enlarged at its extremity, where it is deflected and divided; under a powerful lens these horns appear to be composed of several contiguous spiny bristles; the front pair of eyes have some strong hairs, or bristles, springing up about them and directed forwards.

*Legs* moderate in length and strength, furnished with hairs and a very few minute, erect, fine black bristles. Colour brown, with a reddish hue; genual joints paler and semidiaphanous.

*Palpi* not very long, paler-coloured than the legs; cubital joints longer but less strong than the radials, which have a small projection on their underside, are protuberant on their outer sides, and much elongated rather on their inner sides in front; the projection or elongation is rather prominent, deepens in colour, and is slightly dilated towards the extremity, which is rather obliquely truncated; it is furnished with some short strong hairs, and extends to about three fourths of the length of the digital joint; this joint is oval, with a large lobe on the outer side, and clothed with hairs; palpal organs highly developed, complicated, and with a strong black spine curved in a circular form round their extremity.

*Falces* moderately strong, rather inclined towards the maxillæ, and slightly divergent at their extremities.

*Maxillæ* strong, inclined towards the labium, which is short, broad, and nearly semi-circular.

*Sternum* broad, heart-shaped, and convex. All these parts are similar to the cephalothorax in colour.

*Abdomen* small, short oval; very convex above, and projecting greatly over the base of



the cephalothorax; it is thinly clothed with hairs, and is of a blackish colour tinged with olive-green; when in spirit of wine some paler spots and lines, both transverse, oblique, and longitudinal, are visible.

The adult female differed from the male only in wanting the hornlike projections on the forehead, in being slightly larger, and in the fore part of the cephalothorax being less convex. Sexual organs well developed and of a red-brown colour. Their external form is given in the accompanying drawing (Pl. 57. no. 39. fig. *f*).

An adult male and female of this (the smallest Spider, I believe, yet known to science) were captured by myself among moss in a wood near Bloxworth, Dorset, at the end of March, 1863. Subsequently (in March 1866) another adult example of each sex was found, after many days' close search, in a similar situation and at no great distance from the spot where the former examples were obtained. It thus seems to be a rare as well as very remarkable little Spider; and the male is recognizable from all other species known to me by the two horn-like tufts of bristles between the eyes.

WALCKENAËRA PERMIXTA, n. sp. (Pl. 57. no. 40.)

Male adult, length  $\frac{1}{15}$  of an inch; relative length of legs 4, 1, 2, 3.

*Cephalothorax* very glossy, flattish at the hinder part, rising gradually to the ocular region, the hind slope of which is but very little more abrupt than the rest. Ocular region very prominent and elongated: its extremity is divided into two segments by a deep transverse cleft, the hinder segment being much the smallest; the apex of each segment is rounded off and furnished with short, bristly, pale-coloured hairs, directed towards, and partially meeting over, the cleft; there is a small indentation in the median line of the hinder part. Colour shining dark rich brown.

*Eyes* eight, in four pairs, not very unequal in size—one pair on the summit of the hinder segment of the ocular region a little below the upper margin and rather towards the back, a pair just below each end of the cleft which divides the two segments, and the remaining pair in front of the foremost segment; all on black spots, those on which the side pairs are seated slightly tuberculate; the eyes of the hinder pair widest apart, those of the side pairs nearest together, those of the front pair rather close to each other, but not quite touching.

*Legs* moderately long and strong, clothed with hairs and a very few fine erect bristly hairs, or *very* fine spines?; those of the first and fourth pairs are about equal in length, those of the third pair shortest. Colour red-brown.

*Palpi* moderately long and strong; cubital joint long, subconical or clavate, and notched at its extremity; radial joint short, but with a long stout elongation stretching from its extremity obliquely inwards over the base of the digital joint; from the end of this projection issue two or three short black reflex spines; digital joint oval, comprising the palpal organs, which are prominent and complicated, with spiny processes, and closely encircled by a strong black spine issuing from the inner side and curving upwards round their extremity. The colour of these organs is red-brown; the digital and radial joints are rather paler and hairy; the remaining portions of the palpi are coloured like the legs.



*Falces* strong, moderately long, straight, much inclined towards the maxillæ.

*Maxillæ* moderately long, strong, inclined towards the *labium*, which is short and semicircular.

*Sternum* broad, convex, heart-shaped, slightly hairy, and, with the *labium*, of a dark brown; the colour of the *falces* and *maxillæ* is like that of the legs.

*Abdomen* oval, convex, projecting over the base of the cephalothorax, clothed with hairs, and of a shining brownish-black colour.

The female differs from the male in being rather larger but not longer, and in wanting the extreme cephalic elongation; her cephalic region is gibbous at the hinder part, and is succeeded backwards by a strong depression; her sexual organs are not very prominent; they are of a red-brown colour, and surrounded with a pallid line; the spinners are of the same colour as the legs in both sexes.

I captured adult males and females of this Spider under decayed rubbish in a swamp at Bloxworth, in May 1863. It is closely allied to *W. cristata*, but differs from that species in the position of the eyes and in the hind slope of the cephalic region (*caput*) being less abrupt; the segments of the *caput* also are less pointed and less conspicuously furnished with hairs; and the two species also differ in the form and structure of their respective palpi and palpal organs. *W. permixta* is also generally of a less deep colour than *W. cristata*.

WALCKENAËRA IMPLANA, n. sp. (Pl. 57. no. 41.)

Male adult, length  $\frac{1}{17}$  of an inch.

*Cephalothorax* oval, rounded, and slightly narrowest in front; normal grooves defined, but not strongly; *caput* elevated, sloping from the upper pair of eyes to the middle of the clypeus, which is prominent and almost circular in profile. The summit of the elevation slopes slightly backward; and the occiput is rounded; the hinder part of the elevation rises abruptly from the thorax; the height of the clypeus is greater than the length of the space occupied by the upper and lower central pairs of eyes: looked at from the front, the elevation is greater in breadth at its upper part than in the line of lower central pair of eyes; from each hind lateral eye a deep longitudinal excavation runs to the hinder part of the elevation comprising the area of the upper and lower central pairs of eyes; this portion is thickly furnished with short hairs, of which there are a few also behind the upper eyes on the frontal summit of the elevation. The colour of the cephalothorax is dark black-brown, its surface shining, although, except the elevation of the *caput*, minutely punctuose.

*Eyes* eight, in four pairs, small, one pair over the fore margin of the summit of the *caput* wide apart, separated by a space equal to at least two of the same eye's diameters; another pair lower down, near together, on a common tubercle, but not contiguous, leaving the greatest length of the facial space below; the lateral pairs are a little below the line of the eyes of the lower central pair, and are placed obliquely; all the eyes are on black spots; the space between each fore lateral eye and the eye of the upper pair on its side is less than that between the fore laterals themselves, by the distance between each fore lateral eye and that of the lower middle pair on its side.



*Legs* moderately long, not very strong; colour pale yellow, furnished sparingly with hairs, among which are a few more erect on the uppersides of the genual, tibial, and metatarsal joints; their relative length is 4, 1, 2, 3.

*Palpi* similar to the legs in colour, not very long nor stout; digital joints suffused with brown; cubital joints short, curved, enlarged at their extremities; radials shorter than the cubitals, and furnished in front towards the outer side with some strong black bristly hairs, giving the appearance of a kind of tuft in some positions; the fore extremity of each radial is produced into a long narrowish projection, directed obliquely outwards, imperfectly bifid at its extremity, and with a sharp-pointed, curved, black, spiny projection issuing outwards from beneath, near the bifid portion. Palpal organs well developed, prominent, and complicated, with a doubled-coiled black spine beneath and slightly beyond their extremity, and in connexion with some semitransparent whitish membrane.

*Maxillæ* strong, moderate in length, obliquely truncate, and slightly rounded on the outer sides towards their extremities, and inclined towards the *labium*, which is short and semicircular. These parts are of a yellowish brown colour, tinged with olive.

*Falces* similar in colour to the cephalothorax, straight, strong, moderately long, much inclined to the sternum, which is heart-shaped and strongly suffused with blackish.

*Abdomen* elongate-oval, rather longer than the cephalothorax, glossy, black, sparingly clothed with short hairs. An adult male of this spider was captured among low plants in underwood at Bloxworth in July 1863. It is allied to *W. borealis* (Camb.), *W. picina* (Bl.), and *W. hiemalis* (Bl.), but may be distinguished, not only by the form of the cephalothorax, but specially by the structure of the palpi and palpal organs.

WALCKENAËRA IGNOBILIS, n. sp. (P. 57. no. 42.)

Male adult, length  $\frac{1}{20}$  of an inch.

*Cephalothorax* large, broad-oval, pointed in front on the lower fore margin, broadest behind, normal grooves slight, but apparent. Caput very slightly elevated in the occipital region, the surface of which is rounded, and slopes off into the surrounding surface imperceptibly, and over in a rounding form to the lower margin of the clypeus, at the middle of which this portion is prominent in a somewhat pointed subtubercular form; sides depressed longitudinally towards the junction of the caput and thorax. Colour dark rich brown; the sides under a lens appear finely *rugulose*; the upper and fore parts of the caput are very polished and glossy, and apparently neither punctuose nor rugulose; some very short strong prominent hairs near and about the eyes; the height of the clypeus is less than the distance between the upper and lower pairs of eyes.

*Eyes* eight, in four pairs, small, on black spots, those of one pair are seated on the fore margin of the occipital elevation, and are distant from each other rather more than one eye's diameter; these eyes divide equally the upper surface of the caput looked at from above; another pair (the eyes of which are close to each other) are seated below on a slight common tubercle; on either side of these, a *very* little below their straight line, is a lateral pair, the eyes of each of which pairs are contiguous, and placed obliquely on a common tubercle. The area occupied by the eyes is a transverse parallelogram occupying nearly the whole width of the fore part of the caput, the space between the fore lateral



eyes being much greater than that between each of these and that of the upper pair on its side; the space between these last is very nearly equal to that between the fore lateral eye and that of the lower pair on its side.

*Legs* moderately long and strong; relative length 4, 1, 2, 3; colour red-brown, femora darkest. They are furnished with hairs, among which are some longish, very slender, erect ones, on the uppersides of the genual, tibial, and metatarsal joints.

*Palpi* not long, nor strong, paler-coloured than the legs, except the digital joints, which are dark brown. Cubitals curved, strongest at extremities, radials shorter, but much stronger; they are much and broadly produced on the uppersides in front, extending half-way over the length of the digital joints; the outer edge of the part produced is slightly hollowed; the inner extremity of the production narrows into a long spiny point, curving sharply outwards and round the extremity of the produced part. Digital joints oval, not very large, and, as well as the radials, furnished with hairs. Palpal organs well developed, but not very complicated, consisting of corneous lobes and processes, with a small pointed black spine issuing from their extremities.

*Falces* moderately long, strong, straight, inclined towards the sternum, and similar in colour to the cephalothorax.

*Maxillæ* similar in colour to the falces, strong, greatly enlarged laterally at the insertion of the palpi, obliquely truncate at the extremity on the outer side, and inclined towards the *labium*, which is very short and semicircular, and of the same colour as the sternum.

*Sternum* large, broad, heart-shaped, convex, and granulous (or roughened), with impressed punctures, and furnished with short erect hairs; colour very dark rich black-brown.

*Abdomen* short-oval, very convex above, and projecting considerably over the base of the cephalothorax; colour sooty-black, shining, thinly clothed with short hairs; spinners and spiracular plates dull yellowish brown.

An adult male of this minute spider was captured among moss and dead leaves at Bloxworth, in May 1863\*. It is allied to *W. latifrons*, *W. hiemalis*, and *W. aggeris*, but differs not only in size, but specially in the form of the cephalothorax, position of the eyes, and structure of the palpi and palpal organs.

WALCKENAËRA CIRRIFRONS, n. sp. (Pl. 57. no. 43.)

Male adult, length  $\frac{1}{16}$  of an inch, or  $\frac{3}{4}$  of a line.

*Cephalothorax* oval, rounded, and slightly narrower at the fore extremity than behind; glossy and of a rich dark brown colour, except the upper part of the caput which is much paler (but query whether this is constant); under a lens it is thickly covered with minute punctures, except the upper part and the front of the caput.

*Caput* massive and elevated, but not greatly; the elevation is rounded at the top, slopes a little more behind than before, and its height shown by a deep longitudinal indentation, which runs back immediately from behind each lateral pair of eyes, and

\* Examples of this species have also been more recently received from Dr. L. Koch, by whom they were found near Nürnberg, Bavaria.



divides it from the lower part of the caput. There is a shining white spot at the bottom of the fore end of this indentation; the elevation is slightly retreating, *i. e.* situated rather more on the hinder than on the fore part of the caput, thus leaving the lower portion of this latter (including the clypeus) rounded and prominent. The height of the clypeus is equal to the space between the fore and hind pairs of eyes (not including the diameters of the eyes themselves); the division of caput and thorax is marked behind by strong grooves; the lateral grooves of the thorax are almost obsolete; the profile outline of the caput and thorax, from the hinder part of the latter to the summit of the former, is nearly straight, and gradually ascending, the occipital depression being slight; there is a large, round, shallow, dish-shaped depression on either side of the caput, immediately below and connected with the groove which marks the lower side of the elevation; on either side of the fore part of the elevation is a thin tuft of longish, strong, bristly, black hairs, directed forwards and outwards, and three or four other single hairs between the two tufts behind the posterior pair of eyes. A narrow space connecting the fore and hind pairs of eyes is covered with very short hairs; the elevation of the caput is divided at the fore part by a very slight longitudinal indentation.

*Eyes* in four pairs on the front of the caput, and seated on black spots; those of the hinder (or upper) pair, in the front of the elevation, are less than an eye's diameter distant from each other; those of the lower pair are contiguous to each other, and seated on a common black spot; these are rather the smallest of the eight, and darkest in colour; those of the lateral pairs are contiguous to each other, and placed obliquely, *above* the straight line of the lower pair; the space between each of the lateral pairs and the lower pair is slightly greater than the diameter of a fore lateral eye; the two lateral pairs and the lower pair may be described as forming a transverse curved row (the curve directed downward) across the middle of the caput; and the *lower* pair equally divides the length of the facial space.

*Legs* tolerably strong and long. Relative length 4, 1, 2, 3; colour yellow, femora and tibiæ slightly tinged with reddish orange; they are slightly furnished with yellowish hairs, among which are a very few (on the uppersides of the tibial, genual, and metatarsal joints) erect and darker-coloured.

*Palpi* not very long, nor strong; colour yellow; the fore extremity of the radial joint is tinged with reddish; cubital joint longer than the radial, curved, and slightly enlarged at its fore extremity; radial joint enlarged at its extremity, produced in front, mostly towards the inner side, into a subangular point, with an irregular margin, forming two or three short points. Digital joint short-oval, and not very large. Palpal organs well developed and rather complicated; they have two short, stout, black, corneous spines at their extremity, one of which is slightly tortuous, or corkscrew-shaped.

*Falces* strong, subconical, retreating beneath the lower margin of the clypeus; length rather greater than the height of the clypeus, inclined towards the sternum, and in colour the same as the cephalothorax.

*Maxillæ* much enlarged laterally at the base, moderately long, obliquely truncate, and rounded on the outer sides towards the extremities; they are inclined towards the *labium*, which is short and semicircular; these parts are similar in colour to the falces.



*Sternum* broad, slightly convex, heart-shaped, colour dark-brown suffused with blackish, punctuose like the cephalothorax, and furnished with a very few pale erect hairs.

*Abdomen* equal in length to the cephalothorax, over the hind slope of which it projects considerably; it is moderately convex above, and in colour black, sparingly furnished with pale hairs; surface glossy, sides slightly rugulose in a longitudinal line; spiracular plates dull yellow, with reddish margins; spinners short, and of a dull yellow colour. In spirit of wine the abdomen shows specklings and transverse angular lines of a pale colour. This is observable in many species of *Neriene* and *Walckenaëra* when in spirit of wine.

An adult male of this spider was captured, in company with *W. aggeris* (Camb.), at Southport, Lancashire, at the roots of grass &c., in June 1859.

**WALCKENAËRA BECKII, n. sp. (P. 57. no. 44.)**

Male adult, length  $\frac{1}{16}$  of an inch, or  $\frac{3}{4}$  of a line.

*Cephalothorax* short, broad-oval, a little shorter than the abdomen, and rather broadest behind; lateral margins of the caput without any constriction; lower fore margin rounded; colour deep brown, with a yellow tinge, glossy, but finely punctured under a lens; caput slightly elevated; fore and hind slope of elevation rather abrupt, and its upper surface broad and plane; a very slight depression towards the fore upper margin is visible when looked at from the point. Clypeus perpendicular, and its height equal to the space between the fore central and hind central pairs of eyes. Immediately above and behind each lateral pair of eyes is a long, strong indentation, running backwards in a direction parallel to the surface line of the elevation of the caput. At the bottom of this indentation, close behind the hind lateral eye, is a small shiny transparent spot; the normal furrows of the thorax are scarcely defined, while a strong depression marks the junction of the caput and thorax; the hind slope is long, gradual, and in a very slightly convex line; the cephalothorax entirely without hairs, perhaps accidentally rubbed or broken off (?).

*Eyes* in four pairs, very small, those of the lateral pairs rather the largest, and the fore central pair the smallest of the eight; one pair (removed from each other by about an eye's diameter only) is situated on the upper surface of the elevation of the caput, rather nearer to the fore than to the hinder margin; these are much sunken, and look upwards, and are difficult to be seen clearly, unless looked at from above; those of another pair are seated below these, very near together, but not touching each other, and not far removed on either side; and nearly in the same line are the lateral pairs, the eyes of each of which are placed obliquely on a slight tubercle; the four lowest eyes form a slightly curved row; all have black rims; and the fore centrals are seated on a largish black tubercle; the space between the lateral pairs is equal to that between each and the eye of the pair on the summit of the caput on its side.

*Legs* moderately long and strong, colour yellow, sparingly furnished with pale hairs; relative length 4, 1, 2, 3.

*Falces* strong, very slightly inclined towards the sternum, equal in length to the height of the facial space, very slightly divergent, and with a few fine teeth towards the extremity on the inner surface; their colour is similar to that of the cephalothorax.



*Palpi* moderately long, slender; radial joint rather shorter, but much stronger than the cubital; its extremity is strongly emarginate, forming three short pointed projections, two above and one underneath; that on the outer side above is rather stouter than that on the inner side; the digital joint is small, oval; the palpal organs are prominent, and not very complex; they have a small, slender, curved, black spine at their extremity, near which is a prominent semitransparent mass of a membranous substance.

*Maxillæ* long, strong, almost meeting at the extremities, over the *labium*, which is short and semicircular; these parts are similar in colour to the *falces*.

*Sternum* broad, heart-shaped, glossy, convex, and punctuose, like the cephalothorax, to which it is also similar in colour.

*Abdomen* longish-oval, moderately convex above, projecting a little over the base of the cephalothorax. Colour pale sooty brown-black, shining and sparingly furnished with hairs.

An adult male of this spider was received from the late Mr. Richard Beck, by whom it was captured in the neighbourhood of London in 1864. It is most nearly allied to *W. borealis* (Camb.); but the elevation of the caput is not so great, and the form of the palpi and palpal organs is strikingly dissimilar. In naming it after its discoverer, I have paid a slight tribute to the memory of a kind friend, and one zealous in the study of araneology, which he had followed out in some of its details, microscopically, with great diligence for some little time previous to his lamented death.

#### WALCKENAËRA NUDIPALPIS.

*Walckenaëra nudipalpis*, Westr. Ar. Suecicæ, p. 201.

Adult examples of both sexes were forwarded to me in 1866 by Mr. Morris Young, of Paisley, Scotland, by whom they were captured near that city. Its occurrence as a British spider is now recorded for the first time.

#### WALCKENAËRA CUCULLATA.

*Micryphantes cucullatus*, Koch, Die Arachn. Bd. iv. p. 45, pl. 89. figs. 200, 201.

An adult male of this remarkable and fine species was given me by the late Mr. Richard Beck, by whom it was taken in Caen Wood, near London, in April 1863. It is now recorded for the first time as a British spider.

### FAM. EPEÏRIDES.

#### Genus EPEÏRA.

#### EPEÏRA YOUNGII, n. sp.

Male, immature, length  $\frac{1}{8}$  of an inch.

*Cephalothorax* broad behind; caput narrow and rather elongate; the colour of the thorax is red chestnut-brown, that of the caput yellowish; both are tolerably thickly clothed with hoary grey hairs; the height of the clypeus is equal to the space between the middle anterior and posterior eyes.

The *eyes* are all in the normal position; the middle posteriors are much larger than the anteriors, and the largest of the eight.

*Legs* not very long, moderately strong; they are of a yellowish colour, the femora of



the first and second pairs being strongly suffused towards their extremities with red-brown; they are hairy, and the femora of the first pair have each two strong pale spines on their inner sides, and the femoral and tibial joints have each a few dark ones.

*Palpi* short; digital joint very large and tumid, one more moult, apparently, being required to bring the spider to the adult state.

*Falces* strong, moderately long, and of a red-brown colour.

*Maxillæ, labium, and sternum* are all of normal structure, the latter being of a dark red-brown colour, the two former paler.

*Abdomen* large, subtriangular, and projecting considerably over the base of the cephalothorax; the fore part is very much broader than the hinder part; it is entirely covered with sparse hoary-grey hairs, which tone down the pattern, but do not entirely obscure it; on either side of the fore part (the *shoulders*) it is of a rich deep red-brown colour, going off into a paler hue towards the underside. A little way from the outer corners of these red-brown patches are two broad irregularly interrupted bands of the same colour, which converge towards the spinners; the sides, as well as the upperside, are of a pale clear red-brown, thickly freckled with yellowish-white spots. Some of these spots form a tolerably well defined line outside and next to the converging red-brown bands, as well as a large well-defined triangle within the shoulder-patches (which is succeeded by a broader, more obtuse, and less well defined one just above the commencement of the converging bands), and some oblique stripes on the sides; the underside is of a dark red-brown colour, with a broad, paler, curved, longitudinal stripe on either side of the median line.

An immature male of this species, which had apparently another moult to undergo before becoming adult, was sent me in September 1866 by Mr. Morris Young, of Paisley, by whom several specimens (all immature) were captured among heather in Perthshire in the month of August preceding.

It is allied to *Epeïra solers*; but even in the immature state it presents differences of colour and pattern, which appear to justify its description as a distinct and new species. I have conferred upon it the specific name "*Youngii*," in compliment to the discoverer, to whom I am indebted for the opportunity of making it known to science, as well as for several other new and rare species.

#### EPEÏRA PROMINENS.

*Singa prominens*, Westr. Araneæ Suecicæ, p. 63; Westr. Enum. Ar. p. 35.

*Epeïra bella*, Meade, Ann. & Mag. Nat. Hist. 3rd ser. vol. vii. p. 20; Blackw. Brit. & Ir. Spiders, 343, pl. xxv. fig. 248; Camb. Zoologist, 1862, p. 7950.

This species (which had been described under the name *Singa prominens* by M. Westring before its description by Mr. Meade, *loc. cit. sup.*) I have found, though not in any abundance, both at Drayton Beauchamp, Buckinghamshire, and at Bloxworth, among underwood and low herbage in woods in summer.

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P.S. Note to description of LINYPHIA CONFUSA (*anteà*, p. 429).—In a work by Dr. Thorell, 'Remarks on Synonyms of European Spiders,' published at Upsala in 1870, at p. 56



the difference between *L. minuta* (Bl.) and *L. confusa* (Camb.) is noted, and the latter species is decided by Dr. Thorell to be identical with the *Linyphia leprosa* (Ohlert, Arachn. Stud. p. 12, and Aran. d. Prov. Preuss. p. 47), with typical examples of which he has compared examples of *L. confusa* supplied to him by myself. Dr. T. points out (what I have also noted) that the legs are less distinctly annulated in *L. confusa* (*L. leprosa*) than in *L. minuta*.

*List of Species, with references to page, plate, and figures.*

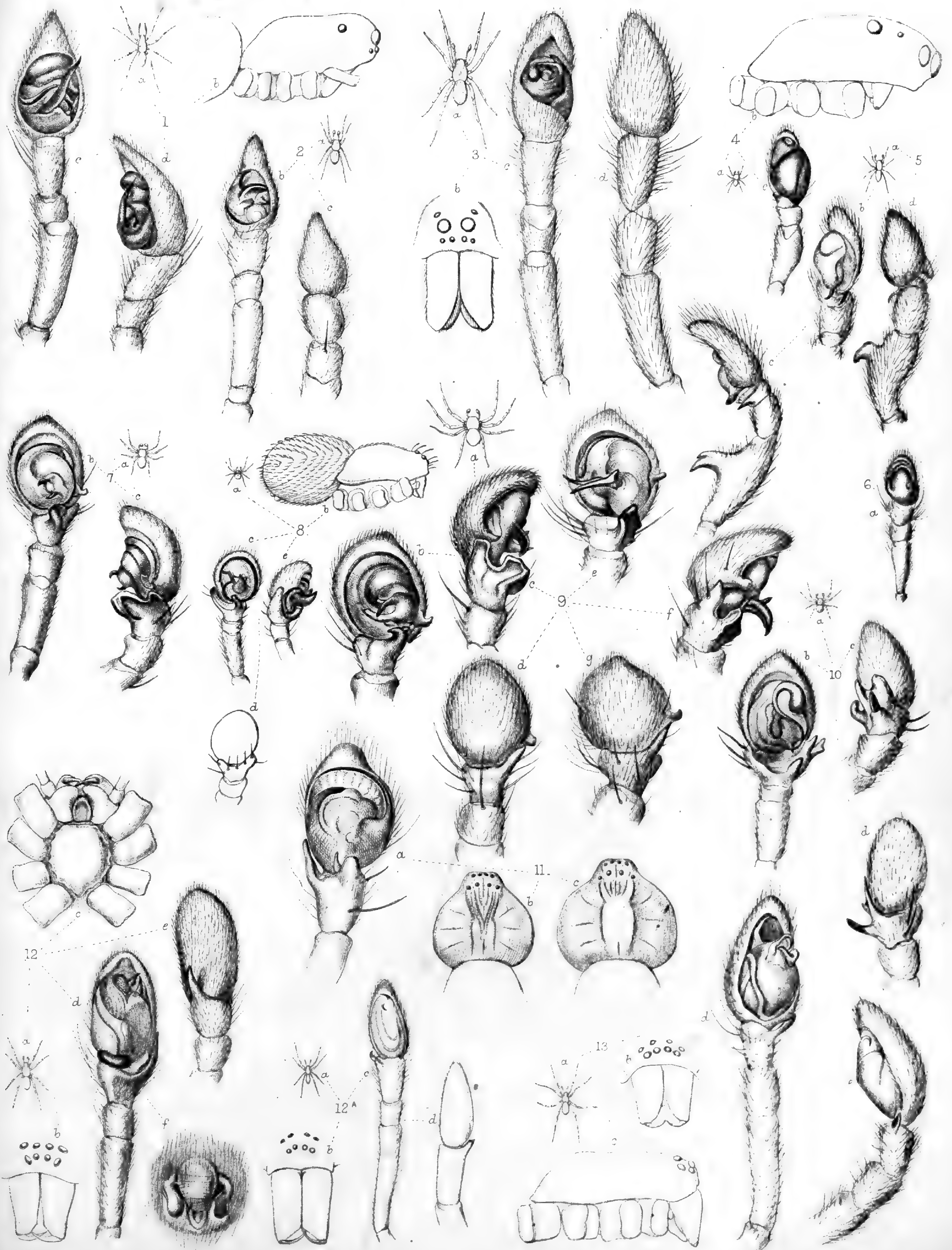
- Lycosa congener*, n. sp. : p. 393, Pl. 54. no. 1.  
 — *Farrenii*, n. sp. : p. 395, Pl. 54. no. 2.  
 — *de Greyii*, n. sp. : p. 396, Pl. 54. no. 3.  
 — *monticola*, Clerck : p. 398.  
 — *miniata*, Koch : p. 398.  
 — *barbipes*, Sund. : p. 398.  
 — *fabrilis*, Koch : p. 398.  
*Salticus affinitatus*, n. sp. : p. 399.  
 — *æquipes*, n. sp. : p. 399, Pl. 54. no. 4.  
 — *expers*, n. sp. : p. 401, Pl. 54. no. 5.  
 — *saltator*, Camb. : p. 401, Pl. 54. no. 6.  
 — *scenicus*, Koch : p. 402.  
 — *histrionicus*, Koch : p. 402.  
 — *pratincta*, Koch : p. 403.  
 — *flavipes*, Koch : p. 403.  
*Thomisus Westwoodii*, n. sp. : p. 403, Pl. 54. no. 7.  
 — *sanctuaris*, n. sp. : p. 405, Pl. 54. no. 8.  
 — *Cambridgii*, Blackw. : p. 406, Pl. 54. no. 9, *a, b, c, d* (no. 9. figs. *e, f, g* are of *T. bifasciatus*, Bl.).  
 — *pallidus*, Bl. : p. 408, Pl. 54. no. 10.  
 — *horridus*, Fabr. : p. 409.  
*Philodromus prædatus*, n. sp. : p. 409, Pl. 54. no. 11.  
*Drassus anglicus*, Camb. : p. 410, Pl. 54. no. 12.  
 — *scintillans*, n. sp. : p. 412, Pl. 54. no. 12A.  
 — *electus*, Koch : p. 413.  
 — *Palliardi*, Koch : p. 413.  
*Clubiona pallens*, Koch : p. 413.  
 — *subtilis*, Koch : p. 414.  
 — *lutescens*, Westr. ; p. 414.  
 — *phragmitis*, Koch : p. 414.  
*Ergatis uncinata*, Westr. : p. 414.  
 — *variabilis*, Koch : p. 414.  
*Uloborus Walckenaërius*, Dugès : p. 415.  
*Agelena proxima*, n. sp. : p. 415, Pl. 54. no. 13.  
*Tegenaria intricata*, Koch : p. 416.  
*Theridion instabile*, n. sp. : p. 416, Pl. 55. no. 14.  
 — *familiare*, n. sp. : p. 418, Pl. 55. no. 15.  
 — *Blackwallii*, n. sp. : p. 419, Pl. 55. no. 16.  
 — *stictum*, Camb. : p. 420, Pl. 55. no. 17.



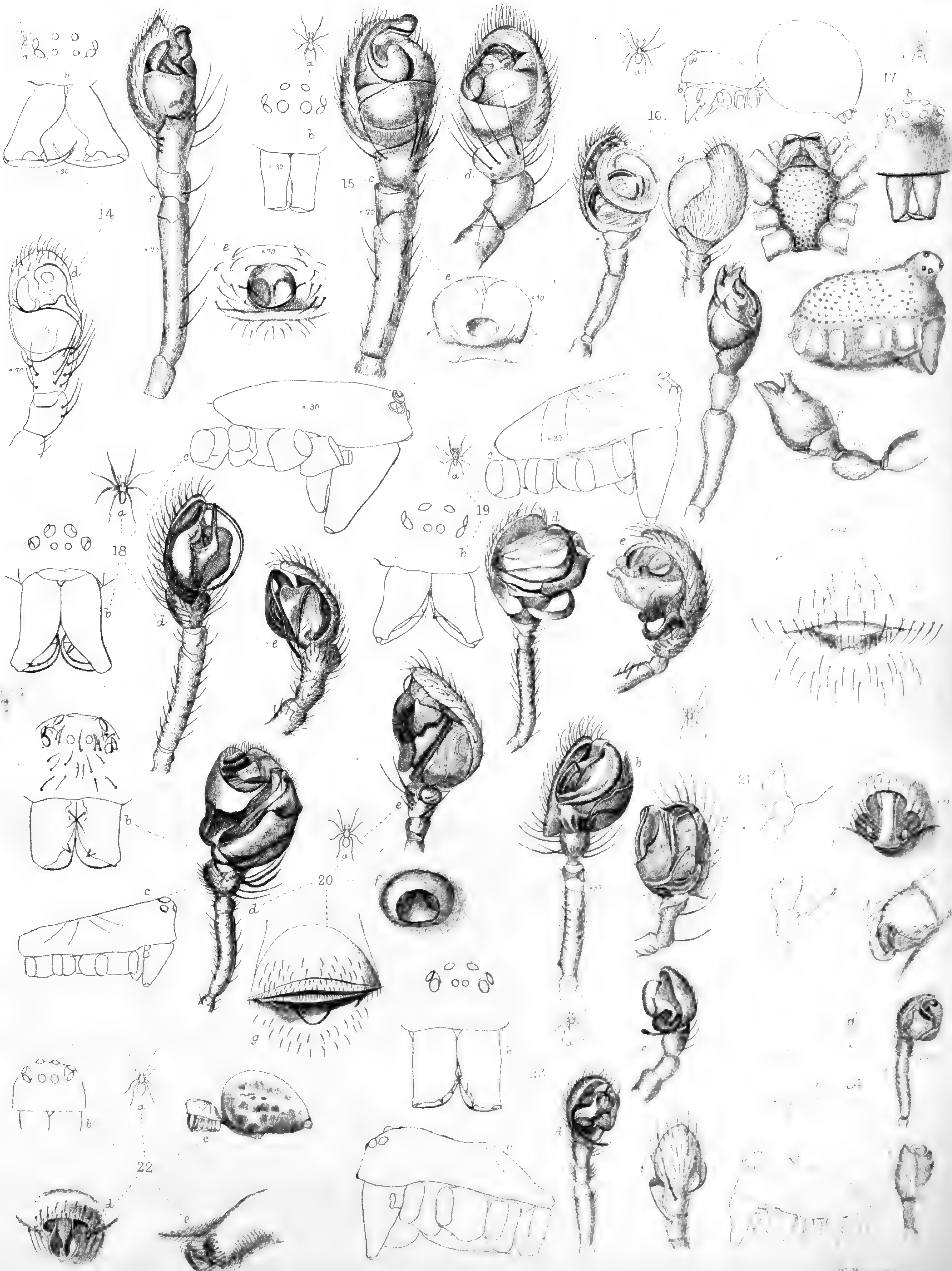
- Theridion venustum*, Walek. : p. 422.  
 — *melanogaster*, Koch : p. 422.  
 — *coracinum*, Koch : p. 422.  
*Linyphia impigra*, n. sp. : p. 422, Pl. 55. no. 18.  
 — *circumcincta*, n. sp. : p. 423.  
 — *approximata*, n. sp. : p. 424, Pl. 55. no. 19.  
 — *furtiva*, n. sp. : p. 425, Pl. 55. no. 20.  
 — *finitima*, n. sp. p. 427.  
 — *confusa*, n. sp. : p. 429, Pl. 55. no. 21, *a, b, c, d, f, g* (fig. *e*, no. 21, is of *L. minuta*, Bl.)  
 — *cingulipes*, n. sp. : p. 429, Pl. 55. no. 22.  
 — *experta*, n. sp. : p. 433, Pl. 55. no. 23.  
 — *longipes*, n. sp. : p. 431, Pl. 55. no. 24.  
 — *inconspicua*, n. sp. : p. 432.  
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 — *oblonga*, n. sp. p. 434.  
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 — *decens*, n. sp. : p. 437, Pl. 56. no. 27.  
 — *decolor*, Westr. : p. 438, Pl. 56. no. 28.  
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 — *decora*, n. sp. : p. 440.  
 — *mollis*, n. sp. : p. 440.  
 — *excisa*, n. sp. : p. 441.  
 — *arundineti*, n. sp. : p. 441.  
 — *Clarkii*, n. sp. : p. 441, Pl. 56. no. 30.  
 — *neglecta*, n. sp. : p. 443, Pl. 56. no. 31, *a, b, c, d, e* (no. 31, *f, g, h*, are of *Nerienne livida*, Bl.)  
 — *latebricola*, n. sp. : p. 444, Pl. 56. no. 32.  
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 — *fortuita*, n. sp. : p. 452, Pl. 57. no. 37\*.  
 — *scabrosa*, n. sp. : p. 453, Pl. 57. no. 38.  
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 — *ignobilis*, n. sp. : p. 457, Pl. 57. no. 42.  
 — *cirrifrons*, n. sp. : p. 458, Pl. 57. no. 43.  
 — *Beckii*, n. sp. : p. 460, Pl. 57. no. 44.  
 — *nudipalpis* (Westr.) : p. 461.  
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*Epiera Youngii*, n. sp. : p. 461.  
 — *prominens* (Westr.) : p. 462.

\* Below fig. *e*, no. 37, Pl. 57, is a figure unlettered belonging to this number.

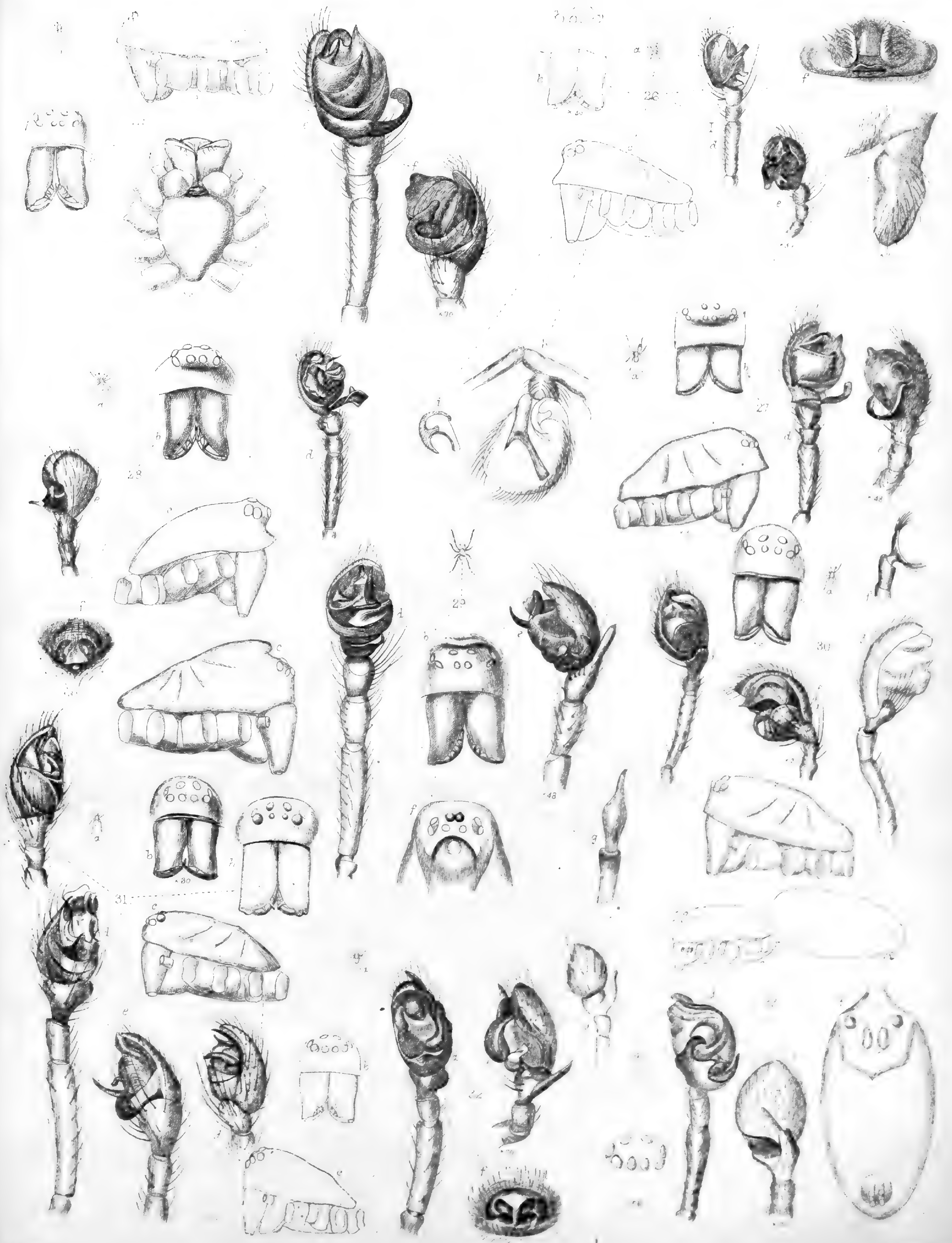




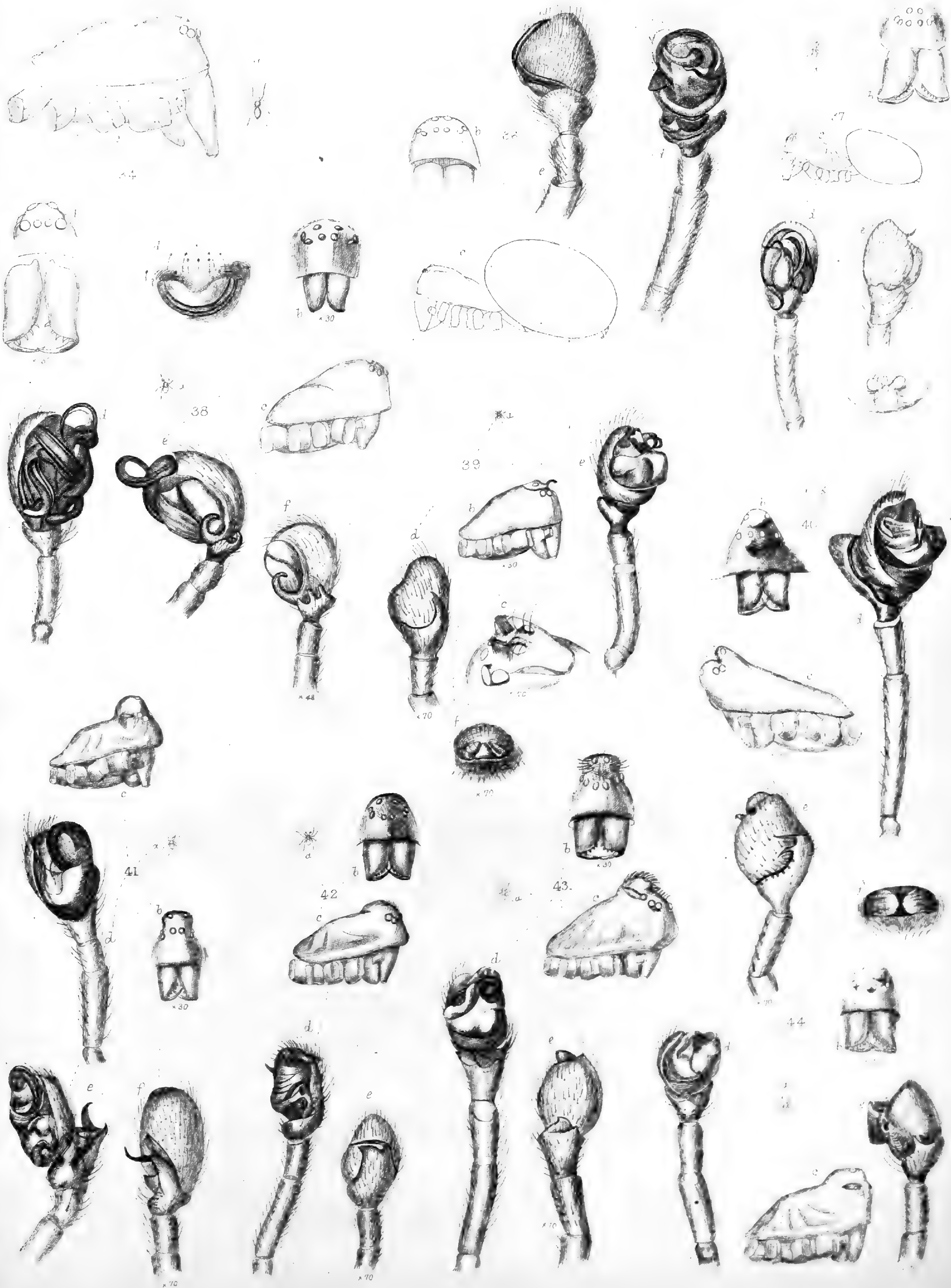














THE  
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M.DCCC.LXXI.



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XVII. *Notes on the Reptiles, Amphibia, Fishes, Mollusca, and Crustacea obtained during the voyage of H. M. S. 'Nassau' in the years 1866-69.* By ROBERT O. CUNNINGHAM, M.D., F.L.S., C.M.Z.S., Professor of Natural History, Queen's College, Belfast.

(Plates LVIII., LIX.)

Read June 16th, 1870.

SINCE my return to this country in the end of July 1869, I have been more or less occupied in the examination of the collections made by me in the course of the three preceding years, and I now venture to lay before the Linnean Society a first instalment of my results, which, although for unavoidable reasons much more limited than I could have wished, are yet, I hope, not without a certain amount of value. My collection of *Mammalia* chiefly consisted of a series of human crania (including those of the aborigines of Peru, Chili, the Chonos archipelago, Patagonia, and Fuegia), of which the greater number are now in the Museum of the Royal College of Surgeons, and of a few skins and skulls of quadrupeds obtained in Brazil, Patagonia, and the island of Chiloe. The Ornithological collection amounted to between one hundred and twenty and one hundred and thirty specimens, for the most part obtained in the Strait of Magellan and on the west coast of Patagonia, and now deposited in the University Museum at Cambridge, while the remaining Vertebrates, together with the entire collection of Invertebrata, were sent to the British Museum.

The Reptiles, Amphibia, Fishes, Mollusca, and Crustacea I have carefully gone over within the last few months; and as I find that a certain number of the species are apparently altogether undescribed, and that many others are new to the national collection, I have drawn up the following brief account of them. I wish, at the outset of these remarks, to express my deep sense of the obligations which I lie under to the gentlemen of the Zoological Department of the British Museum for the facilities which they have afforded me in the examination of specimens and the consultation of books; and I may here state that my thanks are especially due to Dr. Günther for much valuable advice and assistance in the naming of the Vertebrata, and to Dr. Baird for various suggestions in connexion with the Mollusca. The collection was but a small one, as will be gathered from the sequel; but every naturalist who has had the opportunity of undertaking a long sea-voyage will appreciate the difficulties arising from confined space and a variety of other circumstances inseparable from life on board a small ship, and will therefore, I trust, make due allowance accordingly.

## REPTILES.

### I. AMPHISBÆNIANS.

#### 1. CEPHALOPELTIS SCUTIGERA, Hempr.

A single specimen of this curious worm-like species was obtained at Rio de Janeiro in August 1867.



## II. SAURIA.

## 2. CNEMIDOPHORUS LACERTINOIDES, Dum. et Bib.

This beautiful lizard is very plentiful in the neighbourhood of Monte Video, but runs with such extreme swiftness as to render its capture a matter of great difficulty. My specimens, which are much larger than those collected by Mr. Darwin in the same locality, were killed with stones. When the animal is alive the ground-colour is a very vivid green, which soon fades in spirit.

## SCINCIDÆ.

## 3. EUPREPIS STANGERI, Gray.

A specimen of this species was taken at St. Vincent, in the Cape-Verde Islands, in October 1866.

## GECKOTIDÆ.

## 4. TARENTOLA DELALANDII, Dum. et Bib.

Two specimens were taken at St. Vincent. This and the preceding species are, I believe, the only two Reptiles to be met with on the island.

## IGUANIDÆ.

## 5. LEIODERA CHILENSIS, Lesson.

Common in the neighbourhood of Valparaiso, where it burrows in the sand with great agility.

## 6. LEIODERA GRAVENHORSTII, Gray.

Common about Coquimbo, where *L. chilensis* does not appear to be abundant.

## 7. LEIODERA GRACILIS, Bell.

Taken at Coquimbo.

## 8. LEIOLÆMUS NIGRO-MACULATUS, Wiegman.

Common at Coquimbo.

## 9. LEIOLÆMUS CYANOASTER, Dum. et Bib.

Common about San Carlos de Ancud, Chiloe, where it was the only Lizard observed. It varies much in colour, the ground-tint on the back of some individuals being brown, and in others green. The anterior part of the belly in most of the specimens was greenish blue, while the posterior was bright orange.

## 10. LEIOLÆMUS PICTUS, Dum. et Bib.

This elegant little species was taken at Lota in Araucania. One of the specimens was killed with the lash of a riding-whip.

## 11. PTYGODERUS PECTINATUS, Dum. et Bib.

This Lizard appears to extend furthest south of all the South-American species. Mr.



Darwin obtained it in Patagonia; and I met with many specimens of it in the eastern part of the Strait of Magellan, alike on the coast of Patagonia and that of Tierra del Fuego. Nearly all the specimens were taken on open ground; but one occurred in a wood in the neighbourhood of the Chilian settlement of Punta Arenas or Sandy Point.

12. *TARAGUIRA TORQUATA*, Wied.

This species is common about Rio Janeiro, but, like most of its tribe, not easy to capture.

III. *OPHIDIA*.

*COBONELLIDÆ*.

13. *TACHYMENIS CHILENSIS*, Schleg.

One four-banded specimen of this species was taken at Talcahuano, the sea-port of Concepcion, and another, with only two bands, at Coquimbo.

*DRYADIDÆ*.

14. *DROMICUS PLEII*, Dum. et Bib.

Taken at Rio Janeiro.

15. *DROMICUS TEMMINCKII*, Schleg.

Taken on the coast of Luco Bay, in Araucania.

AMPHIBIA.

1. *CYSTIGNATHUS OCELLATUS*, Linn.

Taken at Rio de Janeiro in November 1866.

2. *CYSTIGNATHUS TÆNIATUS*, Girard.

A specimen of this species, previously obtained in the neighbourhood of Santiago, Chili, was taken in the neighbourhood of Ancud, Chiloe, in November 1868.

3. *PLEURODEMA BIBRONII*, Tschudi.

Taken in numbers at Talcahuano, Chili.

4. *CACOTUS*, sp.

A single example of a Batrachian referred by Dr. Günther to this genus, but pronounced by him as in an unfit condition for being made the type of a distinct species, was taken on a tree at Huite, Chiloe.

5. *NANNOPHYNE VARIEGATA*, Günther, g. et sp. n., Proc. Zool. Soc. June 1870.

This pretty little Batrachian, regarded by Dr. Günther as the type of a new genus, was taken in three localities in the wooded region of the west coast of Patagonia, where the climate and vegetation are alike Fuegian. The localities were as follows:—Eden Harbour, March, 1868; Port Grappler, December 1869; Puerto Bueno, December 1869.



## 6. RHINODERMA DARWINII, Dum. et Bib.

A specimen of this curious little species was taken in a wood in the island of Quehuuy off the coast of Chiloe.

## 7. BUFO AGUA, Latr.

Specimens were obtained on the Mount, Monte Video, in February 1866.

## 8. BUFO ORNATUS, Spix.

Taken at Rio de Janeiro in May 1869.

## 9. HYLODES LEPTOPUS, Bell.

A specimen of this species, previously obtained by Mr. Darwin at Valdivia, was captured at Puerto Bueno, west coast of Patagonia, in December 1869. The occurrence of this *Hylodes* and of *Nannophryne variegata* in localities so much further south on the western side of the American continent than Batrachia have been hitherto procured, is a fact of considerable interest.

## 10. PHYLLOMEDUSA BICOLOR, Bodd.

A specimen of this elegant little creature was taken at Rio de Janeiro in May 1869. The colour of the upper surface, at first bright green, changed to purple some time after the specimen had been consigned to spirits.

## 11. HYLALBO-MARGINATA, Spix.

A specimen of this species was found perched on one of the large leaves of an *Agave* at Rio de Janeiro in July 1867. While it was alive the colour of the upper surface was bright emerald-green, and that of the under surface and feet pale yellow, the suckers being tinged with pale vermilion.

## 12. HYLALAGRESTIS, Bell.

I took several examples of this pretty little species, on the surface of rocks exposed to the full glare of the sun, on the Mount at Monte Video, in February 1869. The colours when the animal was alive were as follows:—Upper surface grass-green; beneath yellowish white; back of the thigh with black and white spots. A white streak along the edge of the upper lip, and one along the outer side of the leg between the knee and ankle.

## FISHES.

## TRIGLIDÆ.

## 1. SEBASTES OCULATUS, Cuv. et Val.

A fine specimen of this species, previously known from Valparaiso, was taken on a line in Fortune Bay, on the west coast of Patagonia, in December 1868. The ground-colour when the fish was obtained was a vivid scarlet.



2. *AGRIOPUS HISPIDUS*, Jenyns.

A specimen was dredged in April 1868, at Port Otway, Cape Tres Montes, where Mr. Darwin's specimen, the type of the species, was also procured.

3. *PRIONOTUS PUNCTATUS*, Cuv. et Val.

A specimen was taken in Rio harbour, swimming close to the surface of the water, in September 1867.

4. *AGONUS CHILOENSIS*, Jenyns.

A specimen was dredged at Port Otway, Cape Tres Montes, in April 1868.

## TRACHINIDÆ.

5. *APHRITIS GOBIO*, Günth.

This species, described by Dr. Günther in 1861, in the 'Annals and Magazine of Natural History' (ser. iii. vol. vii. p. 88), from a skin and an old stuffed specimen brought by that assiduous collector Captain P. P. King, from Port Famine, I met with several times in the Strait of Magellan and channels on the west coast of Patagonia. It has a most forbidding and ferocious appearance when caught, opening its wide mouth and erecting its fins and orbital tentacles. The colours, when fresh, are as follows:—Above, dusky brown, sides paler, blotched with brown and orange-yellow. Under surface of head, breast, and belly orange-yellow. Two points worth mentioning, and which were not observable in the specimens from which Dr. Günther drew up his description, are the existence, on the skin of the posterior part of each orbit, of a well-developed tentacle, more or less fringed at the extremity in different individuals, and of a row of branched cutaneous appendages attached to the under surface of the posterior margin of the scales on the sides below the lateral line, and resembling at first sight parasitic Lernæidæ.

6. *ELEGINUS MACLOVINUS*, Cuv. et Val.

This fish was taken in considerable numbers, in the seine, at Punta Arenas, Port Famine, and Port Gallant, in the Strait of Magellan, and formed an agreeable variety to the monotonous diet of preserved meat to which we were subjected.

7. *CHÆNICHTHYS ESOX*, Günth.

This species was described by Dr. Günther in the same paper with *Aphritis gobio*, from an old stuffed specimen also collected by Captain King at Port Famine. Several specimens were taken on fishing-lines by us at Port Grappler, on the west coast of Patagonia, and proved rather good eating. It was beautifully coloured when first taken, the sides being barred with greyish black and fine iridescent purple. Several specimens of a *Caligus*, apparently undescribed, were found adhering to the skin. These I propose naming *Caligus chænichthyis*.

8. *NOTOTHENIA TESSELLATA*, Rich.

Specimens of this species, previously obtained from the Falkland Islands, were met with



at Punta Arenas, in the Strait of Magellan, and in Fortune Bay, on the west coast of Patagonia.

9. *NOTOTHENIA CORNUCOLA*, Rich.

This species, from which *N. virgata* does not appear to be truly separable, is very common in the Strait of Magellan and channels on the west coast of Patagonia; and I also met with it at Chiloe.

10. *NOTOTHENIA MACROCEPHALUS*, Günth.

This species, readily distinguishable from all the other *Nototheniæ*, I only obtained in Fortune Bay, in the channels. There it appeared to be abundant, a good many specimens having been taken on fishing-lines. The colour of the back is a rich golden-brown, becoming golden-yellow on the sides and belly. The largest specimen taken was considerably upwards of a foot long.

11. *HARPAGIFER BISPINIS*, Forst.

This odd-looking little fish is not uncommon in the Strait of Magellan and western channels. Many specimens were taken in Tilly Bay, Fuegia.

SCLENIDÆ.

12. *UMBRINA OPHICEPHALUS*, Jenyns.

This species is rather abundant on the Chilian coast. The small specimen preserved was obtained in Herradura Bay.

SCOMBRIDÆ.

13. *ECHENEIS LINEATA*, Menzies.

A small specimen of this species was taken in the towing-net between the Cape Verdes and Rio de Janeiro

BLENNIIDÆ.

14. *BLENNIUS GENTILIS*, Girard.

A number of specimens apparently referable to this species, previously recorded from California, were taken on the screw of the 'Nassau,' at Rio de Janeiro, in August 1867.

15. *BLENNIUS SORDIDUS*, Benn.

A specimen of this species, founded on a Blenny from the Sandwich Islands, was obtained in the Bay of Coquimbo.

16. *CLINUS NUCHIPINNIS*, Quoy et Gaim.

Many specimens of this species were observed at St. Vincent, darting actively about the rocky pools; and several were preserved.

17. *TRIPTERYGIUM*, sp.

A minute specimen of a species of this genus was obtained in the dredge at Port Otway, Cape Tres Montes, in April 1868; but it does not admit of identification.



## TRACHYPTERIDÆ.

## 18. TRACHYPTERUS ALTIVELIS, Kner.

A specimen of this species was taken, in the seine, at Luco Bay, Araucania.

## ATHERINIDÆ.

## 19. ATHERINICHTHYS LATICLAVIA, Cuv. et Val.

This species, from which the *A. microlepidotus* appears to be very doubtfully distinct, was frequently taken in the seine in the Strait of Magellan, at Punta Arenas, Port Famine, and Port Gallant, often occurring along with *Eleginus maclovinus*. It possesses an extremely delicate flavour.

## 20. ATHERINICHTHYS ALBURNUS, Günth.

Specimens of this species were taken at Punta Arenas. In common with some of the other species of the genus, it is generally met with where there is a considerable admixture of fresh with salt water.

## 21. ATHERINICHTHYS ARGENTINENSIS, Cuv. et Val.

Many specimens, I believe, referable to this species were taken in the seine at Maldonado; and one was sent home, preserved in spirit; but I have not come across it at the British Museum.

## GOBIESOCIDÆ.

## 22. GOBIESOX, sp.

Many specimens of a small species of this genus, but in an immature condition, were taken, along with *Blennius gentilis*, on the screw of the 'Nassau,' at Rio de Janeiro, in August 1867.

## CENTRISCIDÆ.

## 23. CENTRISCUS GRACILIS, Lowe.

A small specimen of this species was taken in the towing-net, between Monte Video and the Strait of Magellan, in November 1867.

## LYCODIDÆ.

## 24. LYCODES LATITANS, Jenyns.

This species was not uncommonly met with in the Strait of Magellan and western channels, lurking under stones. It is difficult to catch, from its eel-like motions and the slipperiness of its scaleless skin.

## MAYNEA, g. n.

*Body* elongated, compressed. *Skin* with small spherical imbedded scales, with interspaces between them. *Dorsal*, *caudal*, and *anal* united. *Ventrals* absent. *Jaws* equally armed anteriorly with minute teeth placed rather far apart. A few minute teeth anteriorly on the vomer and anteriorly on the palatine bones. A row of large open pores along upper and lower jaws, and a few rather smaller ones on the cheeks. Six *branchiostegals*; gill-opening narrow, the gill-membranes being attached to the isthmus; *pseudo-branchiæ* present. No pyloric appendages.



25. *MAYNEA PATAGONICA*, sp. n.

D. 115. A. 85.

Diameter of interorbital space a little less than that of orbit. Head less than  $\frac{1}{7}$  of the total length. Dorsal commencing a little in front of the base of the pectoral. Colour reddish purple, with minute white dots produced by the imbedded scales.

*Hab.* The Otter Islands, in Smythe's Channel.

This fish, which I have Dr. Günther's authority for regarding as the type of a new genus, I have named after my friend Captain R. C. Mayne, the head of the Magellan Survey, as a slight acknowledgment of the ready kindness which he ever displayed in affording me opportunities for prosecuting my investigations during the three years in which I was associated with him.

## GADIDÆ.

26. *MERLUCCIUS GAYI*, Guich.D. 12 | 36. A. 37 ( $\frac{22}{15}$ ).

Eyes large, their long diameter nearly a third of the space between the orbits. Teeth in upper and lower jaws smaller and placed more widely apart than in *M. vulgaris*. Second dorsal deeply notched in the middle, the rays of the posterior third the largest. Anal deeply notched, appearing at first sight as if composed of two distinct fins.

A good many specimens of this fish (which there seems little reason to doubt is the *Merluccius Gayi*, Guich., described at p. 328 of the second volume of the Zoologia, and figured in the Atlas Ictiol. lam. 8. fig. 2 of Gay's *Historia Fisica y politica de Chili*) were taken, with fishing-lines, at the eastern entrance of the Strait of Magellan; and the above diagnostic description is drawn up from a small specimen which I preserved. The figure in the Atlas to Gay's *History of Chili* does not correctly represent the form of the dorsal and anal fins, there being no indication given of the marked manner in which they are cleft. It is probable that this was the "*Gadus*" taken by Captain King off Cape Fairweather in 1826\*, by Skyring in the Messier Channel in February 1830†, and by Fitzroy in Good-Success Bay in February 1833‡.

## PLEURONECTIDÆ.

27. *PLEURONECTES*, sp.

A very young specimen of a *Pleuronectes*, which possibly may be *P. umbrosus*, Girard, was taken in Coquimbo Bay.

## SILURIDÆ.

28. *LORICARIA VETULA*, Val.

A good specimen of this species, taken in the River Plate, which previously did not exist in the British-Museum collection, was given to me in August 1867.

## STOMIATIDÆ.

29. *ASTRONESTHES NIGER*, Rich.

A specimen of this species was taken, in the towing-net, between St. Vincent and Rio de Janeiro.

\* Voyage of 'Adventure' and 'Beagle,' vol. i. p. 8.

† Ibid. p. 335.

‡ *Op. cit.* vol. ii. p. 225.



## SCOMBRESOCIDÆ.

30. *EXOCÆTUS OBTUSIROSTRIS*, Gthr.

A specimen was obtained at St. Vincent, Cape-Verdes.

## CLUPEIDÆ.

31. *CLUPEA NOTACANTHUS*, Gthr.

A small specimen was taken in Herradura Bay, Chili.

## SYNGNATHIDÆ.

32. *SYNGNATHUS ACICULARIS*, Jenyns.

A specimen taken in the Bay of Coquimbo.

33. *SYNGNATHUS (NEROPHIS) ÆQUOREUS*, Linn.

Specimens were taken in the towing-net to the north of the Azores; and many were seen swimming about on the surface of the water.

34. *HIPPOCAMPUS GUTTULATUS*, Cuv.

A specimen of this species was taken at Rio de Janeiro in July 1867.

## SPINACIDÆ.

35. *ACANTHIAS VULGARIS*, Risso.

Specimens of this species, the common "dogfish" of the British seas, were taken in Falkland Sound and at Punta Arenas, Strait of Magellan.

## CARCHARIDÆ.

36. *ZYGÆNA MALLEUS*, Risso.

A specimen of the common Hammer-headed Shark was captured at Madeira in September 1866.

## CHIMÆRIDÆ.

37. *CALLORHYNCHUS ANTARCTICUS*, Lacépède.

Taken at Chiloe and in the Bay of Arauco.

## RAJIDÆ.

38. *PSAMMOBATIS RUDIS*, Günther, g. et sp. n.

A small Ray, described under the above name by Dr. Günther, in the eighth volume of his Catalogue of the Fishes of the British Museum, was taken at Punta Arenas, Strait of Magellan, in May 1867.

## MYXINIDÆ.

39. *MYXINE AUSTRALIS*, Jenyns.

Many specimens of this species were taken in Falkland Sound and at Punta Arenas, Strait of Magellan.



## MOLLUSCA.

## CEPHALOPODA.

## OCTOPODIDÆ.

## 1. OCTOPUS, sp.

A species of this genus was observed at St. Vincent and the Cape-Verde Islands; but as the specimens then preserved are not now in good condition, I have judged it more prudent not to attach any specific name to them. The animal is evidently the same with that whose habits were described by Mr. Darwin at St. Jago, in the Cape-Verdes. The specimens met with at St. Vincent were of small size, of a dirty mottled grey colour, and exhibited great activity of movement, swimming about the rock-pools with great rapidity, tail foremost, and occasionally discharging the contents of the ink-bag, to screen themselves from observation, and, when placed on the surface of the rock, scrambling along on their arms with wonderful agility.

## 2. OCTOPUS MEGALOCYATHUS, Phil. (?).

A species of Octopus which is not uncommon in the Strait of Magellan, and was the only Cephalopod which I encountered in that region, is, I believe, referable to the above species. A number of specimens were procured, most of them taken in the eastern part of the Strait; and a cluster of ova apparently belonging to the species were found on the beach at Punta Arenas. The animal attains a very considerable size; and many large mutilated specimens were met with, thrown up on the sandy beach at Punta Arenas after violent westerly gales. Like most other Cephalopods, the skin exhibits very remarkable changes of colour when the animal is alive.

## 3. OCTOPUS FONTANIANUS, D'Orb.

I obtained two specimens of this species, which is, I believe, common on the coast of Chili, in a rock-pool in the Bay of Coquimbo, on August 17th, 1868. One of them was discovered under a large stone which I had turned over in search of marine animals. Its colour, at first dirty greyish-white, changed almost instantaneously to a rich dark purplish red, as it swam off with great rapidity and the directness of an arrow, propelled by the rapid movements of its arms.

## TEUTHIDÆ.

## 4. LOLIGO GAHI, D'Orb.

Small specimens of this species were obtained in our seine at Luco Bay (Araucania) in November 1868, and at San Carlos de Ancud (Chiloe) in April 1868.

## 5. OMMASTREPES, sp.

Large fragments of a species of the genus were found in the œsophagus and stomach of an albatros (*Diomedea exulans*) caught near the southern extremity of the Chonos archipelago in March 1868.



## SPIRULIDÆ.

## 6. SPIRULA, sp.

A fragment of a shell was taken in the towing-net, to the south of the Cape-Verdes, in October 1866.

## GASTEROPODA.

## MURICIDÆ.

## 7. MUREX LABROSUS, Gray.

Specimens were dredged at Lota, in the Bay of Arauco, in November 1868.

## 8. MUREX BREVICULUS, Sow. ?

Dead shells, apparently referable to this species, were found at St. Vincent, in October 1866.

## 9. PISANIA ANTARCTICA, Reeve.

This species is common in the Strait of Magellan, and was frequently obtained in the dredge at depths of from 12 to 15 fathoms.

## 10. PISANIA FUSCATA, Brug.

Also common in the Strait of Magellan.

## 11. TRITON SCABER, King.

Specimens of this species were dredged in Herradura Bay, coast of Chili.

## 12. TRITON CANCELLATUS, Lam.

Many specimens of this species were obtained on one or two occasions at Punta Arenas, in the Strait of Magellan, cast up on the beach by strong easterly gales.

## 13. TRITON BRASILIANUS, Gould.

This species is not uncommon on the rocks in the bay of Rio de Janeiro, a few feet below high-water mark.

## 14. CANCELLARIA (ADMETE) AUSTRALIS, Phil.

Several specimens of this small *Cancellaria* were dredged in the eastern part of the Strait of Magellan.

## 15. CHORUS GIGANTEUS, Lam.

This large and handsome shell was only obtained at Lota and Luco Bay in the Bay of Arauco.

## 16. CHORUS XANTHOSTOMA, Brod.

Many specimens were dredged in the Bay of Coquimbo.



17. *FUSUS GEVERSIANUS*, Pall.

This species is one of the commonest mollusks in the Strait of Magellan, abounding from the eastern entrance to Port Famine. To the west of Port Famine it is not so abundant, being partially replaced by the following species. It also occurs at the Falkland Islands.

18. *FUSUS LACINIATUS*, Mart.

This elegant species is abundant in the western part of the Strait, and also occurs in the channels on the west coast of Patagonia. I never met with it to the east of Punta Arenas. It inhabits rather shallow water; and specimens were taken in Tilly Bay, Carlos III. Island, feeding on *Mytilus chilensis*. Like the common *Purpura lapillus* of our shores, the animal bores a small circular hole in the valve of the mussel, and then sucks out the soft parts of the body.

19. *FUSUS MURICIFORMIS*, King.

This small species is very common in the Strait of Magellan.

20. *FUSUS LIRATUS*, Couth.

Specimens of this species were procured at Port Stanley, Falkland Islands.

21. *FUSUS PHILIPPIANUS*, D'Orb.

This species was obtained in one or two localities on the Fuegian coast, in the eastern part of the Strait of Magellan.

22. *FUSUS (CHRYSODOMUS) ALTERNATUS*, Phil.

Specimens were dredged in Herradura Bay, in November 1868.

## BUCCINIDÆ.

23. *APOLLON KINGII*, D'Orb.

Dead shells of this species were dredged in Sholl Bay, at the southern extremity of Smyth's Channel.

24. *BULLIA SQUALIDA*, King.

Numbers of dead shells of this species were met with in Gregory Bay and other localities in the eastern part of the Strait of Magellan; but I never succeeded in obtaining live specimens.

25. *NASSA GAYI*, Hien.

Two rather distinct varieties of this species were obtained, one of an elongated form, at Port Otway (Cape Tres Montes), and the other of the ordinary shape, in rock-pools in the Bay of Coquimbo.



26. *CONCHOLEPAS PERUVIANA*, Blainv.

This curious species is abundant on the Chilian coast, adhering with great tenacity to the rocks in the Laminarian zone. It is regarded as a delicacy by the Chilians, by whom it is termed "Loco." I never met with live specimens to the south of Chiloe, but was a good deal puzzled by picking up two worn, dead shells close to Fuegian encampments in the channels on the west coast of Patagonia. One of these occurred at Port Grappler, opposite the south-east corner of Saumarez Island, and the other at Puerto Bueno, at the northern part of the Sarmiento Channel. I find it stated in the 'Voyage of the Adventure and Beagle,' vol. i. p. 167 (Captain Stokes's narrative), that at Port Santa Barbara, at the northern extremity of the Island de Campanha, situated outside Wellington Island, to the south of the Gulf of Peñas, "the shells (*Concholepas peruviana*) used by the Magalhaenic tribes as drinking-cups were found adhering to the rocks in great numbers." This refers to one of the habits of the Fuegian Indians never observed by us during our sojourn in the Strait and channels, though we had frequent opportunities of holding intercourse with them; and it is the only reference to such a custom with which I am acquainted. Did the mollusk still exist in the Strait and channels, I think it is hardly conceivable that it should have escaped my observation, as I carefully examined all the Fuegian encampments and wigwams which we came across; but never, save in the two instances I have mentioned, did I meet with a fragment of the shell. It is possible that at one time the animal may have existed in these regions, and have been extirpated in consequence of being a favourite article of diet, and that the drinking-cups alluded to by Captain Stokes may have been heir-looms handed down through several generations.

27. *MONOCEROS GLABRATUM*, Lam.

This species was met with plentifully at Lota, Bay of Arauco, and also at Chiloe. Dead specimens were also found in the Strait of Magellan.

28. *MONOCEROS IMBRICATUM*, Lam.

This species was found at Columbine Cove, the Otter Islands, and various other localities in the western channels of Patagonia.

29. *PURPURA NERITOIDES*, Lam.

This species was found in abundance on the rocks at St. Vincent, Cape-Verdes.

30. *PURPURA HÆMASTOMA*, Lam.

Fine specimens of this species were taken on the rocks at St Vincent and at Rio de Janeiro.

31. *OLIVA PERUVIANA*, Lam.

This species is very abundant in the Bay of Coquimbo; and many varieties of form and colouring occur, among which the var. *coniformis*, Phil., is not uncommon. I dredged



a great number of specimens, and found others burrowing in the sand at low-water mark. One animal, on being handled, discharged a pale yellowish fluid (like that secreted by *Purpura lapillus*), which changed after a time, on exposure to the air, to a beautiful purple tint which stained my fingers.

## CONIDÆ.

## 32. CONUS, sp.

A live specimen of a small species of the genus was taken at St. Vincent.

## VOLUTIDÆ.

## 33. VOLUTA (SCAPHA) COLOCYNTHIS, Sw.

I picked up a dead shell of this species on the sandy beach at Maldonado, on the north bank of the river Plate; and many live specimens were subsequently obtained by the officers of H. M. S. 'Narcissus.'

## 34. VOLUTA (SCAPHA) MAGELLANICA, Gm.

This Volute occurs very plentifully in the Strait of Magellan; but I never succeeded in dredging a live specimen, which greatly perplexed me for a time. I, however, found two live individuals at low-water mark, and subsequently obtained numbers on the beach at Sandy Point, after a severe easterly gale; and this led me to the conclusion that the species lives in the sand just below low-water mark.

## 35. VOLUTA (SCAPHA) FERUSSACII, Donovan.

I met with the dead shells of this species in hundreds on the gravelly beaches at the eastern entrance of the Strait, but only once succeeded in procuring live specimens. These were found burrowing in the sand at low water at Cape Possession, on the Patagonian shore of the Strait. A few also were met with apparently feeding on the clusters of the *Mytili* attached to the rounded boulders on the beach. The foot of the animal is very large, and of a beautiful purple tint. Several of the specimens, which were kept tied up in a pocket-handkerchief for two days and a half, while I was detained on shore by a gale, were alive when I got on board.

## 36. MITRA, sp.

A small species of this genus was procured at St. Vincent.

## NATICIDÆ.

## 37. NATICA, sp.

## 38. NATICA, sp.

Two species of this genus, one with a horny and the other with a shelly operculum, were dredged in the eastern part of the Strait of Magellan.



## TURRITELLIDÆ.

## 39. SCALARIA MAGELLANICA, Phil.

A single specimen of this species was procured in the Strait.

## CERITHIIDÆ.

## 40. CERITHIUM PULLUM, Phil.

Several specimens of a mollusk referable, I believe, to the above were dredged in the Strait.

## LITTORINIDÆ.

## 41. LITTORINA STRIATA, King.

This species was common in the rock-pools at St. Vincent.

## 42. LITTORINA FLAVA, Brod.

Common on the rocks above high-water mark at Rio de Janeiro.

## 43. LITTORINA ZEBRA, Wood.

This pretty little species was met with very plentifully on the rocks at high-water mark in Valparaiso and Coquimbo Bays.

## PALUDINIDÆ.

## 44. AMPULLARIA FASCIATA, Reeve.

I found a number of specimens of dead shells of this species floating in a marsh at Maldonado, as well as some clusters of its beautiful pink eggs attached to growing reeds.

## TURBINIDÆ.

## 45. MARGARITA VIOLACEA, King.

This pretty little species is very common alike in the eastern and western parts of the Strait of Magellan, and also in the channels. The Fuegians make necklaces of it by drilling holes through the shells and stringing them together with sinews. It is often to be found on *Macrocystis*.

## 46. MARGARITA CÆRULESCENS, King.

This species, much larger than the former (I have met with specimens nearly an inch in diameter), is also very common in the Strait, and apparently also on the Patagonian coast north of the Strait, as I procured it at the mouth of the Gallegos river.

## 47. MARGARITA TÆNIATA, Sw.

I procured this species at the Falkland Islands, and also in the Strait, where, however, it does not appear to be nearly so common as the two former.

## 48. CHLOROSTOMA BICARINATUM, Pat. &amp; Mich.

A specimen of this species was dredged in Herradura Bay.



49. *CHLOROSTOMA ATRUM*, Less.

This strong thick shell I procured abundantly on the rocks at Coquimbo, Lota, Luco Bay, and Port Otway. To the south of Port Otway I did not encounter it.

50. *AMYXA NIGRA*, Gray.

This species I found common on the rocks at Lota and at Ancud, Chiloe.

51. *OMPHALIUS VIRIDULUS*, Gmel.

Taken in rock-pools at St. Vincent.

52. *LABEO PUNCTULATUS*, Lam.

This species was also taken at St. Vincent.

## IANTHINIDÆ.

53. *IANTHINA FRAGILIS*, Lam.

Taken in the towing-net to the south of the Cape-Verdes.

54. *IANTHINA GLOBOSA*, Sw.

Seen in numbers to the south of the Cape-Verdes. One fine specimen, taken in the towing-net, had two specimens of a live Cirriped, of the genus *Lepas*, attached to the shell.

55. *IANTHINA EXIGUA*, Lam.

This species was taken in the towing-net on several occasions to the south of the river Plate.

## FISSURELLIDÆ.

56. *FISSURELLA DARWINII*, Reeve.

This species is not uncommon in the Strait of Magellan.

57. *FISSURELLA EXQUISITA*, Reeve.

I obtained this species at the Falkland Islands and in the Strait.

58. *FISSURELLA PICTA*, Gm.

This species occurs both at the Falkland Islands and in the Strait of Magellan, and attains a large size. Along with *Patellæ* and *Mytili*, it forms a staple article of diet among the Fuegian Indians.

59. *FISSURELLA NIGRA*, Less.

I found this species in abundance on the rocks at Ancud (Chiloe) and at Coquimbo.

60. *PUNCTURELLA FALKLANDICA*, A. Adams.

Several specimens of this species were dredged in the eastern part of the Strait.



## CALYPTRÆIDÆ.

## 61. CALYPTRÆA COSTELLATA, Ph.

I dredged numerous specimens of this species near the eastern entrance of the Strait.

## 62. CREPIDULA DECIPIENS, Ph.

I found many dead shells of this species on the beach at Philip Bay, in the eastern part of the Strait.

## 63. CREPIDULA DILATATA, Lam.

This species is very common at Ancud (Chiloe), and varies extremely in form.

## 64. TROCHITA RADIANS, Lam.

Many large dead shells of this species were found in a raised beach in Herradura Bay.

## 65. CRUCIBULUM FERRUGINEUM, Reeve.

Specimens were obtained on the rocks in Coquimbo Bay.

## PATELLIDÆ.

## 66. PATELLA MAGELLANICA, Gm.

Extremely common in the Strait of Magellan and at the Falkland Islands. In some parts of the western channels I did not meet with it at all.

## 67. PATELLA ÆNEA, Mart.

Common in the Strait of Magellan.

## 68. PATELLA VENOSA, Reeve.

This species was met with at Port Laguna, in the Chonos archipelago.

## 69. PATELLA CLYPEASTER, Less.

Not uncommon on the rocks at Lota (Bay of Arauco).

## 70. NACELLA CYMBULARIA, Lam.

Very common in the Strait of Magellan and western channels, occurring on the kelp (*Macrocystis pyrifera*).

## 71. NACELLA VITREA, Ph.

Common in the Strait and channels, on the kelp. I am inclined to believe that it is merely a young stage of *N. cymbularia*.

## 72. TECTURA VARIABILIS, Sow.

Specimens of this shell, which is very common on the coast of Chili, were collected in Coquimbo Bay and at Lota.



73. *TECTURA ZEBRINA*, Less.

This species was met with abundantly at Lota and Luco Bay.

74. *SIPHONARIA VENOSA*, Reeve.

I found this specimen at St. Vincent.

75. *SIPHONARIA MAGELLANICA*, Ph.

This species is very common in the Strait, abounding on the rounded stones on the beaches.

## CHITONIDÆ.

76. *CHITON ACULEATUS*, Linn.

I procured some magnificent specimens of this species on the rocks at Coquimbo. It is almost invariably to be met with in very exposed situations, on rocks on which the surf breaks violently; so that to obtain it involves a considerable amount of danger and difficulty.

77. *CHITON MAGNIFICUS*, Desh.

Fine specimens of this handsome species were met with at Coquimbo, generally in similar situations with the preceding, the difference being that the *C. magnificus* appeared to prefer clefts in the rocks.

78. *CHITON GRANOSUS*, Reeve.

This species I found at Chiloe, and also in the channels on the west coast of Patagonia. It does not appear to extend as far south as the Strait of Magellan.

79. *CHITON CUMINGII*, Fremb.

This beautiful Chiton was found at Coquimbo.

80. *CHITON ELEGANS*, Fremb.

This species was also met with at Coquimbo.

81. *CHITON CHILOENSIS*, Sow.

This species is very common at Chiloe. It appears to me to come very near *C. elegans*.

82. *CHITON BOWENII*, King.

I found a number of specimens of this species at Chiloe; but I do not remember observing it in the Strait of Magellan, where King appears to have procured it.

83. *CHITON SETIGER*, King.

This is much the commonest *Chiton* in the Strait of Magellan and western channels, and sometimes attains a considerable size. I have met with specimens 3 inches long. In old individuals the sculpturing of the valves is frequently much obliterated, and the fasciculi of setæ are often worn off.



## 84. CHITON FASTIGIATUS, Gray.

This beautiful species I met with chiefly in the western part of the Strait. Many fine specimens were obtained in Borja Bay in January 1869.

## 85. CHITON ATRATUS, Sow.

This species I also encountered in the western part of the Strait.

## 86. CHITON ILLUMINATUS, Reeve?

I met with several small specimens, probably referable to this species, in the eastern part of the Strait.

## PULMONIFERA.

## 87. HELIX AUDOUINII, D'Orb.?

A single live specimen of a large *Helix*, perhaps referable to the above species, was found at Island Harbour, in the Mexican Channel, on the 18th of April 1868, and despatched, along with the rest of my collections, in spirit, to the British Museum; but I have not succeeded in lighting on it there, and therefore do not feel certain as to the species.

## 88. BULIMUS PAPYRACEUS, Mawe.

Specimens of this species were obtained at Rio de Janeiro in November 1866.

## 89. BULIMUS AURIS-MURIS, Brug.

This is a common species in the neighbourhood of Rio de Janeiro. Many specimens were taken in August 1867, in the Botanical Gardens and about Tynca.

## 90. BULIMUS OVATUS, Müller.

Two dead shells belonging to this species were found in the weeds on Tynca Peak in June 1869.

## 91. BULIMUS TAUNAISII, Fér.

Specimens of this species were procured at Rio in August 1867.

## 92. BULIMUS ROSACEUS, King.

Young specimens of this species were obtained at Valparaiso in July 1868.

## 93. SUCCINEA, sp.

I met with this abundantly in the neighbourhood of Punta Arenas, and also obtained it at Port Gallant.

## 94. LIMNÆA.

A species of this genus (perhaps the *L. viatrix*, which has been recorded from the Rio Negro) was taken in a small stream running into Oazy Harbour, in the eastern part of the Strait.



95. *CHILINIA FLUCTUOSA*, D'Orb.

A species of *Chilinia* which, I believe, is the *C. fluctuosa* was taken in numbers at Port Grappler, in the western channels. It occurred in brackish water, in some cases associated with living *Balani*. Many of the shells had the apex eroded.

96. *PERONIA*, sp. (Pl. LVIII. fig. 4: *a*, ventral; *b*, dorsal surface.)

A single specimen of a naked mollusk, apparently belonging to this genus, and of which I give a sketch, was dredged at Sholl Bay, at the southern extremity of Smyth's Channel, in December 1868. The mantle was of a dirty yellow colour, marked with lines and blotches of light vandyke brown; and its under surface around the foot was marked with light-coloured striæ. The animal possessed the power of shortening and elongating the tentacles. At times it crawled along the sides of a glass, filled with sea-water, in which it was kept, on its large muscular foot, the shape of which underwent constant changes; and at others it floated on the surface of the water, with the foot uppermost. In the figure, taken after death, the foot is extended. Couthouy has described *Peronia marginata* from Fuegia; but as I have not seen his description, I do not know whether it is this species or not.

*TECTIBRANCHIATA.*97. *APLYSIA DACTYLOMELA*, Rang.

Specimens of this species were taken at St. Vincent. Mr. Darwin mentions it in his account of his visit to St. Jago.

98. *APLYSIA BRASILIANA*, Rang.

I found a specimen of this species on the rocks of the Island of Paqueta, in the harbour of Rio de Janeiro, in September 1867.

*NUDIBRANCHIATA.*99. *DORIS*, sp.

Specimens of a large species, of a yellow colour, were procured at Ancud, Chiloe.

100. *DORIS*, sp. (Pl. LVIII. fig. 6, dorsal surface.)

A specimen of a species of this genus, of which I give a sketch, was obtained on a frond of *Macrocystis*, in Tuesday Bay, near the western entrance of the Strait of Magellan, in December 1868. The surface of the mantle was minutely villous, and it was tinted with delicate shades of greyish white and yellowish white. The branchial plumes were semi-transparent. Should this species prove to be undescribed, I would suggest that it be named *Doris magellanica*.

101. *EOLIS CAMPBELLII*, n. s. (Pl. LVIII. fig. 5: *a*, dorsal surface; *b*, ventral surface.)

A beautiful *Eolis*, of which I have found no description, and of which I give a sketch, was obtained on a rock in Swallow Bay, on the north-east of Fuegia. It is certainly



distinct from the *Eolidea patagonica*, D'Orb. The mantle was of a beautiful pale rose-pink hue, slightly freckled with pale chocolate-brown. The foot was also pale rose-pink, having a pale bluish hyaline appearance at the edges. The branchial tufts were pale pink, with their central ramifications chocolate-brown. I dedicate this species to Dr. S. Campbell, R.N., late Surgeon of H. M. S. 'Nassau,' to whom I was greatly indebted for much kind assistance in the collecting and preserving of specimens.

## PTEROPODA.

## 102. PNEUMODERMON PERONII, Cuv.

A number of specimens of this species were taken, in the towing-net, between St. Vincent and Rio Janeiro in October 1866.

## 103. CLEODORA PYRAMIDATA, Linn.

This species was taken, in the towing-net, between the river Plate and the Strait of Magellan in November 1867.

## 104. CUVIERIA COLUMELLA, Rang.

Taken in the towing-net, along with *Cleodora pyramidata*, in November 1867.

## LAMELLIBRANCHIATA.

## OSTREIDÆ.

## 105. OSTREA CHILENSIS, Ph.

This species is very abundant in the Bay of San Carlos de Ancud (Chiloe).

## 106. PECTEN PURPURATUS, Lam.

Common in the Bay of Coquimbo.

## 107. PECTEN PATAGONICUS, King.

This species is common in the Strait of Magellan.

## 108. PECTEN NATANS, Ph.

This beautiful little species, the valves of which are so transparent that the body may be as clearly seen through them as though it was surrounded by an envelope of talc or mica, is very abundant on the growing fronds of the kelp (*Macrocystis*) in the Strait of Magellan, skipping actively about by opening and closing its valves.

## 109. PECTEN DARWINII, Reeve?

Lead valves of a *Pecten*, probably referable to this species, were found at the Otter Islands in Smyth's Channel.

## 110. LIMA PYGMÆA, Ph.

A few specimens of this elegant little species were dredged in the Strait of Magellan.



## MYTILIDÆ.

## 111. MYTILUS CHILENSIS, Hupé.

This species is common in the Strait of Magellan, Chiloe, and Chili, and is one of the principal articles of diet of the Fuegians. Pearls are frequently to be met with in this species—a fact which did not escape the observation of some of the earlier navigators in the Strait.

## 112. MYTILUS MAGELLANICUS, Chemn.

This species is common in the Strait of Magellan, as well as at the Falkland Islands.

## 113. MYTILUS OVALIS, Lam.

I obtained specimens of this species in the western channels.

## 114. MODIOLARCA TRAPEZINA, Lam.

This is one of the most abundant mollusks in the Strait of Magellan and western channels, being attached by a gelatinous byssus in myriads to the fronds of the *Macrocystis*. The shell varies greatly in colour, being sometimes of a pale-yellow tint, and at others dark olive, verging on black.

## ARCADÆ.

## 115. LEDA, sp.

Many specimens of a small *Leda* were dredged at Port Tamar, in the western part of the Strait of Magellan.

## 116. YOLDIA, sp.

Specimens of a fine *Yoldia* were dredged at the Otter Islands in December 1868; and one was also obtained at Playa-Parda Cove in January 1869; but I have not succeeded in finding them at the British Museum, though they are recorded in the register.

## UNIONIDÆ.

## 117. UNIO CHILENSIS.

Specimens of this species were obtained for me by Mr. Gray, the Navigating Lieutenant of the 'Nassau,' at Limache, not far from Valparaiso.

## LUCINIDÆ.

## 118. KELLIA BULLATA, Ph.

Dredged in the eastern part of the Strait of Magellan.

## CYPRINIDÆ.

## 119. ASTARTE LONGIROSTRIS, D'Orb.

Common in the eastern part of the Strait of Magellan.

## 120. CARDITA THOUARSII, D'Orb.

Dead valves of this species were dredged at Sholl Bay.



## VENERIDÆ.

## 121. CHIONE EXALBIDA, Chemn.

Dead valves of this species are very abundant on the sandy beach at Punta Arenas; but I found very few living species.

## 122. CHIONE ANTIQUA, King.

This species was obtained at Ancud, Chiloe.

## 123. CHIONE COSTELLATA, Sow.

Specimens were procured at Lota (Bay of Arauco). I think there is good reason to doubt whether this species is distinct from *C. antiqua*.

## 124. ANOMALOCARDIA MACRODON, Lam.

I found specimens of this species at the island of Paqueta, Rio de Janeiro.

## MACTRIDÆ.

## 125. MACTRA (MULINIA) EDULIS, King.

This species is common at Punta Arenas (Sandy Point), Port Famine, and other localities in the Strait of Magellan.

## 126. MACTRA (MULINIA) EXALBIDA, Gray.

Obtained at Sholl Bay.

## 127. LUTRARIA (DARINA) SOLENOIDES, King.

Common at Punta Arenas, Port Famine, and numerous localities in the eastern part of the Strait of Magellan.

## TELLINIDÆ.

## 128. MESODESMA CHILENSIS, D'Orb.

This species is extremely abundant in the Bay of Coquimbo.

## SOLENIIDÆ.

## 129. SOLEN GLADIOLUS, Ph.

This species I met with at Lady Point and Port Famine.

## 130. SOLEN MACHA, Molina.

Obtained in the Bay of Coquimbo.

## 131. SOLEN DOMBEII, Lam.

Obtained at Ancud, Chiloe.

## GASTROCHÆNIDÆ.

## 132. SAXICAVA ANTARCTICA, Ph.

Common in the Strait of Magellan.



## PHOLADIDÆ.

## 133. PHOLAS CHILENSIS, Mol.

Common at Ancud (Chiloe), and regarded as a delicacy by the Chilotes.

## BRACHIOPODA.

## 134. WALDHEIMIA VENOSA, Solander.

This fine species occurs plentifully in Possession Bay and various other localities in the eastern part of the Strait of Magellan. Numbers of live specimens were dredged off Cape Possession, in about fifteen fathoms water, and preserved in spirit. The largest specimen procured, which is not much inferior in size to that described and figured by Mr. Davidson in the 'Annals and Magazine of Natural History' (ser. 3, vol. xx. p. 81), was dredged at Port Famine in January 1869. To the westward of Port Famine I have not met with it. The specimens of this species collected by me are by far the largest recent Brachio-poda in the British-Museum collection.

## 135. WALDHEIMIA DILATATA, Val.

This species is also to be met with abundantly in the eastern part of the Strait of Magellan. All the specimens obtained, which were in general associated with individuals of *W. venosa*, were of small size.

## 136. TEREBRATELLA MAGELLANICA, Chemn.

This species is also common in the Strait of Magellan. I have dredged it from the eastern entrance as far west as Port Gallant. They are not unfrequently distorted in shape.

## TUNICATA.

## 137. CYNTHIA GREGARIA, Less. Cent. Zool. pl. lii. fig. 3; Voyage du Coquille, tom. ii. p. 435.

This species, discovered by Lesson at Port Lous, in the Falkland Islands, I met with in the Strait of Magellan, and also at Stanley Harbour, Falkland Islands.

## 138. CYNTHIA VERRUCOSA, Less. Cent. Zool.

I only met with this curious species at Stanley Harbour, Falkland Islands, among the masses of *Macrocystis* lying on the beach.

## 139. CYNTHIA MAGELLANICA, n. s. (Pl. LVIII. fig. 2.)

This species, which appears to be undescribed, I met with principally in Peckett Harbour, on the Patagonian coast of the eastern part of the Strait of Magellan. The individuals frequently occurred in masses, and were in general of a globose form. The test is rather thin, smooth, and of a greenish hue. The specimen dissected by me presented nothing specially interesting in the form or arrangement of its organs.



## 140. CYNTHIA GIGANTEA, s. n.

This species, of which I have likewise met with no description, is of very large size. It is of an oblong form, flattened from side to side. The test is very strong and coriaceous, of a dirty brown colour. The oral and atrial apertures are irregularly plicated, situated on two very prominent mammiform papillæ. The base is generally incrustated with sand; and in many cases the test bears a number of parasitic animals. The largest specimen obtained measured no less than 8 inches from base to apertures, and was between 4 and 5 inches broad. Attached to the test were a number of moderate-sized *Boltenia* and a variety of Polyzoa.

## 141. BOLTENIA LEGUMEN, Lesson.

A species of *Boltenia*, common in the eastern part of the Strait, and also met with at the Falkland Islands, is, I believe, referable to the above species, obtained "sur les rivages de la baie Française de la Soledad, une des Malouines."

## 142. PYURA MOLINÆ, Blainv.

I met with the only described species of this curious genus of social Tunicata both at Chiloe, where it is known under the name of "pinré," and at Luco Bay (a subdivision of the Bay of Arauco), and preserved specimens from both localities, which were afterwards despatched to England. I regret, however, that I have not succeeded in finding them among my collections deposited at the British Museum, and that I am, in consequence, unable to furnish an exact description of the animal, which as yet appears to be principally known from Molina's account of it ('Saggio sulla storia naturale del Chili'). The individual animals (which are of considerable size, sometimes exceeding a couple of inches in length) lie in cells, in a firm matrix of cartilaginous consistence; and from the hurried inspection that I made of them at the time they were collected, I have little doubt that the genus belongs to the social, and not the compound section of attached Ascidians.

## GOODSIRIA, g. n. (Ascid. Soc.).

*Mass* elongate, lobed, rooted at the base, composed of very many minute flask-shaped animals, imbedded in cells in the circumference of a fibro-gelatinous matrix. *Oral* and *atrial* orifices of individuals in general distinct, situated on well-marked papillæ.

Species unica:—

## 143. G. COCCINEA.

On what appears to me to be a new genus of social Tunicata, of which I met with numerous examples in the eastern portion of the Strait of Magellan, and also at Port Stanley, in the Falkland Islands, I have bestowed the above generic name in honour of the late Prof. Goodsir, to whom, conjointly with the late Prof. Edwards, science is indebted for valuable observations on this class of animals.

The animal mass presents a very remarkable appearance when fresh, reminding one in some measure of certain of the fleshier Alcyonoid polyps. It frequently attains a very



considerable size, specimens above two feet in length having been found. The colour when recent is of a vivid scarlet, whence the specific name, and the surface is papillate. I regret that at the time when the specimens were obtained, having much work on my hands, I had not sufficient leisure to undertake a minute investigation of the component animals, which are very small, seldom exceeding a line in length; and I have not succeeded in making out the details of their structure after their three years' immersion in spirit. Their general arrangement and form, however, will be readily understood by a reference to the sketches which accompany this paper. (See Plate LVIII. fig. 3: *a*, a mass, is represented of the natural size; *c* shows a small portion of the surface, slightly magnified; *b*, a transverse section through one of the masses, of the natural size; *d*, a portion of the same, magnified; *e*, a single individual, still more magnified.) Numerous specimens are in the British Museum.

144. *APLIDIUM PEDUNCULATUM*, Quoy et Gaim.

Many specimens of a pedunculated Tunicate found attached to the fronds of *Macrocystis* are not, I think, distinct from the above species from Australia, described and figured by Quoy and Gaimard (Voyage de l'Astrolabe, Mollusques, tom. iii. p. 626; Atlas, pl. 92. figs. 18, 19).

145. *APLIDIUM FUEGIENSE*, n. s.

Mass firm, flattened, disk-like, of a pale bluish-grey colour, marked with innumerable rather irregularly distributed slightly projecting points of a pale yellow colour (the individual animals).

Several specimens of this Tunicate were dredged in the Strait of Magellan. The first was brought up on a fishing-line in Philip Bay, north-west of Fuegia, in December 1866. I have not been able, after much trouble expended in cutting sections of the mass, to make out the anatomy of the animals further than to satisfy myself that they belong to the genus *Aplidium*. In fig. 1, Pl. LVIII., *a* represents a portion of the surface of the natural size, *b* the same magnified, and *c* a vertical section magnified.

146. *SYCOZOA SIGILLINOIDES*, Lesson.

This name was given by Lesson (in the 'Voyage de la Coquille,' Zoologie, tom. ii. p. 436) to a remarkable pelagic Tunicate allied to *Pyrosoma*, which was taken "flottant, par un beau jour de calme en Décembre 1822, à trente lieues au sud de la Terre-des-Etats, par 53 degrés de latitude australe, dans le voisinage du Cap Horn." The animal is figured in the 'Atlas,' Mollusques, No. 13. fig. 5. I obtained specimens of it only on one occasion, in December 1866, between the river Plate and the Strait of Magellan; and these are now in the British Museum. I may add that I have met with no notice of *Sycozoa*, save in the 'Voyage de la Coquille.'



## CRUSTACEA.

## DECAPODA.

## BRACHYURA.

## 1. EURYPODIUS LATREILLII, Edw.

This species was taken abundantly in the dredge at the Tysson Islands, in Falkland Sound.

## 2. EURYPODIUS AUDOUINII, Edw. and Luc.

Dredged at Port Otway, Cape Tres Montes.

## 3. EURYPODIUS SEPTENTRIONALIS, Dana.

This species is common in the Strait of Magellan from the eastern entrance as far as Sandy Point. I feel somewhat doubtful whether it is distinct from *E. Audouinii*, as some of the points of distinction pointed out by Dana, *e. g.* the length of the hairs on the legs, are not to be depended on.

## 4. EURYPODIUS BREVIPES, Dana.

This species, which, I think, is a good one, although the length of the joints of the limbs is certainly not a thoroughly reliable distinction, being subject to a very considerable amount of variation in different individuals, was dredged in Possession Bay.

## 5. EPIALTUS DENTATUS, Edw.

This crab has a wide range on the coast of Chili. I obtained specimens at Ancud (Chiloe), Lota (Bay of Arauco), and Coquimbo. It is of a dull greenish colour when alive, and is very sluggish in its movements. It appears to be an inhabitant of shallow water, as I invariably found it under stones in the rock-pools at about half-tide.

## 6. CANCER EDWARDSII, Edw.

This crab, which closely resembles our British species in general appearance, is common at Ancud (Chiloe), where it is largely eaten by the inhabitants.

## 7. XANTHO PLANUS, Edw.

Common at Chiloe, and attains a considerable size.

## 8. XANTHO GAUDICHAUDII, Edw.

I met with numerous examples of this pretty species at Ancud (Chiloe), in pools in the rocks at low tide.

## 9. PILUMNOIDES PERLATUS, Edw. and Luc.

This species is also common at Chiloe.

## 10. ERIPHIA GONAGRA, Fabr.

This crab is abundant at Rio de Janeiro on rocks in shallow water.



11. *PIRIMELA DENTICULATA*, Montagu.

A specimen was obtained at St. Vincent, Cape-Verdes.

12. *PLATYONYCHUS PURPUREUS*, Dana.

This large swimming-crab is common at Coquimbo and in Luco Bay; and I have reason to believe that it extends along the west coast of South America as far north as Panama.

13. *LUPA SPINIMANA*, Leach.

This handsome species appears to be common at Rio de Janeiro, as it is frequently exposed for sale in the market. A fine specimen was taken on the rocks of a small island in the harbour in October 1866.

14. *LUPA RUBRA*, Lam.

Several specimens of this crab were taken on the rocks of a small island in the harbour of Rio de Janeiro in August 1867.

15. *LUPA CRIBRARIA*, Lam.

I found a number of specimens of this prettily marked species on the sandy beach of Five-fathom Bay, Rio de Janeiro, in the beginning of October 1867.

16. *TRICHODACTYLUS QUADRATUS*, Latr.

This species is common in freshwater streams and damp places in their vicinity in the neighbourhood of Rio de Janeiro. On one occasion, in August 1867, on a rock at the side of a stream at Tijuca, I found a female with between fifty and sixty live young ones under the pleon in the ordinary situation of the ova, which renders it probable that in this species, as in the Land-crabs, the young undergo no metamorphosis. Dr. Von Martens is right in his conjecture in the 'Zoological Record' for 1868, that the crab which Mr. Spence-Bate has named *Uca Cunninghami* is only this well-known species.

17. *TRICHODACTYLUS GRANARIUS*, Nic.

This crab (which, I think there is some reason to doubt, is not a true *Trichodactylus*) is common on the coast of South Chili. I generally met with it in situations where the sea-water was rendered brackish by small streams debouching into it. It was extremely common at Ancud (Chiloe); and I met with a single specimen at Port Laguna, to the north of the Darwin Channel, in the Chonos archipelago.

18. *PINNOTHERES TRANSVERSALIS*, Edw. and Luc.

A single specimen of this remarkable species was taken on the sandy beach near Punta Arenas (Sandy Point), in the Strait of Magellan, after a severe gale, in June 1867.

19. *HALICARCINUS PLANATUS* (Fabr.), White.

This curious flat-backed crab is very common under stones on the beach at Punta Arenas and many other localities in the Strait of Magellan, where it was also dredged at depths of from 12 to 15 fathoms.



## 20. OCYPODA RHOMBEA, Fabr.

This crab is common on the sandy beach outside the harbour of Rio de Janeiro, but is exceedingly difficult to capture, on account of the speed with which it runs on the approach of the enemy. On one occasion, when, I suppose, I must have seen thirty or forty individuals, I only succeeded in obtaining a single one, and that with the assistance of two friends. The animal is generally to be found resting on the sand, about ten yards above the edge of the water, and, on becoming aware, at a considerable distance, of the danger with which it is menaced, rushes down into the surf, where it is impossible to capture it.

## 21. SESARMA ANGUSTIPES, Dana.

A specimen of this crab was taken at Rio de Janeiro in July 1867.

## 22. GONIOGRAPSUS INNOTATUS, Dana.

Taken with the preceding, at Rio de Janeiro in July 1867.

## 23. CYRTOGRAPSUS ANGULATUS, Dana.

A crab which I have little doubt in referring to this species is very plentiful in the rock-pools in the vicinity of Monte Video. Dana's specimen was taken at the mouth of the Rio Negro, the north-eastern boundary of Patagonia.

## 24. CYCLOGRAPSUS CINEREUS, Dana.

This species was taken at Lota (Bay of Arauco).

## 25. GRAPSUS PLANIFRONS, Dana.

This crab is not uncommon among the rocks at the entrance of the Bay of Coquimbo. It is very fierce, and difficult to dislodge from the clefts in which it is generally to be found ensconced.

## 26. PLANES MINUTUS, Fabr.

This long-known species was taken with *Scyllæa pelagica* and other animals on Sargassum, to the south of the Azores.

## 27. HEPATUS CHILIENSIS, Edw.

This handsome crab is not uncommon in the Bay of Coquimbo, where a fine specimen was taken.

## 28. HEPATUS ANGUSTATUS, Fabr.

Many specimens of this species were found on the beach of Five-fathom Bay, Rio de Janeiro, in October 1867.

## 29. PLATYMERIA GAUDICHAUDII, Edw.

Fine specimens of this remarkable crab were obtained from fishermen in the Bay of Coquimbo in August 1868.



30. *ACANTHOCYCLUS GAYI*, Edw. and Luc.

This species was taken plentifully under stones in rock-pools at Lota, and resisted capture most fiercely, giving the most savage nips with its great right or left hand.

31. *BELLIA PICTA*, Edw.

I only obtained this species at Lota. The British-Museum specimens are labelled "Peru."

32. *PSEUDOCORYSTES ARMATUS*, Edw.

This appears to be not uncommon on the coast of Chili. I obtained specimens of it at Lota and in Herradura Bay.

33. *PELTARION SPINULOSUM*, White.

This species is common in the neighbourhood of Punta Arenas, in the Strait of Magellan, where it burrows in the sandy beaches; and I dredged it in various localities between Punta Arenas and the eastern entrance.

*ANOMURA.*34. *LITHODES ANTARCTICA*, Homb. and Jacq.

This species, which attains a large size, is abundant in the Strait of Magellan, and appears to extend as far north as Chiloe, on the west coast of South America. The young individuals differ most strikingly from the old ones in the much greater spininess of the carapace. Old individuals much resemble *L. arctica* in their general appearance. Like that species, the *L. antarctica* is very sluggish in its movements, crawling slowly about over the stones or among the stems of the *Macrocystis*. A great number of young specimens were seen in Borja Bay in January 1867.

35. *LITHODES VERRUCOSA*, Dana.

This species, which is perhaps not truly distinct from *L. granulosa*, Homb. and Jacq., is common in the eastern portion of the Strait of Magellan (I do not think I ever observed it to the west of Cape Negro); and we also met with it in great numbers at the Tyssen Islands, Falkland Sound. Like the *L. antarctica* it inhabits shallow water; and it is even more inactive than that species in its movements.

36. *ALBUNEA*, sp.

Dead specimens of a species of this genus were met with in Herradura Bay, on the coast of Chili, in August 1867; but I have not found them among my collections at the British Museum.

37. *REMIPES SCUTELLATUS*, Fabr.

A live specimen of this species was taken at St. Vincent, in the Cape-Verdes, in October 1866. It was found burrowing in the sand of the beach.



## 38. HIPPA EMERITA, Linn.

Many specimens of this species were taken in Five-fathom Bay, Rio de Janeiro, in October 1867.

## 39. HIPPA TALPOIDES, Say.

Common on the coast of Chili. Specimens were found at Ancud (Chiloe), Luco Bay and San Vicente, near Talcahuano.

## 40. PAGURUS FORCEPS, Edw. ?

A *Pagurus* which I refer with some doubt to this species is very common in the Strait of Magellan and western channels.

## 41. BERNHARDUS OBESO-CARPUS, Dana.

This species was obtained at Coquimbo.

## 42. PORCELLANA TUBERCULATA, Guérin.

Common in the rock-pools at Coquimbo.

## 43. PORCELLANA VALIDA, Dana.

Abundant at Ancud (Chiloe), and taken also at Lota.

## 44. PORCELLANA TUBERCULIFRONS, Edw. and Luc.

Very common under stones in rock-pools at Coquimbo, and taken also at Chiloe.

## 45. PORCELLANA PATAGONICA, n. sp.

Length and breadth of carapace about  $\frac{5}{16}$  of an inch. Front trilobate; the middle lobe much projecting and pointed; all three lobes minutely crenulated on the margin. Carpus not dilated in front or behind, with three prominent teeth nearly of equal size on the anterior margin, and a tooth at the outer side of the articulation with the hand. All the legs minutely granulated; the first pair slightly crested on the anterior margin. Carapace smooth on the centre, minutely granulate on the sides.

This species, which appears to me to be undescribed, was dredged in the Strait of Magellan and at Port Otway.

## 46. ÆGLEA LÆVIS, Lat.

Specimens of this curious Crustacean, which had been collected in a freshwater stream in the neighbourhood of Valparaiso, were given to me by an officer of H. M. S. 'Topaze,' then on the Chilian station.

## MACRURA.

## 47. GALATHEA SUBRUGOSA (White), Dana.

This species, which is figured in the unpublished plates of the Crustacea of the An-



tarctic Expedition, as well as in Dana's magnificent work, is common in the Strait of Magellan and on the west coast of Patagonia. I obtained and preserved specimens from the Strait, the western channels, Port Otway, and Ancud. It is evidently distinct from the *G. monodon* of Milne-Edwards, from the coast of Chili—the spine on each side of the long central spine of the rostrum being of considerable length, whereas the lateral spines of *G. monodon* are described as “petites épines très-courtes.”

48. GRIMOTHEA GREGARIA (Fabr.), Leach.

Obtained between the Falkland Islands and Strait of Magellan in 1867. Specimens were also given to me the following year, which had been collected by the officers of the ‘Narcissus’ at San Carlos, in Falkland Sound. Dana's were taken in the south of Fuegia; and I find an excellent drawing of an individual, also captured in the south of Fuegia, among a collection of sketches made by Dr. Hooker when on the Antarctic expedition, and lent by him to me. A few specimens which I kept alive for some days in a glass of sea-water swam rapidly about backwards, by means of rapid flexions and extensions of the tail.

49. CALLIANASSA UNCINATA, Edw.

I found fragments of this species lying on the sandy beach of the island of Quehuy, off Chiloe, and was told by an English resident there that the species was not uncommon, burrowing in the sand.

50. CALLIANASSA GIGAS, Dana (?).

An imperfect specimen of a *Callianassa*, which does not appear to me distinct from the above species obtained at Puget Sound, was picked up by me on the beach at San Carlos de Ancud, Chiloe, in April 1861.

51. BETÆUS SCABRO-DIGITUS, Dana.

I found this species abundant in the rock-pools at Lota (Bay of Arauco), where it was difficult to catch, owing to the activity of its movements. Their colour was dull green. Dana's specimens were taken at Valparaiso.

52. BETÆUS TRUNCATUS, Dana.

This species I dredged at Puerto Bueno, west coast of Patagonia, on the 7th of December 1868. Dana's specimens were from Fuegia.

53. HIPPOLYTE GRAYI, n. sp.

Of this species of *Hippolyte*, which appears to be undescribed, and of which I give a sketch (Pl. LIX. fig. 8), I only obtained a single imperfect specimen, from Port Otway.

Rostrum shorter than the carapace, with two prominent teeth on its upper surface, and a third at its base, immediately above the eye. On the middle line of the carapace, behind the eye, are three strong teeth. Beneath the eye a fine spine. Feet long and slender, the posterior ones denticulated on the under surface. Length a



little more than an inch. Named in honour of Nav. Lieut. F. G. Gray, R.N., who was of material assistance to me in my dredging operations.

54. *RHYNCHOCINETES TYPUS*, Edw.

I obtained many specimens of this fine Crustacean in rock-pools at Coquimbo at low tide. It is an exceedingly beautiful creature when alive, the body and legs being elegantly mottled and banded with various shades of red and brown.

55. *PALÆMON FORCEPS*, Edw.

This species is the prawn so largely sold in the market at Rio de Janeiro, in the harbour of which it is taken.

56. *PALÆMON CÆMENTARIUS*, Pœppig.

I procured five examples of this large species, termed "Camaron" by the Chilians, and esteemed by them as a great delicacy, in freshwater marshes between the town of La Serena and the sea. In Gay's 'Historia Fisica y Politica de Chile' we are informed that it is to be found "en los embocadores de las riveras donde construyen de grandes cavidades que cubren con tierra."

*STOMAPODA.*

57. *MACROMYSIS MAGELLANICA*, sp. n.

General form that of *M. gracilis*, Dana (from Rio de Janeiro). Cephalic portion of carapace partially separated by a suture from the remainder. Rostrum as in *M. gracilis*. Segments of pleon about as long as broad, with the exception of the sixth, which is almost twice as long. Terminal segment of pleon *deeply bilobate*. Taken at the eastern entrance of the Strait of Magellan, January 1867.

58. *PHYLLOSOMA*, sp.

A very small species of this genus, which I consider more prudent to leave undetermined, was taken in the towing-net between the river Plate and the Strait of Magellan, in November 1867.

59. *ALIMA HYALINA*, Leach.

Taken in the towing-net to the south of the Cape-Verde Islands.

60. *GONODACTYLUS STYLIFERUS*, Edw.

I obtained a specimen of this beautiful Crustacean in the Bay of Coquimbo, at the end of August 1868.

*AMPHIPODA.*

61. *ORCHESTOIDEA TUBERCULATA*, Nic.

Common on the sandy beach of San Carlos de Ancud, Chiloe, where it skips about after the manner of our common Sandhopper (*Talitrus locusta*).



62. *ALLORCHESTES PATAGONICUS*, n. sp. (Pl. LIX. fig. 14.)

A single specimen of an *Allorchestes*, apparently undescribed, was taken by me in a freshwater stream in the neighbourhood of the Chilian settlement of Punta Arenas (Sandy Point), in the Strait of Magellan. Unfortunately it is considerably injured; so I abstain from describing it, and content myself with bestowing on it the above provisional name.

63. *ATYLUS*? *BATEI*, n. sp. (Pl. LIX. fig. 9.)

Cephalon not produced into a rostrum. Eyes oblique. A mesial dorsal carina. Last segment of pereion, and first four of pleon, produced into dentiform processes.

Of this species, which appears to be new, and which I have named after Mr. Spence Bate, to whose kindness I am indebted for information as to sessile-eyed Crustacea, a single specimen from Possession Bay, Strait of Magellan, is in the collection.

64. *ATYLUS HUXLEYANUS*, Bate.

Taken in the Strait of Magellan.

65. *THEMISTO ANTARCTICA*, Dana.

Taken in numbers in the towing-net between the river Plate and the Strait of Magellan, during a calm which succeeded a violent gale, in November 1867.

66. *IPHIMEDIA NORMANI*, n. sp. (Pl. LIX. fig. 7.)

Cephalon produced into a sharp-pointed rostrum. First three segments of pleon having a sharp-pointed tooth on each lateral margin. Eyes subreniform. Superior and inferior antennæ of nearly equal length. Colour purplish. Length 4 lines.

One specimen of this species, named in honour of the Rev. A. M. Norman, was dredged off Elizabeth Island in February 1867.

67. *CAPRELLA DILATATA*, Dana.

Taken in numbers on the screw of H.M.S. 'Nassau,' in August 1867.

*ISOPODA.*68. *SEROLIS ORBIGNIANA*, Aud. et Edw.

Very abundant in the neighbourhood of Punta Arenas, Strait of Magellan.

69. *SEROLIS GAUDICHAUDII*, Aud. et Edw.

Dredged in the Bay of Arauco (Chili), in November 1868.

70. *SEROLIS CONVEXA*, n. sp. (Pl. LIX. fig. 3.)

Most nearly allied in form to *S. planus*, Dana. Body very convex, much more so than in any of the other species of the genus with which I am acquainted. A prominent carina along the mesial line. Two last segments of pereion distinctly narrower than those which precede them. Last segment of pleon more elongated than



in *S. planus*, and possessing three well-marked ridges—a median, interrupted in the middle, and two lateral, each terminating in a sharp point. Eyes very prominent, and placed rather near each other. Two specimens taken on the north coast of Fuegia.

71. CASSIDINA EMARGINATA, Guérin. (Pl. LIX. fig. 4.)

This species (described, but not figured, by Guérin in the 'Icon. Règne Anim.,' from specimens taken at the Falkland Islands) I found plentifully on the fronds of growing *Macrocystis*, in the Strait of Magellan and channels on the west coast of Patagonia. Only a single unnamed specimen existed previously in the national collection.

72. SPHÆROMA LANCEOLATUM, White.

Extremely common under stones and among the roots of *Macrocystis* in the Strait of Magellan and channels. Is this species truly distinct from *S. gigas*, Leach?

73. CYMODOCEA DARWINII, n. sp. (Pl. LIX. fig. 1: *a*, antenna; *b*, last joint of first leg.)

Texture of body calcareous. Dorsal surface rough, with many minute granulations. First segment of pereion longer than the others. Fifth enlarged at either extremity, each of which bears a blunt spine. Last segment of pleon emarginate at the apex, and furnished with a strong short spine. External caudal lamella minute, narrow. A very few specimens of this species were dredged on the north coast of eastern Fuegia.

74. IDOTEA ANNULATA, Dana.

Specimens of this species were taken in the towing-net between Rio de Janeiro and the river Plate, and between that river and the Strait of Magellan.

75. EDOTIA TUBERCULATA, Guérin.

Taken in the eastern portion of the Strait of Magellan.

76. EDOTIA MAGELLANICA, n. sp. (Pl. LIX. fig. 6; *a*, one of the anterior legs.)

Body much smaller than that of *E. tuberculata*, and broader proportionally. No dorsal tubercles. Length 7 lines.

Taken off Cape Espiritu Santo, at the eastern entrance of the Strait of Magellan.

77. CYMOTHOA GAUDICHAUDII, Edw.

Taken on a fish, in the Bay of Coquimbo, August 1868.

78. CERATOTHOA EXOCÆTI, n. sp. (Pl. LIX. fig. 5.)

Allied to *C. linearis*, Dana. Body long, linear. Head longer than broad, the front prominently projecting. Processes of next segment to head longer than in *C. linearis*. First segment of pereion distinctly exceeding the two following in length. Antennæ curved backwards along the sides of the head. Posterior segment of pleon



as in *C. linearis*. Three preceding segments shorter, and rather wider than in *C. linearis*.

Taken in the mouth of a Flyingfish to the south of the Cape-Verdes. The specimen is an ovigerous female.

79. *PTERELAS MAGNIFICUS*, Dana.

I obtained specimens of this handsome species on fish of various species at Fortune Bay (west coast of Patagonia), and at Dungeness (eastern entrance of Strait of Magellan).

80. *CIROLANA HIRTIPES* (?), Edw.

An imperfect specimen of a *Cirolana* which, I think, is referable to the above species was taken on a fish at the Tyssen Islands, Falkland Sound.

81. *NEROCILA FALKLANDICA*, n. sp. (Pl. LIX. fig. 2.)

Last two segments of pereion armed with acute points. Three last epimerals acute.

Pleon longer than broad. The first two segments laterally produced, and armed with acute points. The last segment somewhat triangular, emarginate at the tip.

Caudal appendages aculeate; the outer are considerably the larger.

Taken on a fish in Falkland Sound, by one of the officers of H.M.S. 'Narcissus.'

*ENTOMOSTRACA.*

82. *CYPRIDINA GIBBOSA*, Dana.

Taken in the towing-net between Monte Video and the Strait of Magellan, December 1866.

*SIPHONOSTOMA.*

83. *CALIGUS CHÆNICHTHYIS*, n. sp. (Pl. LIX. fig. 15.)

The general form of this species, apparently undescribed, will be better understood by the figures than by any description. The cephalic buckler is deeply horseshoe-shaped posteriorly.

The two specimens figured are, I believe, male (*b*) and female (*a*), and were taken on *Chænichthys esox*, in Port Grappler, west coast of Patagonia.

84. *LERNÆA*, sp. (Pl. LIX. fig. 11 *a, b*.)

The two *Lernæans* figured were taken on the gills of fish in the Strait of Magellan; but as the species of this genus vary very much in form, I have thought it more prudent not to name the species.

85. *LERNÆOCERA*, sp. (Pl. LIX. fig. 10.)

The specimen figured was found attached to the eye of a fish taken at the Otter Islands, west coast of Patagonia.

86. *CHONDRACANTHUS*, sp. (Pl. LIX. fig. 13. Two views of an individual, and a portion of one of the ovaries.)



A single specimen of a *Chondracanthus* closely resembling *C. merluccii* in general form was taken in the mouth of a Gadoid fish, at the eastern entrance of the Strait.

87. SPHYRION KINGI, sp. n. (Pl. LIX. fig. 12.)

Specimens of this singular Crustacean, which I have figured of the natural size, were taken on the gills of fish at the entrance of the river Gallegos (east coast of Patagonia), and at the eastern entrance of the Strait of Magellan. It differs from the species (*S. lævigatus*) on which the genus was founded, which was described by Quoy and Gaimard in the voyage of the Uranie (Zoologie, p. 541; Atlas, pl. 86. fig. 10) under the name of "*Chondracanthe lisse*," in the greater width of the sucking-disk and of the body, as well as in various other points, which will be readily understood by a comparison of the figures of the *S. lævigatus* and the *S. Kingi*, which I have thus named because I believe that Captain King was the first to obtain specimens of it, as he makes reference in his narrative to remarkable Lernæans taken on fish at the entrance of the river Gallegos. In the determination of this species I have to express my obligations to Dr. Baird, who suggested to me its true affinities, to Prof. Kölliker, of Wurzburg, who informed me of the existence of other specimens of it in the Museum of the College of Surgeons, and to Prof. Flower for his kindness in showing me the specimens in question.

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DESCRIPTION OF THE PLATES.

TAB. LVIII.

- Fig. 1. *Aplidium fuegiense*, n. sp. : *a*, portion of surface, natural size ; *b*, the same, magnified ; *d*, a vertical section, magnified.
- Fig. 2. *Cynthia magellanica*, n. sp., natural size.
- Fig. 3. *Goodsiria coccinea*, sp. n. : *a*, a mass, natural size ; *b*, a transverse section through a mass, natural size, showing the arrangement of the individuals ; *c*, a portion of the surface, magnified ; *d*, a portion of a transverse section, magnified ; *e*, a single individual removed from its cell, more highly magnified.
- Fig. 4. *Peronia*, sp. : *a*, ventral ; *b*, dorsal surface.
- Fig. 5. *Eolis Campbellii*, n. sp. : *a*, dorsal, and *b*, ventral view, of the natural size.
- Fig. 6. *Doris magellanica*, n. sp., natural size.

TAB. LIX.

- Fig. 1. *Cymodocea Darwinii*, n. sp. magnified ; *a*, antenna ; *b*, last joint of first leg.
- Fig. 2. *Nerocila falklandica*, n. sp., natural size ; *a*, antenna, magnified.
- Fig. 3. *Serolis convexa*, n. sp., natural size.
- Fig. 4. *Cassidina emarginata*, Guérin, natural size.
- Fig. 5. *Ceratothoa exocæti*, n. sp., natural size.
- Fig. 6. *Idotea magellanica*, n. sp., magnified ; *a*, first leg, more highly magnified.



Fig. 7. *Iphimedia Normani*, n. sp., magnified.

Fig. 8. *Hippolyte Grayi*, n. sp., magnified.

Fig. 9. *Atylus Batei*, n. sp., magnified.

Fig. 10. *Lernæocera*, sp., magnified.

Fig. 11. *Lernæa*, sp., slightly magnified.

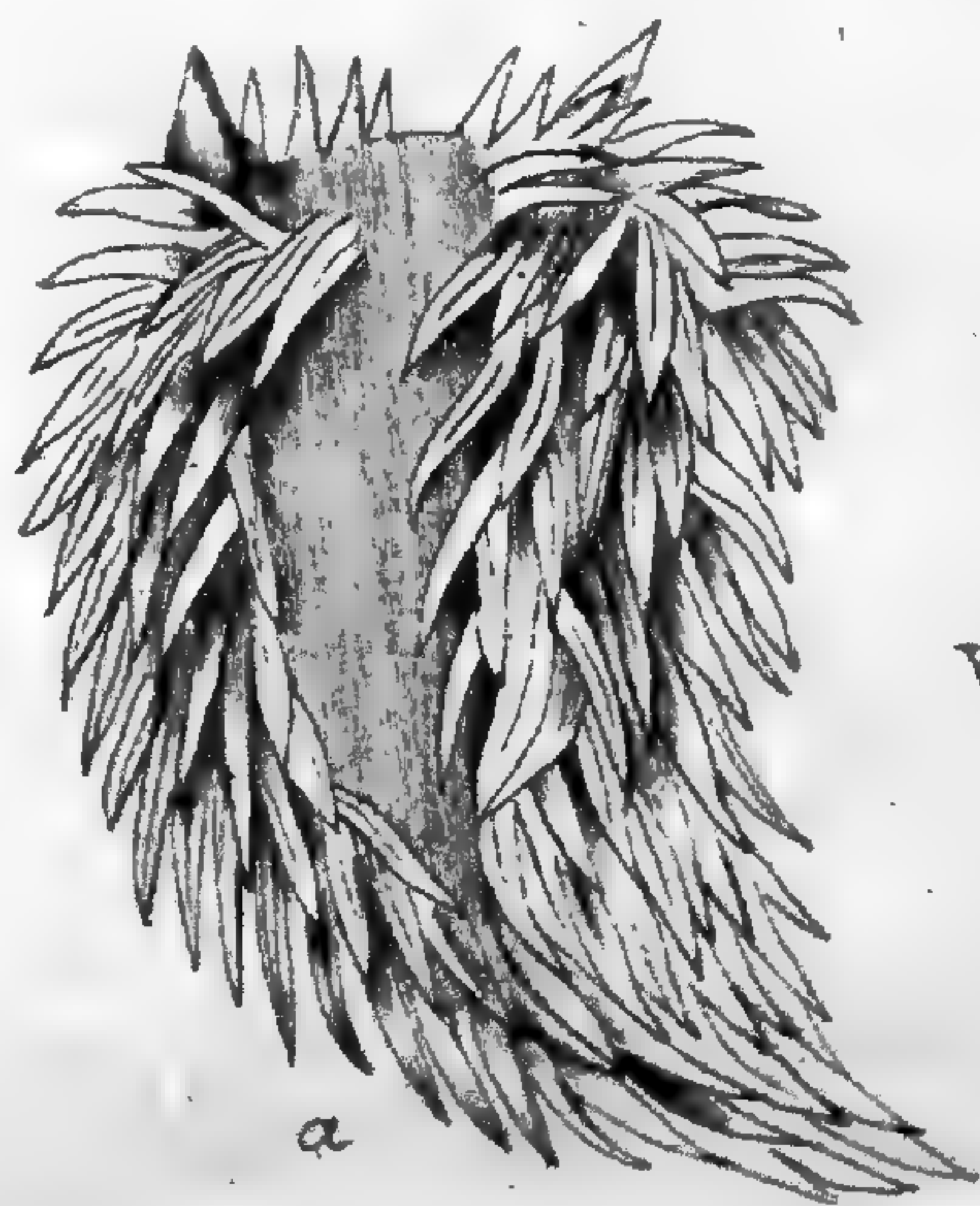
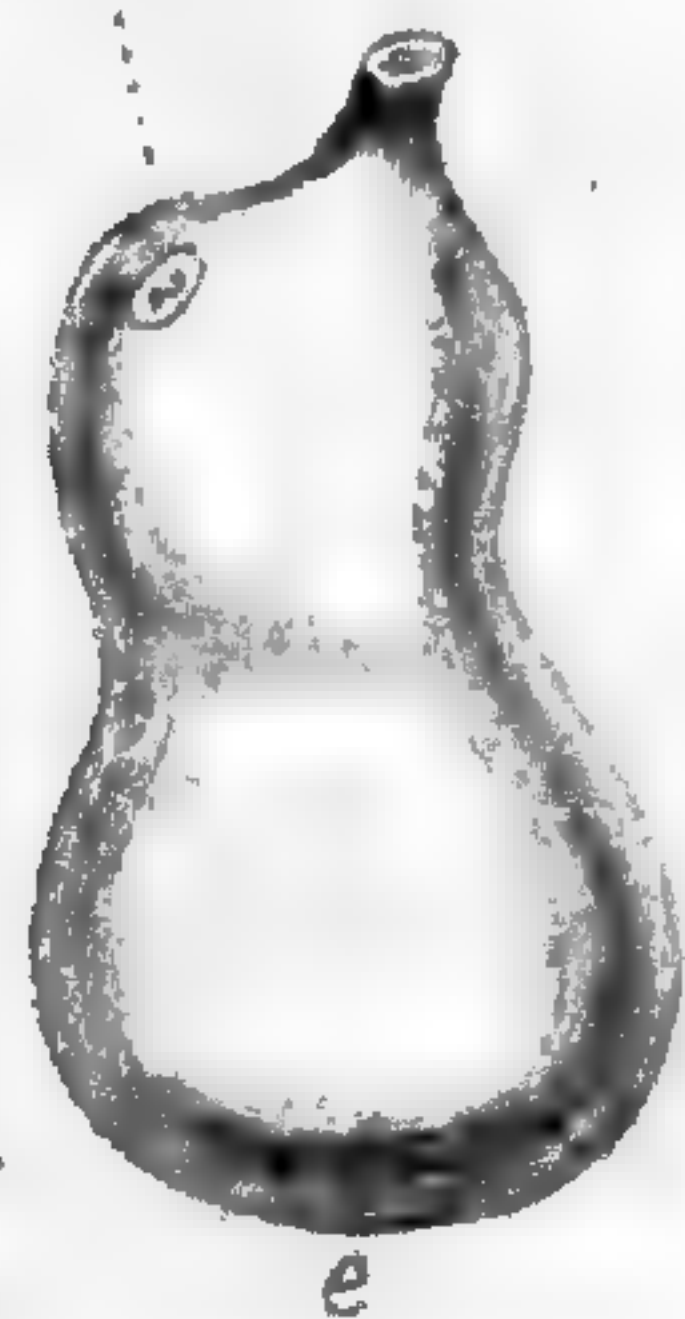
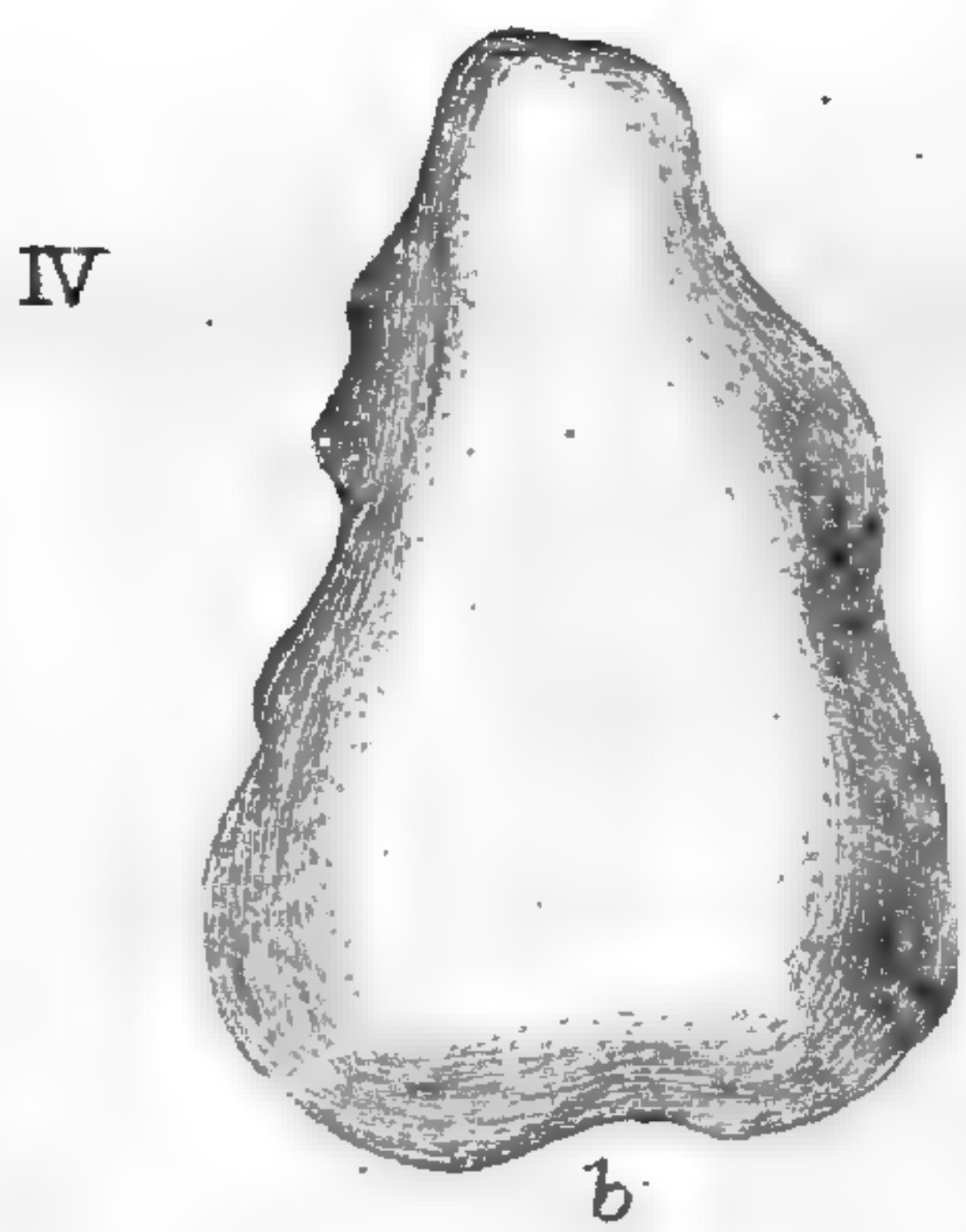
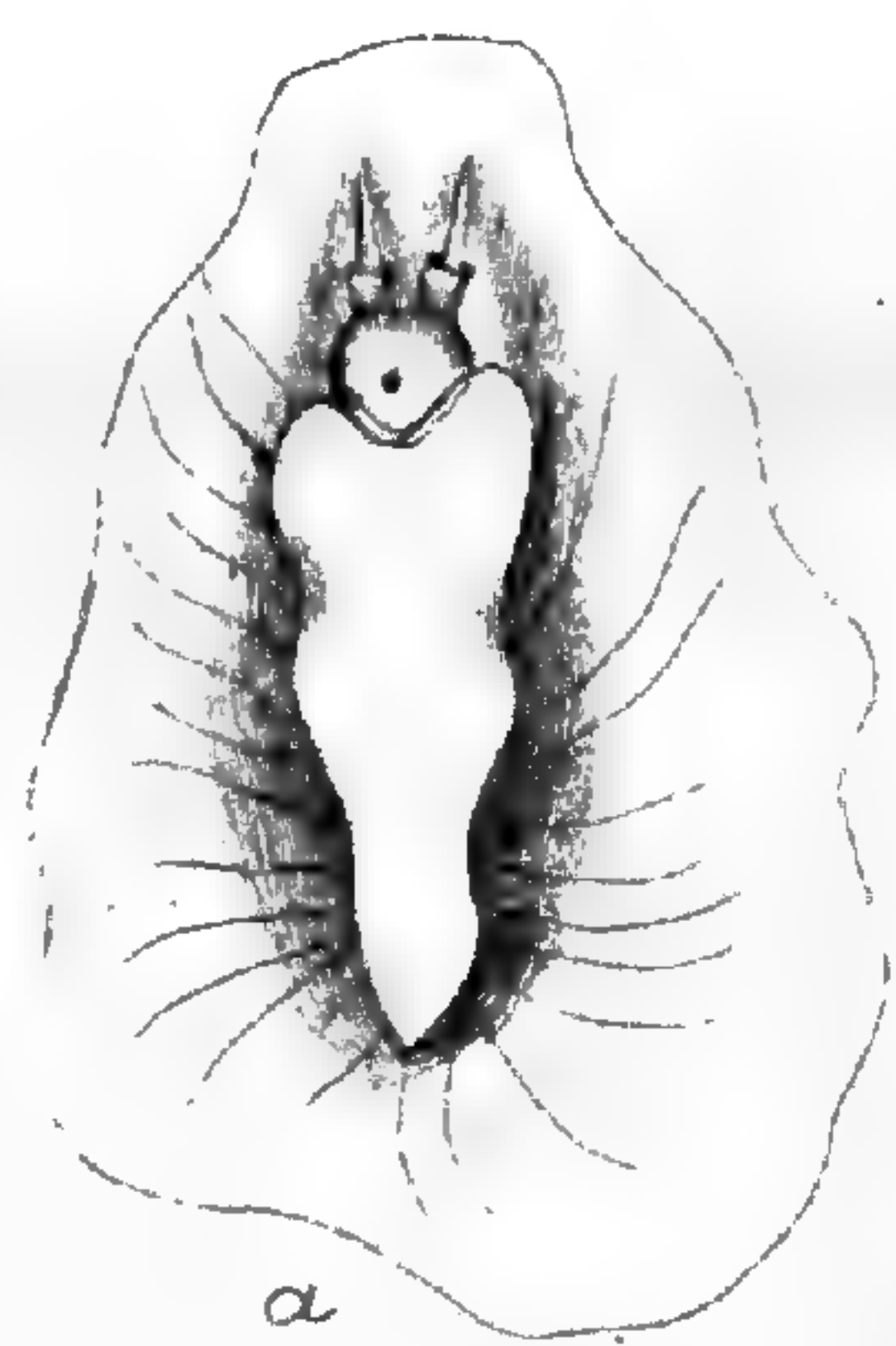
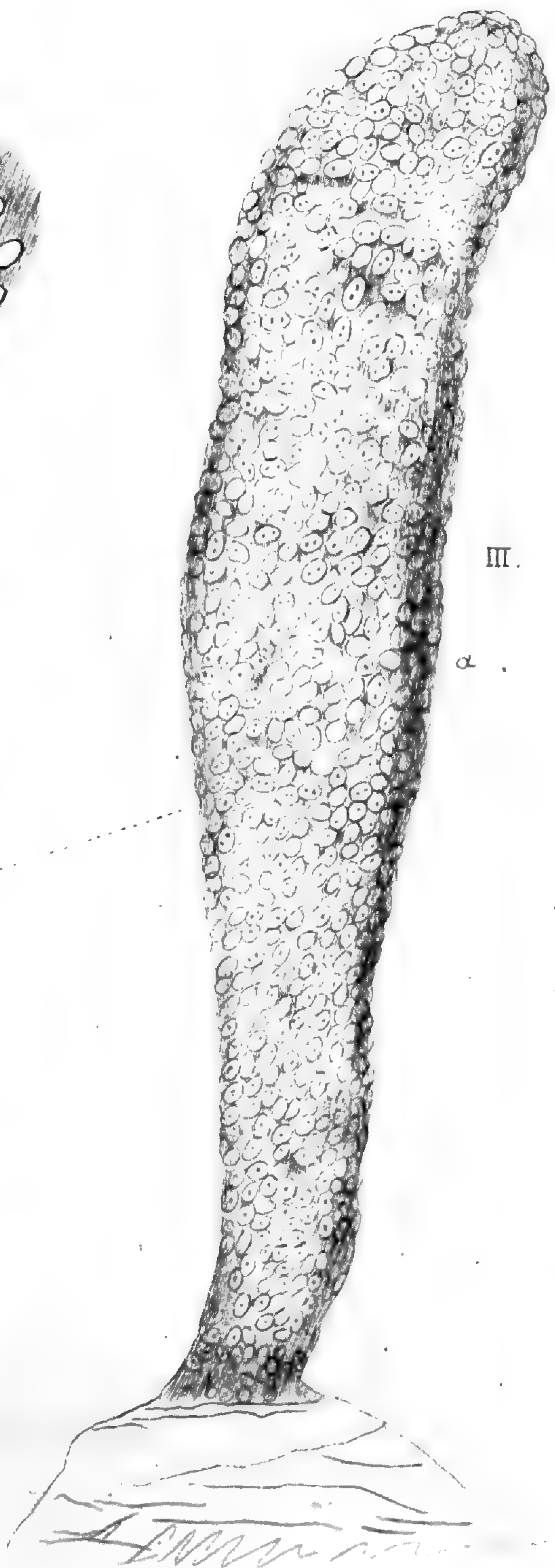
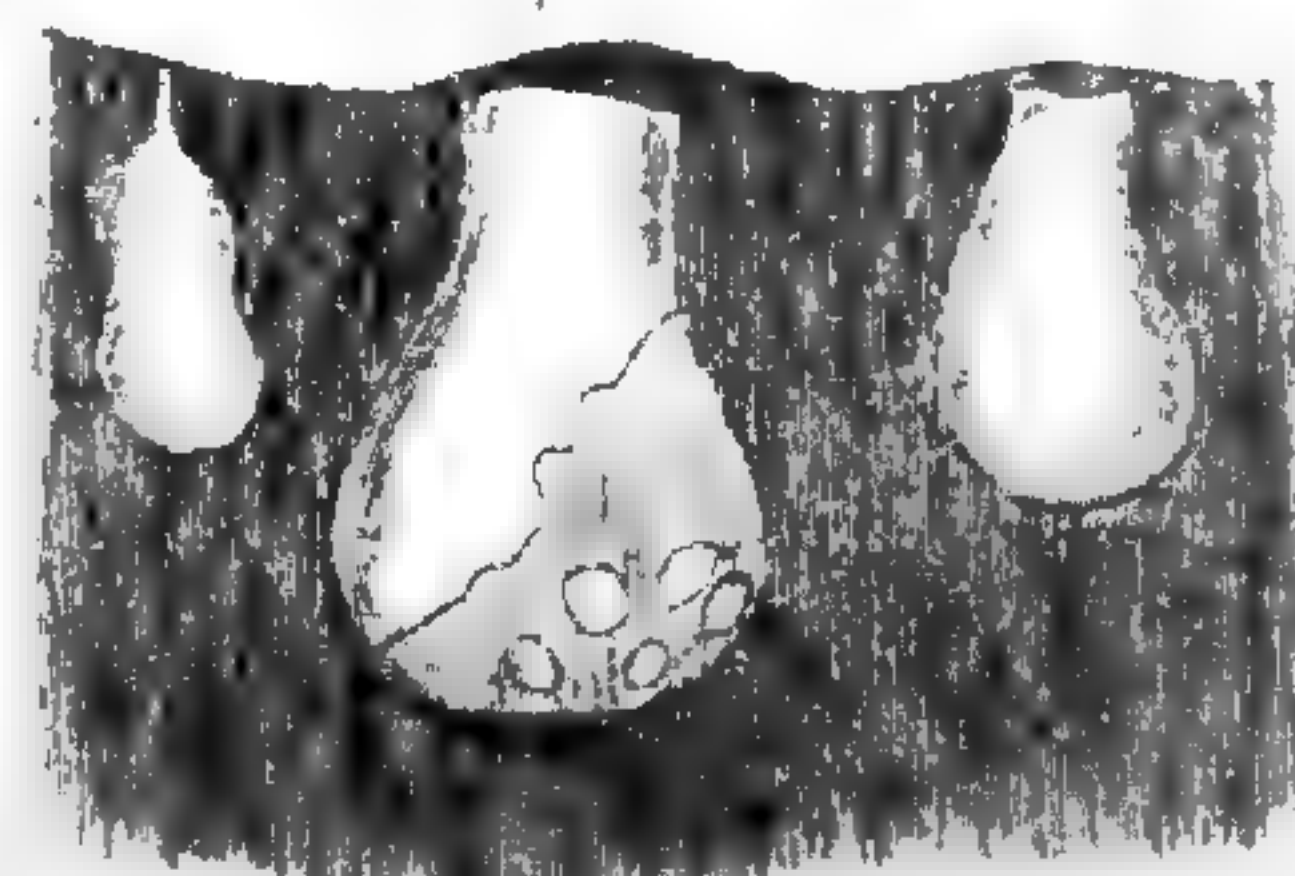
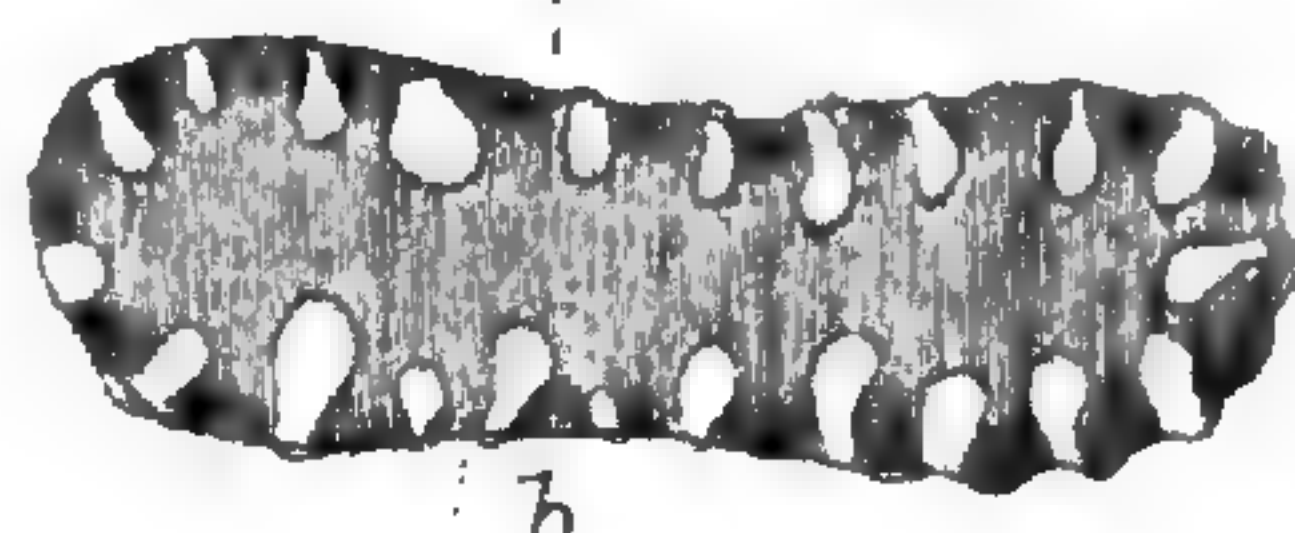
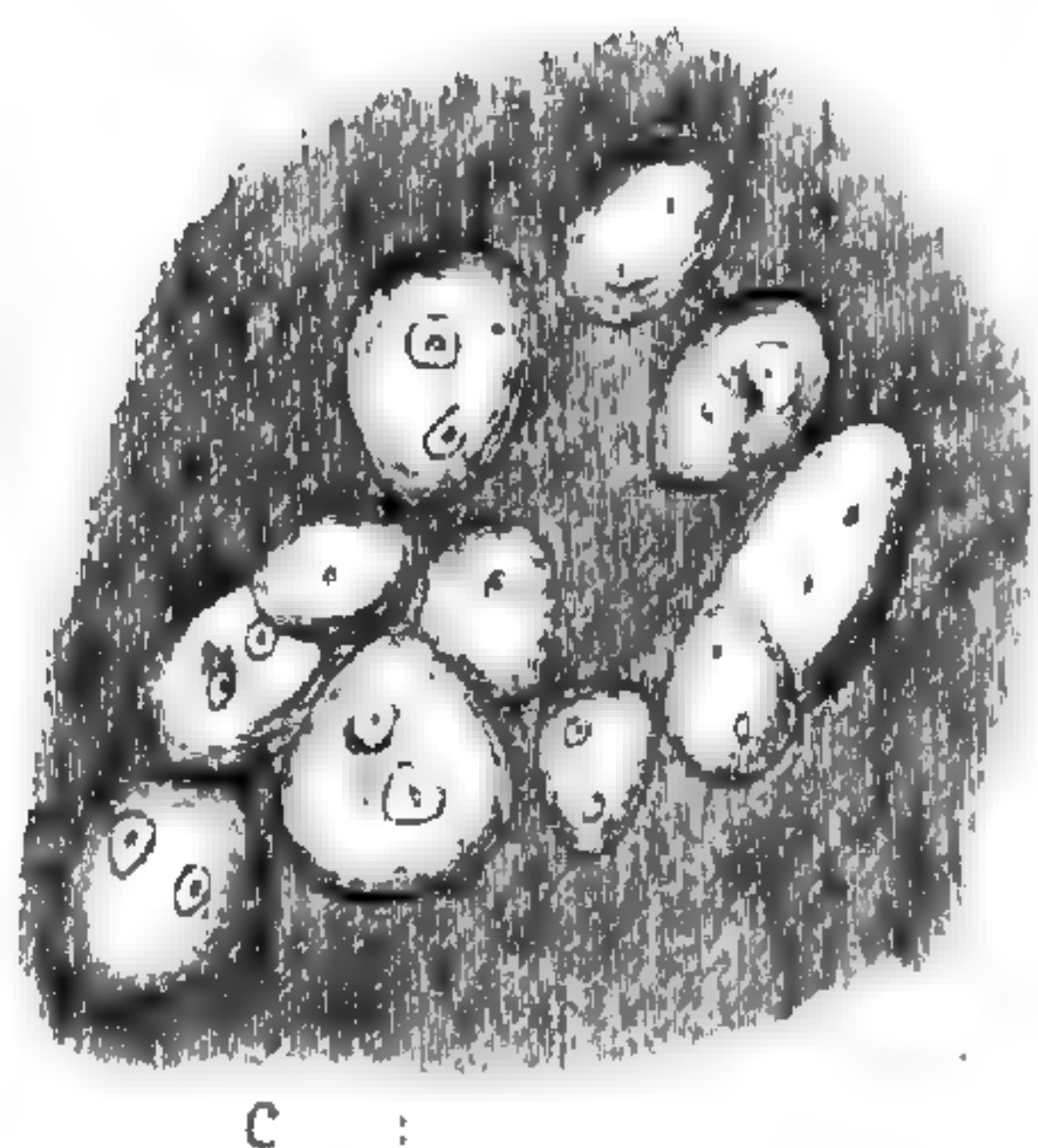
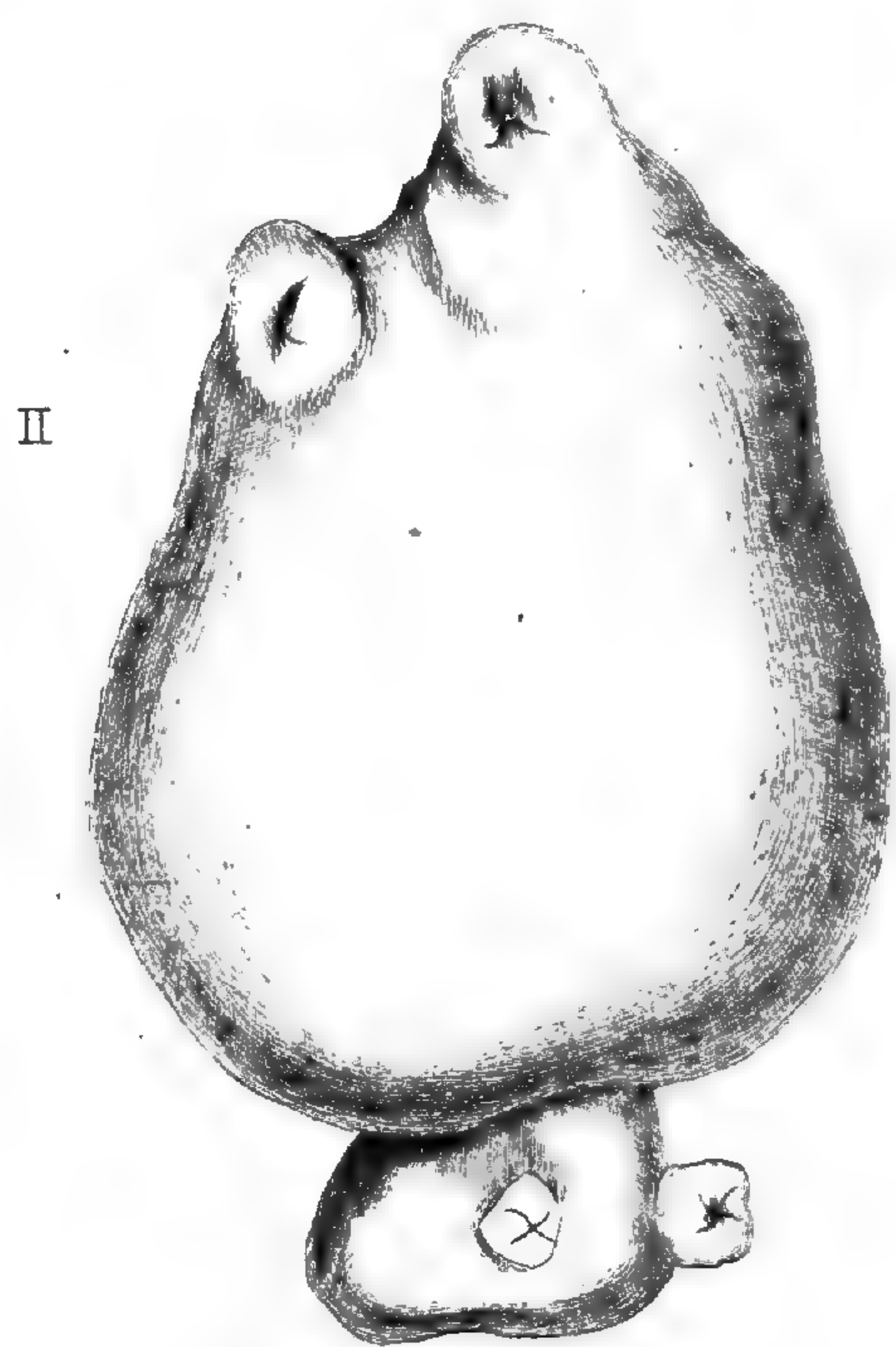
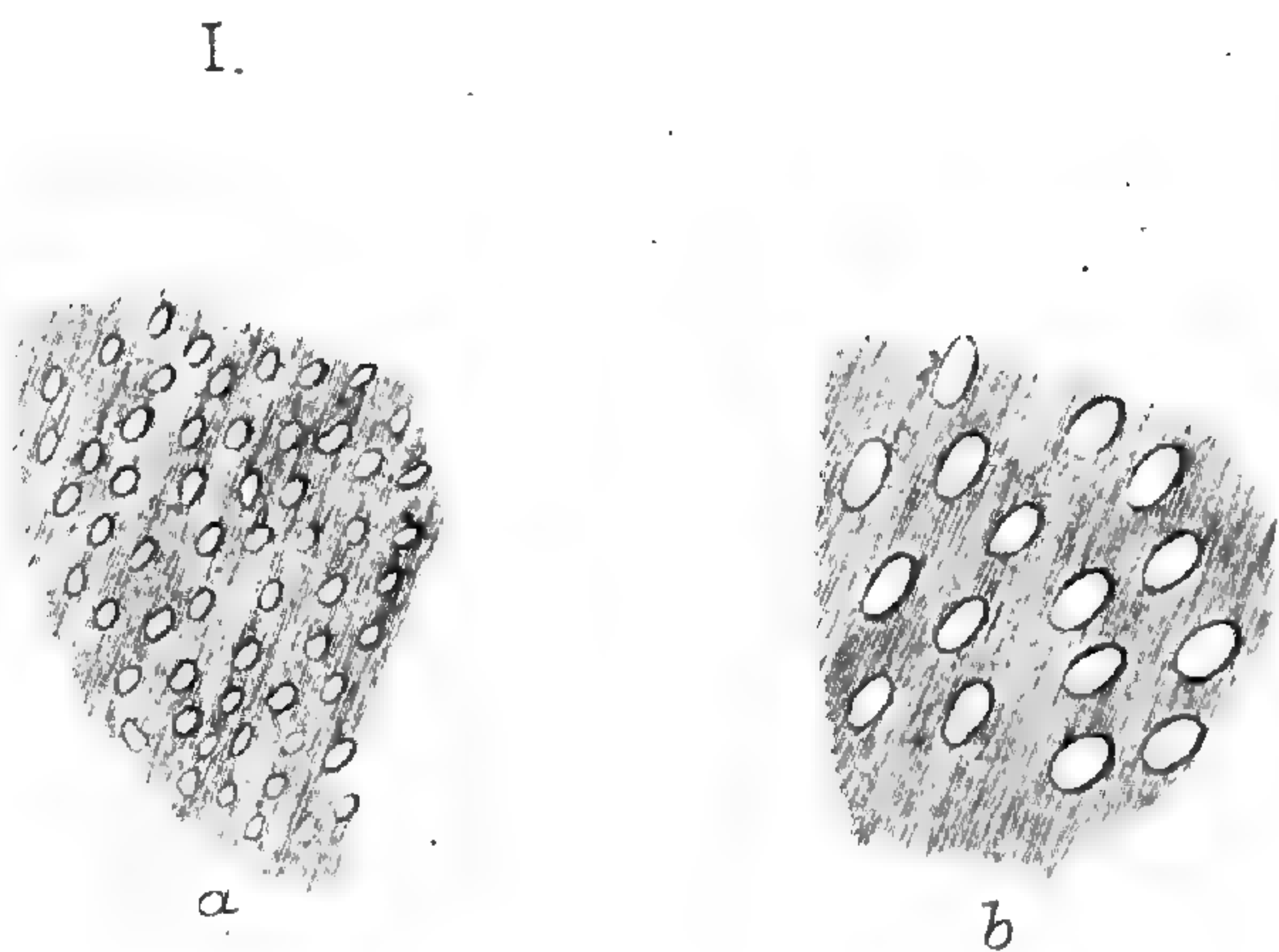
Fig. 12. *Sphyrion Kingi*, n. sp., natural size; the line shows the length of the longest specimen; *a*, sucking-disk of the largest specimen, natural size.

Fig. 13. *Chondracanthus*, sp., magnified.

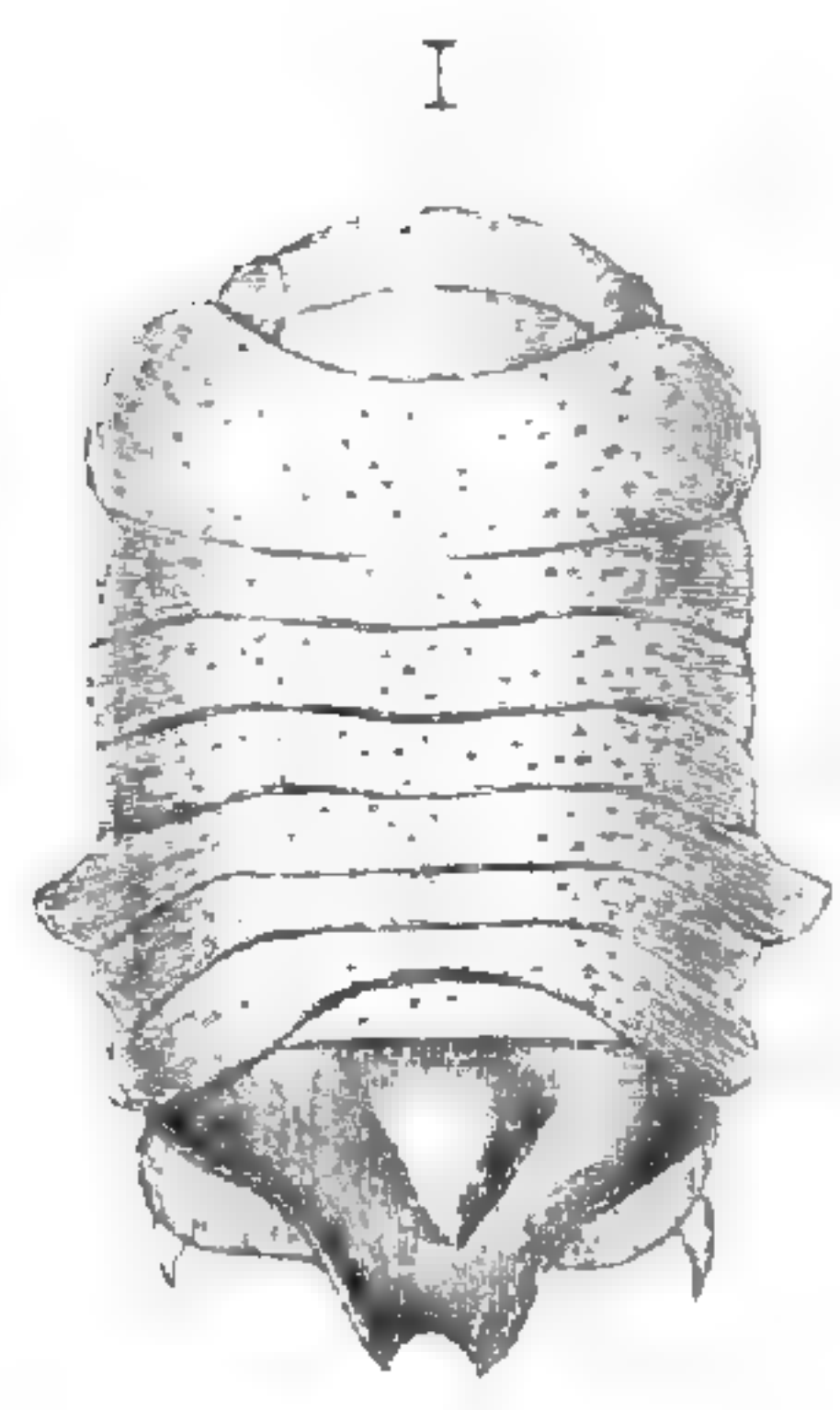
Fig. 14. *Allorchestes patagonicus*, n. sp., magnified.

Fig. 15. *Caligus chænichthyis*, n. sp., magnified.

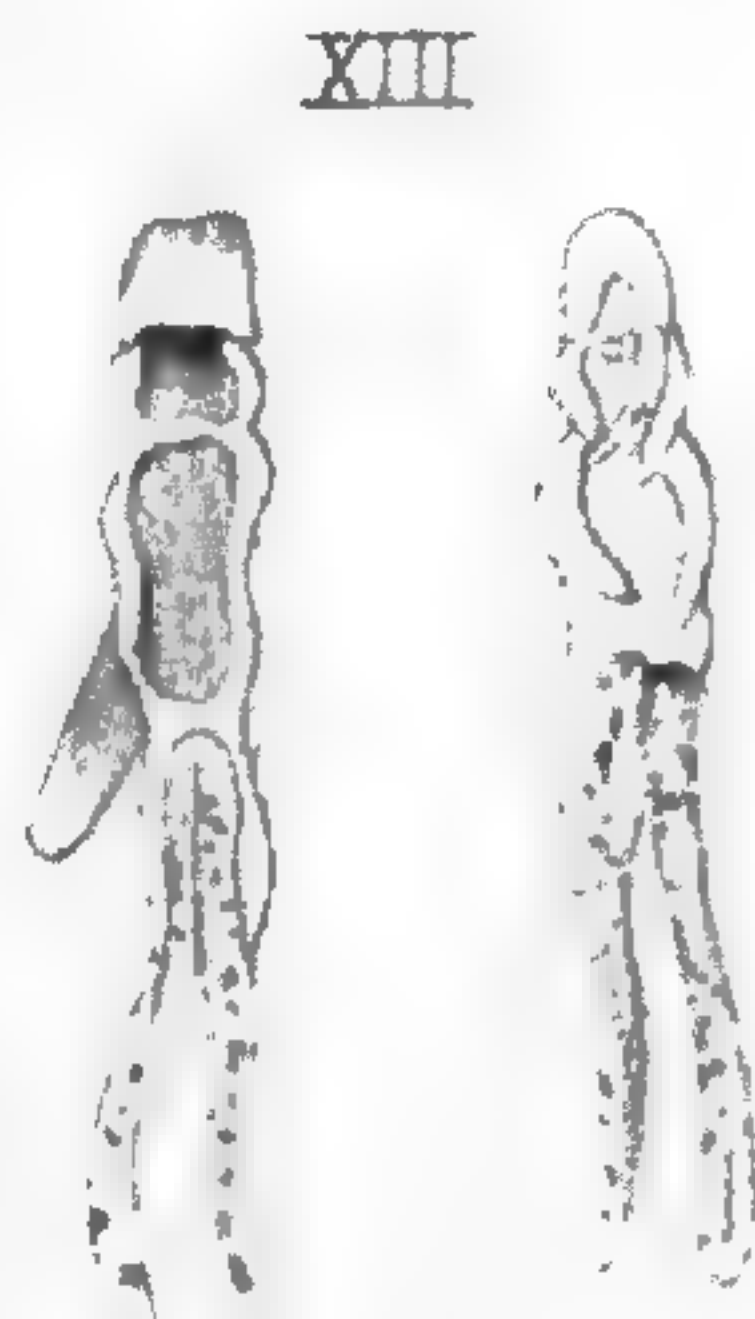
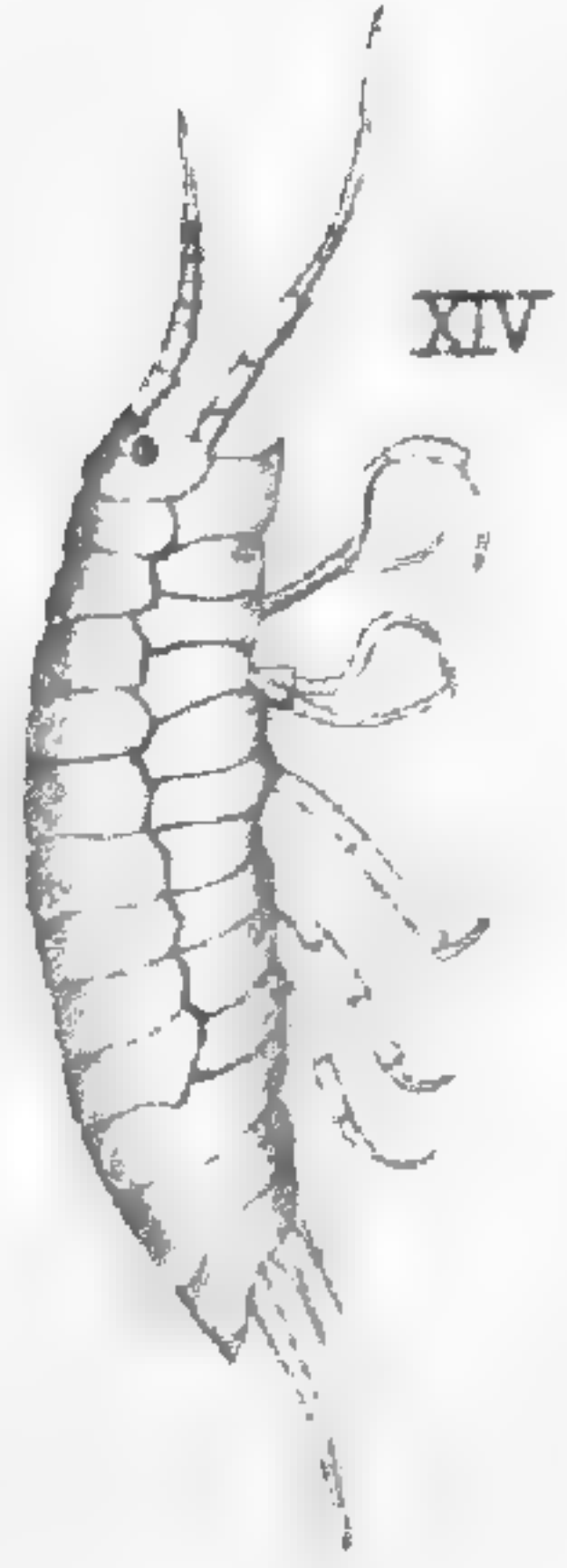
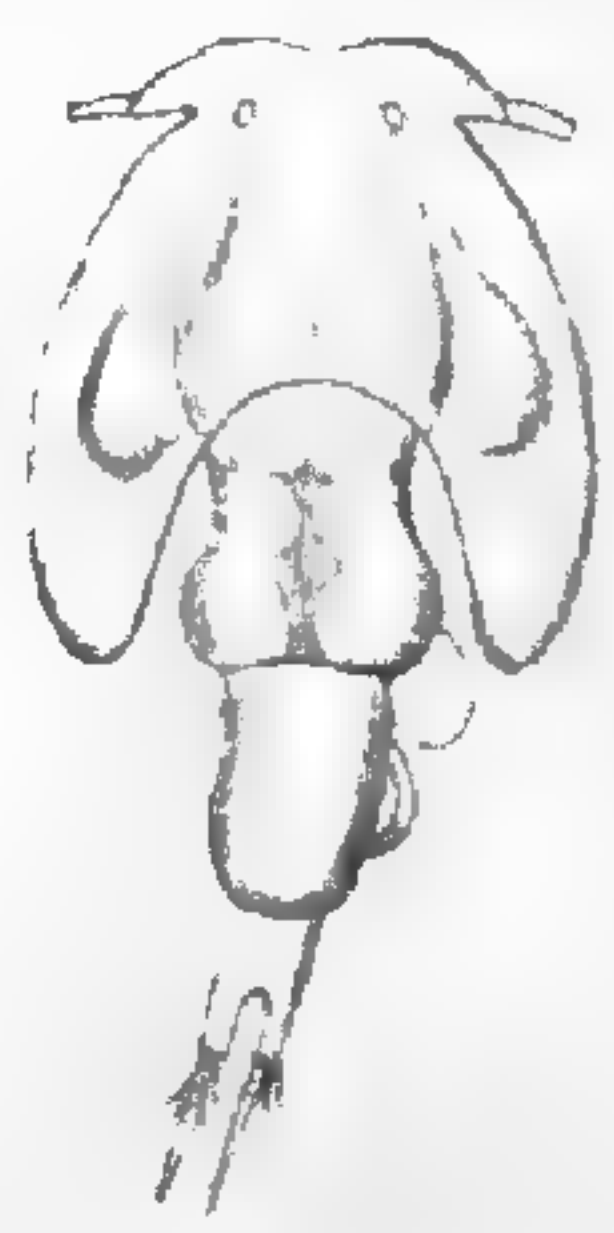
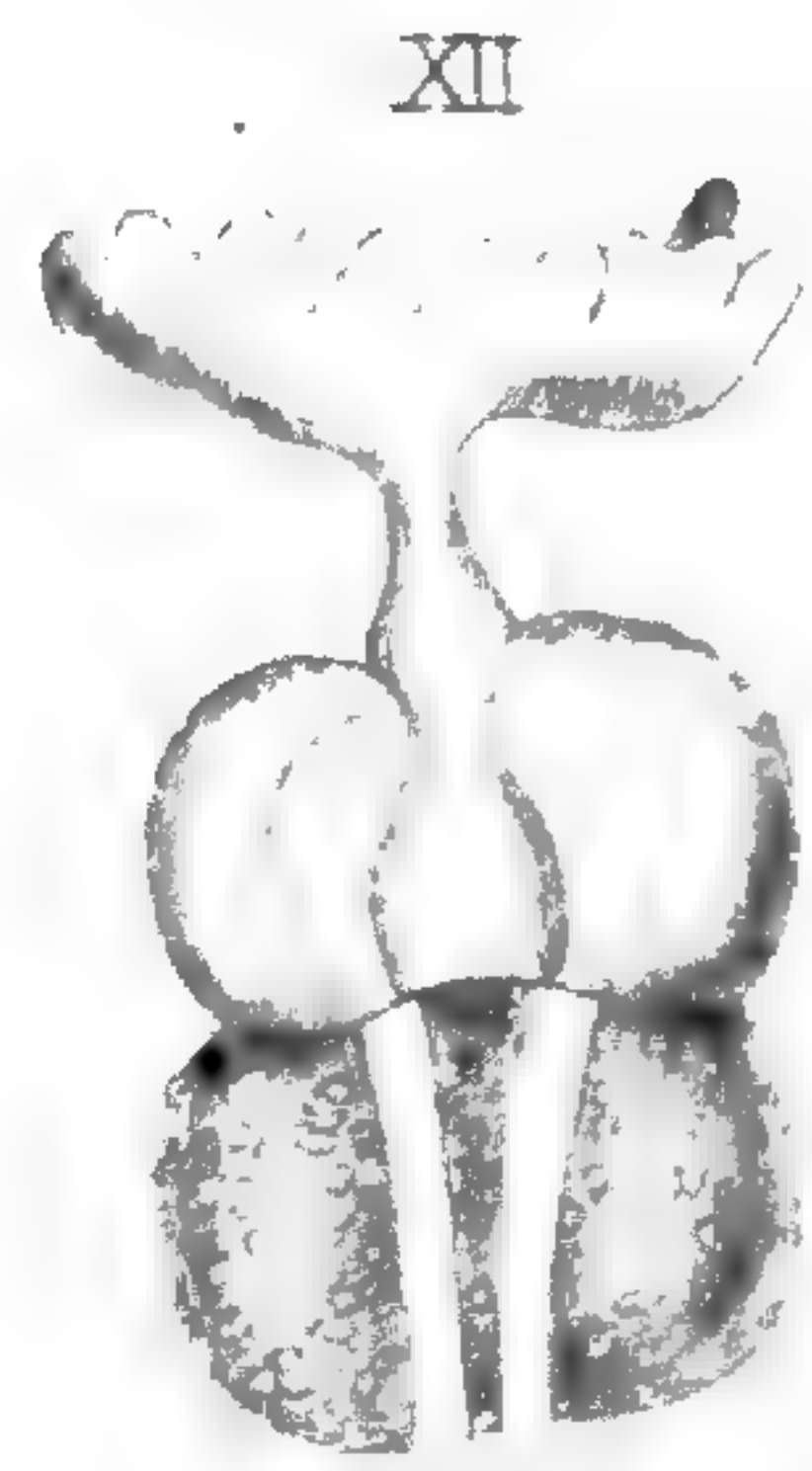
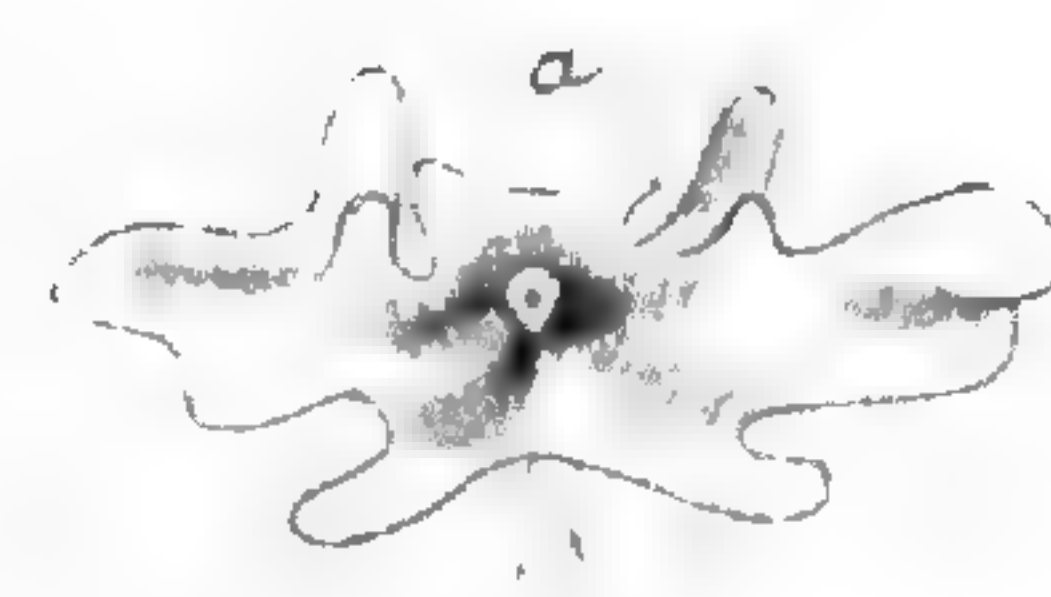
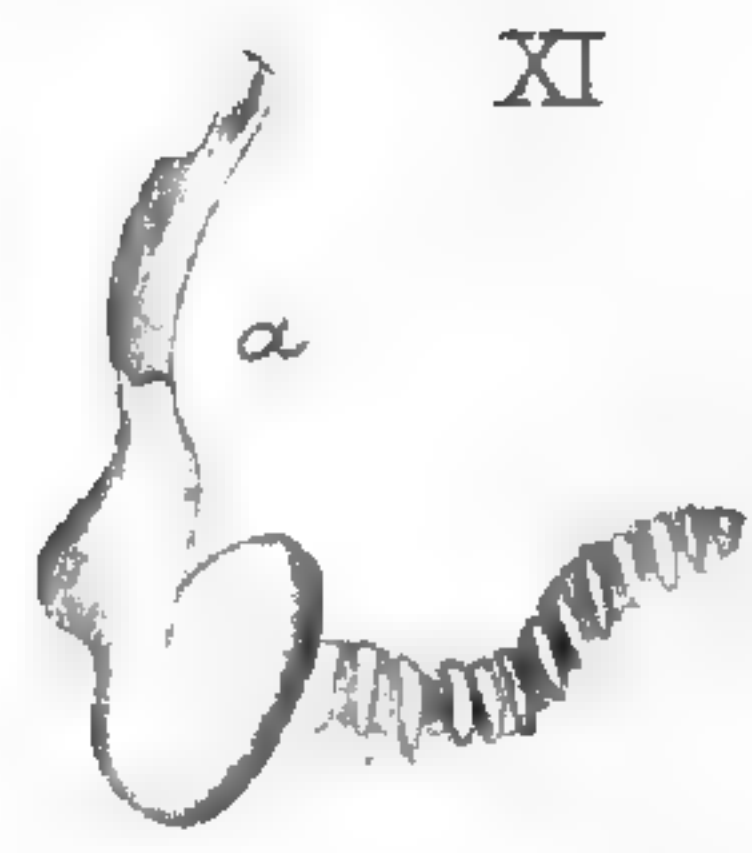
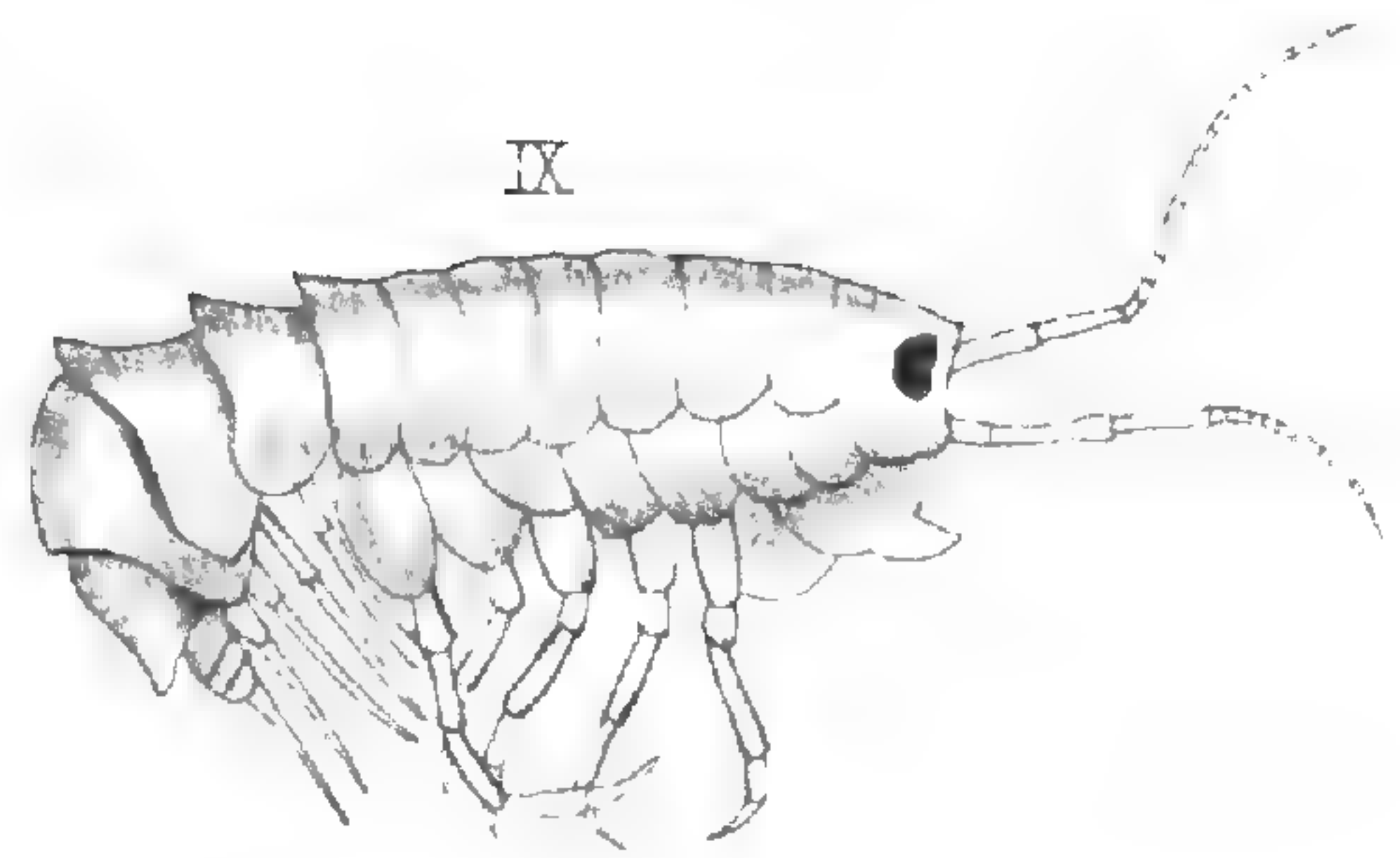
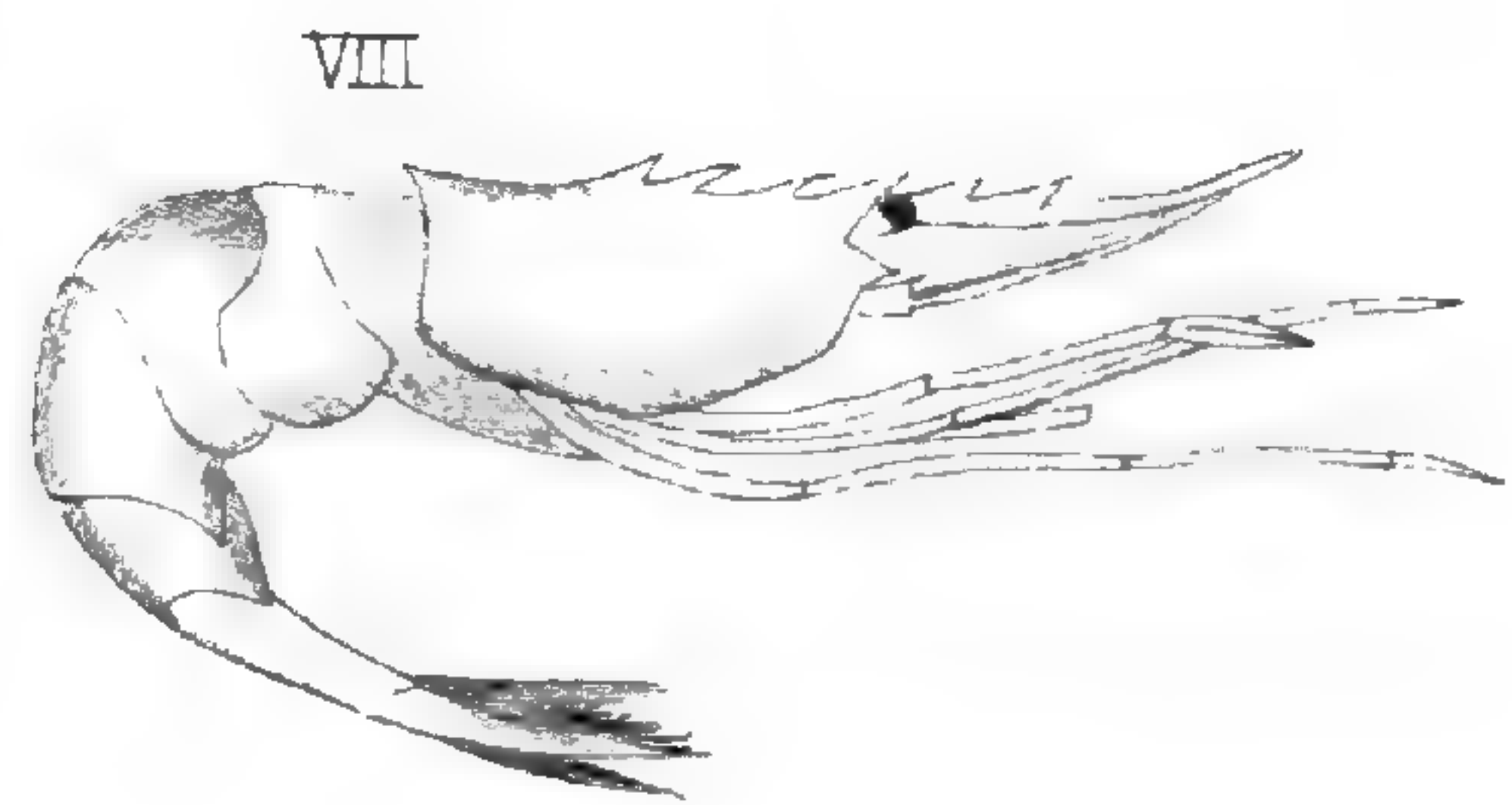
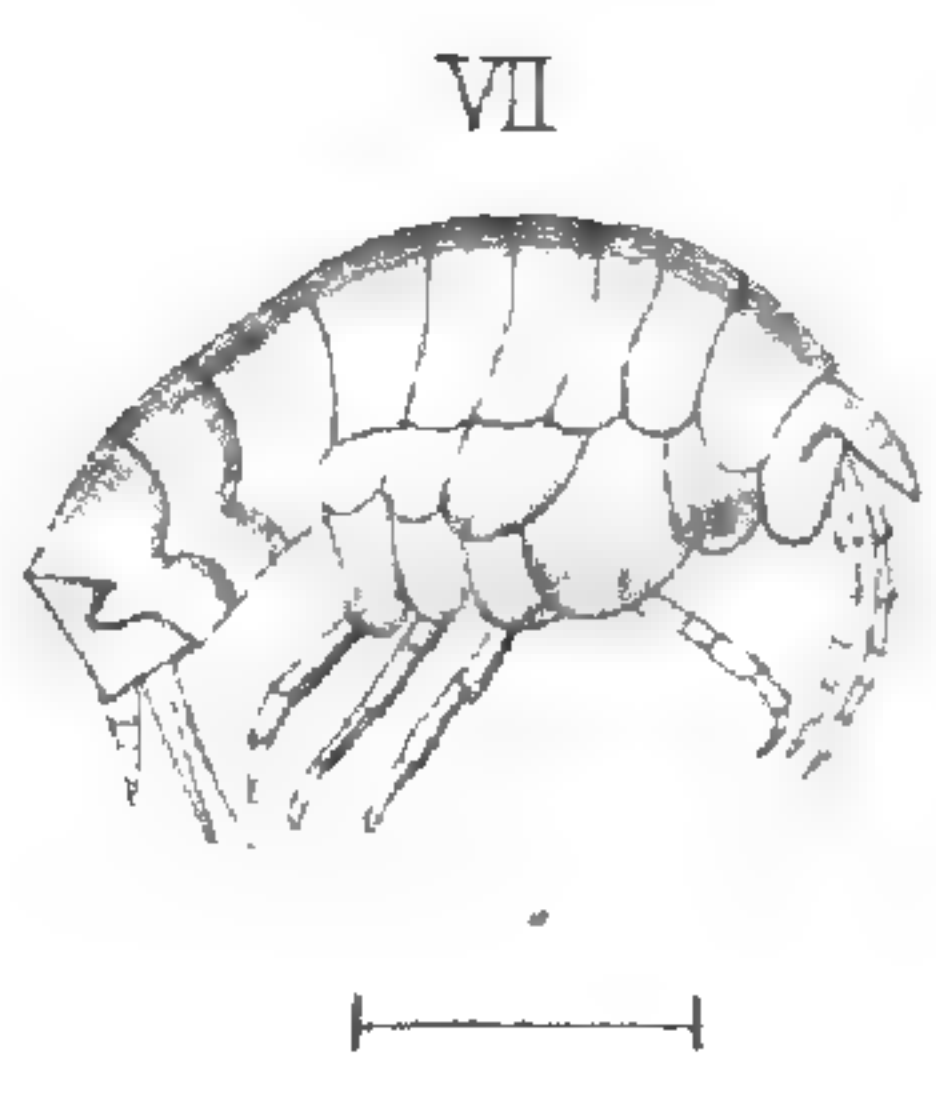
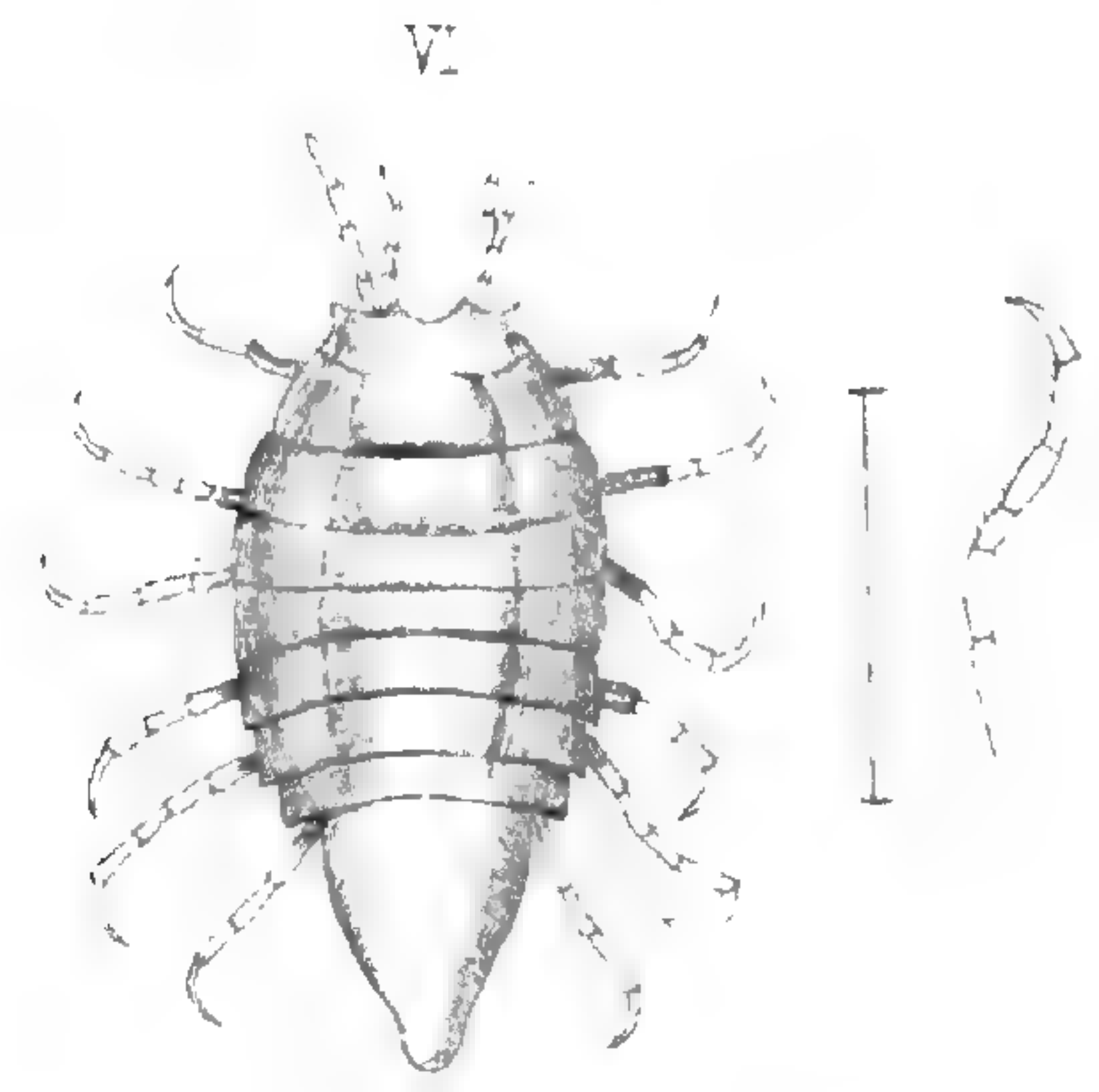
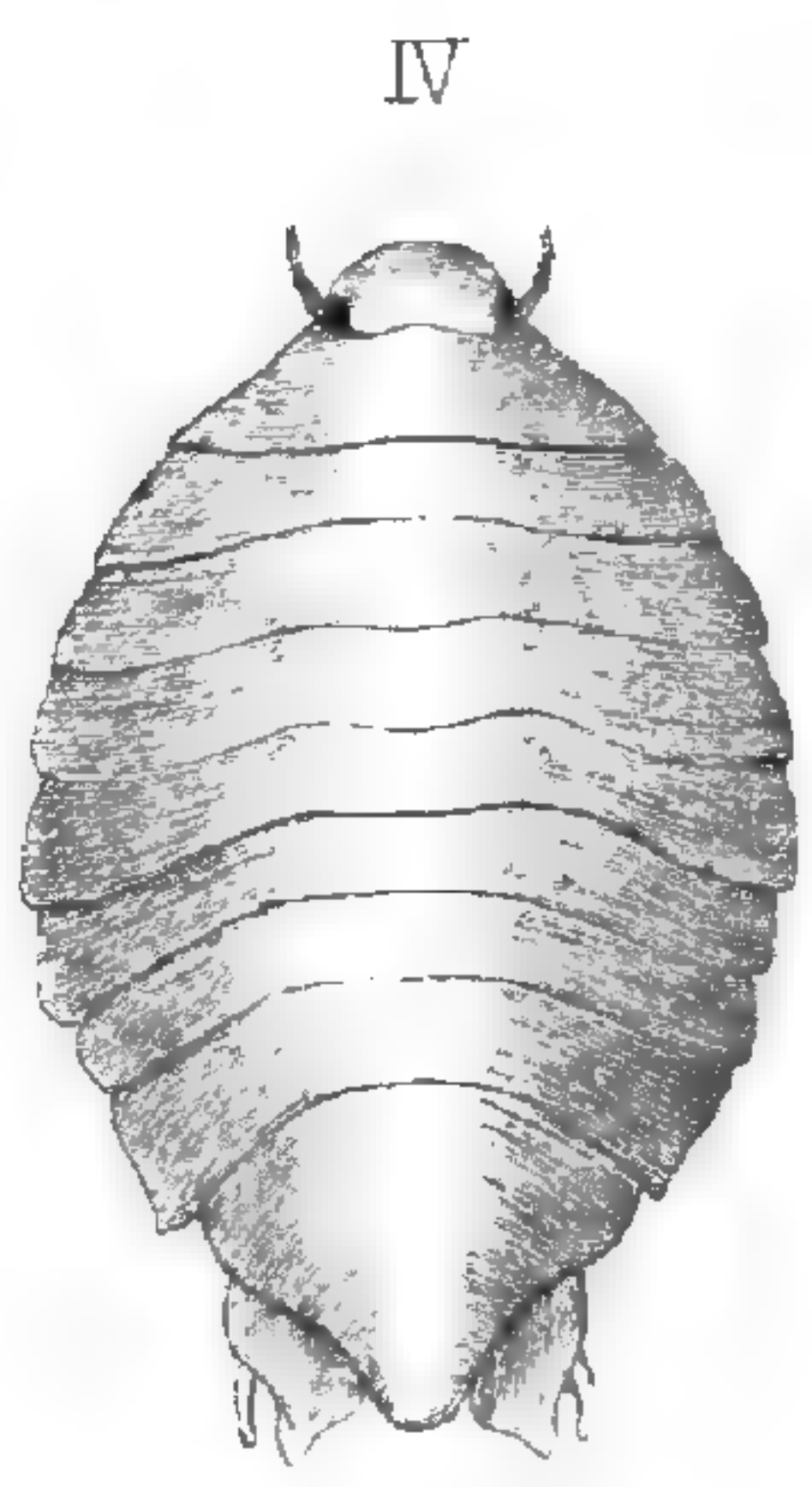
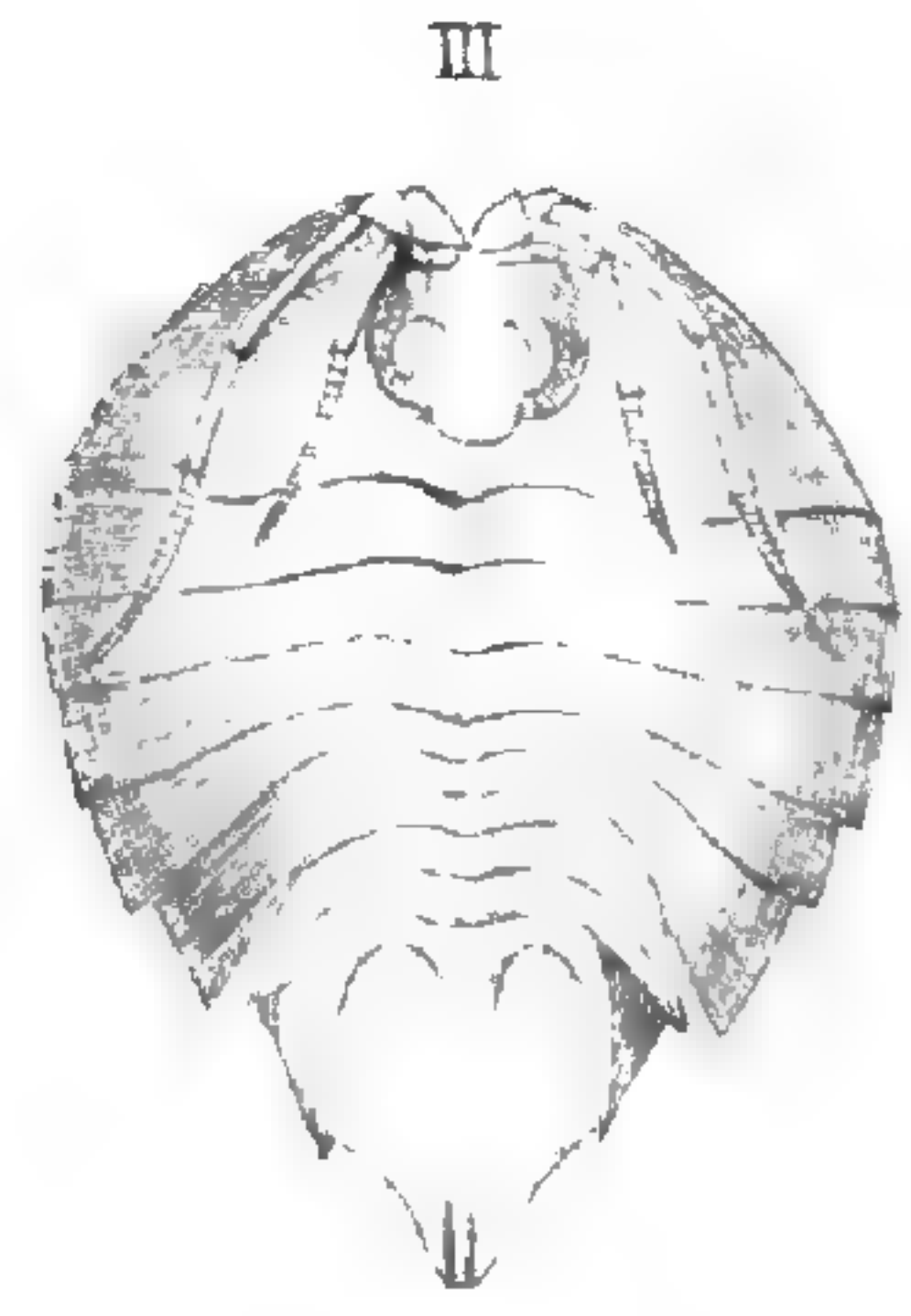








ANTENNAE





XVIII. *Revision of the Genus Cassia.* By GEORGE BENTHAM, Esq., F.R.S., P.L.S.

Read March 4th, 1869.

(Plates LX.-LIII.)

THE genus *CASSIA* has frequently been the subject of the special researches of monographists. The medical importance of its principal products, Senna-leaves and Fistula-fruits, have rendered the investigation of the species from which the best supplies are obtained necessary on the part of pharmacologists. The great beauty of many of the trees and shrubs it includes is well appreciated, not only in tropical plantations and gardens, but also in those of Southern Europe, and, indeed, as far north as Paris, where a few species, chiefly, I believe, *C. corymbosa* and its allies, are amongst the most conspicuous of the autumn-flowering shrubs; and although we rarely see any in this country, yet it is probable that when our subtropical gardens become more general, Cassias will assume their appropriate places in them. To botanists it presents an excellent instance of a large, widely distributed, much varied, but well-defined group. So natural, indeed, is the genus that, notwithstanding the great contrast in habit between the splendid arborescent *Fistulas* and some of the weedy herbaceous *Prosospermas*, or *Chamæcristas*, and although its principal characters are derived from the pod and the anthers, which both present more diversity than in any other Leguminous genus, yet there is hardly a species which has ever, by any tolerably fair botanist, been falsely or carelessly included in or rejected from the genus, except perhaps in the case of a few garden seedlings which had not yet flowered.

One result, however, of the early attention given to the genus has been the large number of imperfectly described species, or, at any rate, of so-called species, which it is exceedingly difficult to identify. This circumstance, and the very large increase which the genus has recently received, obliged me, in working up the Brazilian species for Martius's great 'Flora,' to go through the whole genus with all the care I could bestow upon it. As a result of my investigations I beg to lay before the Society a systematic enumeration of the whole genus, observations on old species, and descriptions of new ones from the extra Brazilian regions of America or from Asia, with some general observations on systematic arrangement and geographical distribution, referring for systematic details of Brazilian species to the Cæsalpinieous volume of Martius's 'Flora' about to be sent to press, of African species to the second volume of Oliver's 'Flora,' now far advanced, and of Australian species to the second volume of my 'Flora Australiensis'\*.

\* [It is now two years since this paper was read: I have since been enabled, during a visit I made in the autumn of 1869 to Paris, Geneva, and Munich, to verify a number of synonyms which had remained doubtful; and my account of the Brazilian Cæsalpinieæ being now at length published, and the greater part of the second volume of Oliver's 'Flora' being already in type, I have been able to refer to both these works throughout the systematic enumeration, which I have endeavoured to bring down to the present time. I have thought it right to leave the preliminary observations precisely as they were read to the Society.—April 1871.]



Linnaeus, in the standard second edition of his 'Species Plantarum' (1762), enumerated 30 species, which, by the elimination of repetitions founded on imperfect materials, must be reduced to 25. From that time to the first decade of the present century many new species were added, and a still greater number of old ones redescribed under new names, chiefly from botanical gardens in various parts of the world; and notwithstanding the general enumerations of Willdenow and Persoon, the whole genus had fallen into a state of the greatest confusion when Colladon took it up at the suggestion of De Candolle. That great master, who succeeded in forming so many botanists from among his pupils, always recommended to beginners the working out a special monograph as the best exercise, whether in systematic, physiological, or applied botany. Accordingly, M. Colladon, working under De Candolle's eye, and evidently with direct assistance from him, published in 1816, as his inaugural thesis for the degree of Doctor of Medicine, his 'Histoire Médicale et Systématique des Casses,' in 4to, with 20 plates. After devoting a considerable space to the pharmaceutical products of the genus, the systematic portion contains an enumeration of all of the species then known, with diagnoses and descriptions, in as far as his materials allowed. But herbaria in those days were very scanty; and, owing either to the insufficiency of the characters given by various writers or to his having sometimes taken up species from rude drawings, out of 125 species that he enumerates as more or less known, nearly one half have proved untenable. De Candolle himself, reworking up the genus for his 'Prodromus' nine years later, owing chiefly to the additions made by Humboldt and Bonpland, raised the number to 211 species enumerated; but these, again, from the same causes must probably be reduced to about 110.

After another period of twelve years the late Dr. Vogel in 1837, on the occasion of working up Sellow's Brazilian Leguminosæ, found it necessary to revise the genus *Cassia*, which he did with that accuracy and ability which distinguished all his systematic labours, enumerating 278 species, out of which nearly 200 appear to be well established, a far larger proportion than is the case with any of his predecessors. During the thirty-two years which have now elapsed since the publication of his 'Synopsis generis Cassiæ,' the only work on the subject deserving notice is Batka's elaborate investigation of the few species forming the group of true *Sennas*. In this excellent memoir he has very effectually cleared up the confusion which had arisen from the vague and careless manner in which the species had been noticed by the earlier and even by some more recent writers. In raising, however, these four species to the rank of a distinct genus, he appears to have been rather led away by a naturally exaggerated view of the importance of the characters he has elucidated in a group so long the object of his exclusive attention than by any general comparison with allied groups.

In the meantime the examination of the rich stores accumulated in the Kew herbarium, the study of many of the older types in the Linnæan and Banksian herbaria, the notes I had formerly taken at Paris and Geneva, and the collections lent to me from Munich and other parts of the Continent have given me the opportunity of clearing up a large number of the old doubtful Cassias, and of making no small an addition of new species chiefly from central Brazil, carrying the total number of known species, estimated according to the views I have usually adopted, to 338, besides about a dozen published



ones about which I feel some doubt. This total number might be readily raised to at least 360, by adopting as species several which I have considered rather as marked varieties, or might perhaps equally well be reduced to 300, by uniting those which are not marked off by any definite limits.

Of the general character and affinities of the genus I need say nothing; for the territory assigned to it in the system has long since been well fixed, and no ambiguous or connecting species has hitherto come forward to disturb the frontier. The distribution of the numerous species into subordinate groups, however, has presented some difficulties. De Candolle's seven sections are mostly natural, but very unequal in value; and the characters he gives, which he could only verify in a small number of species, will not stand the test of a closer investigation. Vogel's seven sections, partly the same as, partly different from De Candolle's, are much more accurately defined, and some of them excellent; but the characters being taken sometimes from the anthers alone, sometimes from the pods or the seeds alone, some of his groups are too technical, of unequal value, or so far from natural, that, for instance, between the great sections of *Chamæfistula* with 28 species, *Chamæsenna* with 51, and *Senna* with 12 species, there are no less than 45 species well known by good flowering specimens, which he is obliged to leave as ambiguous between the three. Following up, however, the indications so well broached by Vogel, it appears to me that the genus may be divided into three large groups, so well defined in flower and fruit as to have a right to the designation of subgenera. These are:—

1. **FISTULA**, in which the three lower anthers, on long incurved filaments, open more or less from the top downwards on the inner face in longitudinal slits; four or more of the others, on shorter filaments, open by basal pores, one to three of the uppermost being usually smaller and indehiscent. The pod is long, cylindrical or slightly compressed, very hard, and usually, if not always, indehiscent; the transverse septa between the seeds are very perfect, and the seeds flattened parallel to those septa, usually inclosed in a juicy or dry and pith-like pulp. The species of this subgenus are all trees or tall shrubs; the flowers large and showy, in racemes, produced usually, but not quite always, on the old wood; and there are no petiolar glands.

2. **SENNA**, in which the perfect anthers (either seven only, the three upper ones being small and imperfect, or the whole ten) open in single or double terminal pores, or in terminal short slits, occasionally continued a short way down the sides. The pod opens along one or both sutures without elasticity, or in a few species remains indehiscent with a thin or soft pericarp. The seeds, varying much in the direction in which they lie in the pod, are always attached by filiform funicles. The habit and inflorescence are very varied.

3. **LASIORHEGMA**, in which the anthers, either ten or sometimes fewer by abortion, open in short terminal slits, occasionally continued down the sides as in a few species of *Senna*, but usually with a marked woolly line down the sutures. The pod opens elastically in two valves; and the funicle of the seed is reduced to a small adnate or triangular protuberance, never filiform. The habit and inflorescence of each of the three sections comprised in the subgenus is peculiar; but, in the case of two at least, corresponding forms are to be found in the other subgenera.



These three great subgenera thus modified will, I believe, be found to be distinguished by positive characters in the fruit or in the flower, or in both, and so combined with habit and inflorescence that there can be no hesitation as to the subgenus into which any specimen, whether in flower only or in fruit only, should be placed; nor have I met with a single species really intermediate between either, although in each subgenus there may be a subordinate group or species approaching to, without overstepping, the general boundary.

For the subdivision of these subgenera I have not in *Fistula* succeeded in tracing any natural groups intermediate between the subgenus and the species; in *Senna* I have adopted several sections and minor groups, either founded chiefly on the pod but not always recognizable in the flower, or characterized by the anthers without any distinctive pod, or by the seeds or glands, but none of them so clear and well defined as the subgenera. *Lasiorrhagma*, however, has three very good natural and well-marked sections, *Apoucouita*, *Absus*, and *Chamæcrista*, characterized chiefly by inflorescence. Such details on these and other groups as it may be worth entering into, will find their place in the following observations on their geographical distribution.

On this subject of geographical distribution I am induced to enter into some detail, as *Cassia* seems to present, in this respect, a good example of analogous phenomena in the majority of large natural tropical genera common to the New and the Old World, such as *Hibiscus*, *Crotalaria*, *Bauhinia*, *Mimosa* (in the Linnean sense), *Eugenioid Myrtæ*, *Hedyotis* (in its broad sense), *Psychotria*, *Solanum*, &c.—phenomena which may be shortly summed up as a general diffusion of uniform primary types, with more or less of divergence into secondary types in different directions in different countries, the smaller groups becoming, generally speaking, more and more local, diverging in different directions and with different combinations of characters in different countries, and the number of identical species over the whole range very few, beyond those which, as weeds of cultivation, are liable to frequent interchange by existing means of transport.

I would premise, also, that in all considerations of geographical distribution of species or other groups, it seems necessary to consider, as an established fact, the great principle that natural affinity results from community of descent. The admission of a separate arbitrary creation of species, unmeaningly modified from an imaginary type, not only reduces the science to a dry statistical enumeration, but entails the preliminary exact determination of what is a species, which no one has as yet succeeded in giving; whereas, in adopting the doctrine of descent, natural genera, sections, species, and varieties become superior and subordinate groups, similar in nature and differing only in degree. Under this aspect, when treating of the area occupied by a group, it matters little whether you call it a section, a species, or a variety, provided only you make yourself clearly intelligible as to what is the grade of subordination you have in view, and, following the terminology which you believe to be the most generally received, you keep to the same term for what you consider the same grade throughout the genus or order you are considering. Thus in speaking, for instance, of the Chilian *Cassia Candolleana*, Vog., whether we follow Closs in breaking it up into three species, or with Vogel regard it as a single representative species, or, as suggested by some others, reduce it to a variety



only of the widely spread *C. bicapsularis*, its geographical and natural relations remain the same. I have, in the following enumeration, after much hesitation, classed it as a variety; but all that is thereby meant is, that, upon weighing all the evidence afforded by the materials at my disposal, it has appeared to me that its relationship to the other forms of *C. bicapsularis* is rather of that degree which botanists whose views I adopt call varieties than of the remoter degree which they term species.

Of the original seat or birthplace of the genus *Cassia* we have no evidence whatever, and I cannot even put forward a conjecture. The fossil *Cassias* mentioned by Heer and Saporta, even if any of them may with tolerable plausibility be referred to the genus, are far too recent to afford any clue. All that the consideration of the data at our command would suggest is, that at least the three great and well-defined types, *Fistula*, *Senna*, and *Lasiorhegma* were differentiated at a time when the configuration of land and water was very different from what it now is, and had been well fixed before the areas they occupied had become broken up by the intervention of apparently insurmountable obstacles; for all three of these great groups show the same combination of general characters in America, in Asia, in Africa, and in Australia. Going even a little further, we may observe here and there a subordinate group, such as that of the *Chamæsennæ Pictæ*, bearing a close family resemblance in the New and the Old World, which seems to show a differentiation at an early period. Descending lower in the scale, if we observe any one organ similarly modified in several species in both hemispheres, the correlative changes in other organs are usually different in the two cases; and some groups, ranking almost as high as any of the subordinate sections, such as *Psilorhegma* and *Xerocalyx*, are exclusively limited to one hemisphere, showing the probability of their formation since the interposition of impassable barriers.

To illustrate these views I would pass in review the principal groups nearly in the order in which they are found in the detailed enumeration given below.

*Fistula* comprises nineteen species, of which eight are American, five Asiatic, five African, and one Australian, all retaining in each country those marked characters in flower and fruit which have induced several botanists to raise them to the rank of a genus; but each species confined to its own part of the world, and none of them forming natural combinations into intermediate groups, as if each species had been independently modified from the common stock without having passed through an intermediate stage of a smaller number of fixed species. It is true that the species of *Fistula* may be classed according to characters derived from foliage, bracts, or even from floral organs; but such classification, as far as hitherto attempted, is purely artificial, the modification of one organ bearing no correlation to that of any other; and if some of these modifications of isolated organs are peculiar to one of the four continents, this may only show that circumstances have acted in one case on one organ, in another on another. The large ovate leaves in few distant pairs of *C. Fistula* and others are chiefly characteristic of Asiatic and African species; and when they occur in American species (*C. Spruceana* and *C. Sagotiana*) they are accompanied by a dilatation of the petiole never observed in Asia or in Africa. Numerous narrow tomentose leaflets are common in American species; and this divergence is accompanied in *C. grandis* by a marked difference in the pod and



stamens; but in other species, such as *C. moschata* and *C. leiandra*, with the same diverging foliage, the pod retains nearly the ordinary *Fistula* shape. The Asiatic species perhaps the most distinct in foliage, *C. javanica*, has the smallest difference in the pod, consisting merely in the substance surrounding the seeds being dry and pithy instead of pulpy; and the most distinct pod among the African species, that of *C. abbreviata*, has nothing peculiar in its foliage. A remarkable thickening of the filament of the lower anthers is observable in one or two of the species of each of the four continents without any correlative character hitherto observed.

Of the subgenus *Senna*, we have above 160 species, of which about 120 are American and 40 in the Old World, besides a few, such as *C. occidentalis* and *C. Tora*, which are now ubiquitous weeds of tropical regions. They have been variously distributed, by De Candolle into four sections, by Vogel into five, of which one is again subdivided into four; but some of these are purely artificial, being founded on the fruit alone, and widely separating species which have evidently a near connexion. For the present purpose it has appeared better to arrange them into sixteen groups, believed to be more natural, although not always very well defined, and which, in the enumeration given below, I have collected into five more marked sections, adopting, with some modifications the *Chamæfistula*, *Oncolobium*, *Prososperma*, and *Chamæsenna* of Vogel.

Of these sixteen groups, ten, with about one hundred species, are American; three, with twenty-eight species, belong exclusively to the Old World; one, the *Bicapsulares*, has six American and three African species, but the species of the two countries are separated by characters which may perhaps indicate a separate origin, and should form perhaps separate groups; whilst two only, the *Floridæ* with eight species and the *Pictæ* with fourteen, are common to the New and the Old World, without any common character separating the American from the Asiatic, African, or Australian species, although each species of each country is quite distinct, and further divergence into the nearest allied groups is in a different direction in the two hemispheres.

There is but little of general interest to point out in the distribution of the American groups. Most of them and many of the species extend over a great part of tropical America, from Brazil to Mexico; many other species and some groups are more local: the *Platycarpæ* are chiefly, but not exclusively, Chilian or Bolivian; the *Molles* mostly sub-Andine, from Mexico to Ecuador, or West-Indian; the two aphyllous species belong to extratropical South America, where there is a tendency to the abortion of foliaceous expansions in a great variety of genera, analogous to that observable in the Australian scrub and in the Egypto-Arabian deserts, the shrubs becoming more generally phyllo-dineous in Australia, spinescent in Africa, juncous in South America. In other respects these two aphyllous species appear to be an offset of the widely spread American group of *Bifloræ*. The group of *Chamæfistulæ Brachycarpæ*, a very natural one, characterized by the calyx and other points besides the pod, is Mexican and Texan, and therefore chiefly extratropical, with the addition of one species from extratropical South Brazil, without any intermediate Andine continuity—a circumstance frequently observed in other genera and orders, where closely allied or even identical species are widely severed between California and the Argentine States, or still more so between the more temperate or



almost arctic zones at the two extremities of the great Andine range, giving evidence of an exceedingly remote common origin and wide extension, of a retention of identical characters through countless ages, and a total extinction in the intermediate space, which had become no longer so well suited to their unmodified constitution.

There are two species, *C. occidentalis* and *C. Tora*, which I have already mentioned as exceedingly abundant in waste and cultivated places all round the tropics, although I have classed the sections they belong to, *Oncolobium* and *Prososperma*, as essentially American. I do so because the fact of all the nearest allies of these species being exclusively American, the Asiatic and African stations by roadsides in gardens and other cultivated places, and other circumstances already pointed out by Alph. de Candolle (*Géographie Botanique*, 772) in regard to *C. occidentalis* show the probability of their comparatively recent introduction from America, although not necessarily through human agency, and possibly even before the discovery of America by Europeans. There remains to be considered whether each of these two species has not a truly Asiatico-African representative, the *C. Tora* having been distinguished by most botanists from *C. obtusifolia* as well as *C. Sophera* from *C. occidentalis*, systematically as well as geographically. But the straight and curved pod of *C. Tora* and *obtusifolia* respectively occur in both hemispheres (though the straight one may be more common in Asia than in America), and sometimes on the same individual at different stages of maturity, or perhaps varying according to the degree in which maturity has been hastened or retarded by climatological conditions. As to *C. Sophera*, however, whether it be a distinct species or a variety of *C. occidentalis*, it certainly is much more abundant in Africa and Asia, and especially in Australia, than in America; and though generally said to be growing with *C. occidentalis*, Roxburgh says that one form of it, his *Senna purpurea*, was raised from seeds received "from the mountainous parts of the coast." It may also be observed that it was early confounded by Forskohl and others with one of the true *Sennas*, and seeds may have been sent out to the West Indies with those of *C. angustifolia*. I have seen specimens from various parts of Central America which are probably truly indigenous; but, generally speaking, *C. occidentalis* seems more disposed to pass into *C. ligustrina* in Central America, and into *C. Sophera* in the Old World. It remains therefore, with me at least, still a very doubtful question, 1st, whether *C. Sophera* is really any more than a comparatively recent and uncertain variety of *C. occidentalis*, and, 2ndly, whether, if it be really a tolerably constant species of older date, it had or had not its origin in the Old World. In tropical and subtropical Eastern Australia it appears to have a still more definite aspect than in Asia or Africa, to diverge into forms not known elsewhere, and to have more the appearance of being indigenous, besides that the typical *C. occidentalis* has not yet been received from thence. The balance of evidence would perhaps lead one to conjecture that *C. Sophera* results from some offset of the group of American *Oncolobia* which had found its way into the Old World at a very early period, but yet not long enough isolated or not sufficiently modified in character to have lost the power of combining with *C. occidentalis* when brought into its contiguity.

If further observation should lead to the conclusion that *C. Sophera* is really a diver-



gence from the *Oncolobium* type originating in Australia or Asia\*, and *C. ligustrina* a corresponding one of American origin, the two being connected by *C. occidentalis*, this would only be another instance of the diversity of divergence in distant countries, which has frequently been brought to my notice in working up the Australian flora. Of this I need only notice two examples, *Pelargonium* and *Nicotiana*. *Pelargonium* is essentially a South-African genus; but one species (only one according to F. Mueller), *P. australe*, has, probably at some far distant epoch, found its way into Australia, become there very abundant, and diverged into a great variety of forms, of which one only, and that not a common one, appears to be identical with one of the rarer varieties of the S. African *P. grossularioides*, a species which in S. Africa is also very variable, but there diverges from the form common to the two countries in a totally different direction, and with different combinations of characters from what is observed in Australia. So also in the case of the Australian representative of the S. American genus *Nicotiana*; *N. suaveolens*, Lehm., one of its numerous forms, has remained undistinguishable from the Chilian *N. acuminata*, Grah. (apparently one of the several varieties of *N. angustifolia*, Ruiz & Pav.); whilst the great mass of them has diverged in one direction in Australia, in another in S. America, so as to give a generally distinct character to each geographical type.

There is one group, the *Bicapsulares*, or *Chamæfistulas* with several pairs of leaflets and a cylindrical scarcely dehiscent or indehiscent pod, in which, as above mentioned, I have included six American and three African species; but the group is perhaps, like the whole section *Chamæfistula*, too artificial; and the American species may be more nearly allied to the strictly American *Chamæsennæ Platycarpæ*, and the African ones on the one hand to some Asiatic or African *Fistulæ*, and on the other to the Asiatic *Chamæsennæ Floridæ*.

I have said that two very natural groups, the *Floridæ* and the *Pictæ* (both *Chamæsennæ*), are, like the *Fistulæ*, really common to the two hemispheres. Like the *Fistulæ* also, the species are all perfectly distinct, but do not form geographical groups. The *Floridæ* have four American species, three Asiatic ones (of which one extends to Australia), and one confined to Australia. In America their nearest allies appear to be the strictly American *Chamæfistulæ Speciosæ*, whilst in the Old World they are more connected with the African *Chamæfistulæ* and, to a certain degree, with the Asiatic and African *Planæ*. The *Pictæ* are very remarkable in their distribution: there are ten American, two African, and two Australian species, most of them very limited in their areas; and although not distributable into groups, the two which are perhaps the nearest allied to each other are very widely dissevered, the tropical African *C. didymobotrya* and the tropical Australian *C. venusta*, a disseverance which calls to mind a similar one in such marked genera as *Adansonia* and *Erythrophlæum*, each with one tropical African and one Australian species. The common parent of the *Pictæ* must have been a contemporary of the progenitor of the *Fistulæ*, although his descendants, more dainty

\* More probably in Australia than in Asia, if we consider the peculiar varieties it has formed in the one whilst it remains comparatively constant in the other, and if we also take into account other evidences of a more direct early connexion between the vegetation of tropical America and Australia than between that of tropical America and Asia.—April 1871.



perhaps in their requirements, may have either never spread into Asia, or not been able to maintain themselves there.

From the *Pictæ* have evidently diverged the true *Sennas*, differing chiefly in the shortness of the pod, with a few minor characters. The divergence arose probably since the first disseverance of the general area, as it exists only in the Old World, and is rather greater in the four African or Asiatic species than in the single Australian one.

The last and most distinct group of the subgenus *Senna* is the section *Psilorhegma*, strictly limited to the Old World, and chiefly Australia, where it disports itself after the truly Australian fashion, the foliage varying from the ordinary flat membranous leaflets to rigid vertical or terete ones, or the whole leaf reduced to a phyllodium, the pods straight or variously twisted, and all with so little regard to specific distinctness that, whilst I considered that I had gone as far as I fairly could in reducing the published species to a more normal standard, F. Müller is of opinion that six or seven of those I have adopted are really variable forms of a single one. There is one in Cunningham's collection, *C. gonioides*, which I had overlooked when working up the 'Flora Australiensis'; this carries the number of species, as there proposed, to sixteen, one of which extends over a great part of tropical Asia. These, with one from the Eastern Archipelago, one from New Caledonia, and one from the Sandwich Islands, make a total of nineteen species. The section characterized chiefly by having the ten stamens all perfect, with the anthers approaching those of *Lasiorhegma*, and the pod and seeds of *Chamæsenna*, passes into the latter section through the E. Indian *C. auriculata* and *C. divaricata*. The similarity of the fruit is indeed so great that the Indian species *C. glauca* has always been placed in *Chamæsenna*, even by Vogel, who, under the impression that *Psilorhegmas* were all Australian, never examined the flowers. Miquel, however, examined a specimen of Horsfield's, and published it as a new species of *Psilorhegma*; but then he also retained the identical *C. glauca* in *Chamæsenna* by the side of *C. divaricata*, Nees, which is also a *Psilorhegma*, although with almost precisely the aspect of the American *C. biflora*, a *Chamæsenna*, and indeed approaching that species in the inequality of its anthers, which, however, being all perfect, places the plant, with its Asiatic countrymen, in *Psilorhegma*, and not with the American *Chamæsennæ*.

The third great subgenus, *Lasiorhegma*, distinguished by its anthers as well as by the elastically dehiscent pod and exceedingly short funicle, has three very distinct sections, although the most prominent character of each is in the inflorescence.

The first and most marked, *Apoucouita*, consists of only three South-American trees, two of which have but recently been discovered by Mr. Spruce. With the general characters of *Lasiorhegma*, but rather peculiar anthers, and the habit rather of *Fistula*, they suggest nothing further as to their origin or connexions.

*Absus*, distinguished from *Chamæcrista* chiefly by the inflorescence and perhaps by more regular flowers, has, when taken as a whole, a singular distribution. Seventy American species, all shrubby or perennial and decandrous, are mostly very local, chiefly Brazilian, a few limited to Guiana or Columbia, and some of the few common ones extending to Central America and Mexico. None appear to cross the Southern Andes, and there is no trace of them in the Old World. The seventy-first species, on the other



hand, is an annual, with small mostly pentandrous flowers, and is abundantly diffused over tropical Africa, Asia, and Australia, but as yet unheard of in America, excepting in a single locality in Jamaica, where it was rare, probably introduced, and from whence it has not spread. These circumstances might suggest a separate divergence from the *Chamæcristas*; and indeed Schrank proposed a genus *Grimaldia*, consisting of *C. Absus* and two or three *Chamæcristæ*, with small flowers and a few leaflets. But the affinity of *C. Absus* certainly appears closer with the American *C. hispidula*. The American *Absi* generally run perhaps more directly into *Chamæcrista*, through *C. (Absus) coriacea* and *C. (Chamæcrista) Burchellii*.

The last section, *Chamæcrista*, with a large number of herbaceous or suffrutescent species, readily propagating by seed, and many of them very abundant in individuals, is an exceedingly puzzling one to botanists. The nicest shades by which the majority of forms pass into each other make it impossible to settle what is to be regarded as species with any satisfaction; and although I have reduced a considerable number of Vogel's, and adopted a few others which he had suppressed, I have not yet much confidence in the result, and in many instances his judgment may have been better than mine, although I have had an infinitely greater number of specimens before me on which to base my conclusions. I have thus enumerated fifty-two American and sixteen Old World species, only one of the latter being apparently identically represented in America, whilst the only American species extending into the Old World appears to be the N. American *C. nictitans*, which, if the small specimens in the Hookerian herbarium are correctly determined, is found also in N. China and the Himalayas.

Two of the most distinct groups, *Xerocalyx* and the *Coriaceæ*, are exclusively American; so also are the greater number of the species with few leaflets; but the great mass of forms allied to *C. Chamæcrista* in the New World and to *C. mimosoides* in the Old show divergences in different directions with different correlations of characters which render it impossible to distribute them into geographical groups. Thus, venation of the leaflets being one of the most constant characters in the section, we have the nearly central costa of *C. Chamæcrista* marking several American species, and the very excentric or almost marginal costa of *C. mimosoides* in several of the Old-World species; but in the case of two species, which at first sight, as well as on examination of the flowers, fruits, and all but the leaflets, appear identical, the American *C. patellaria* has always the venation of the Asiatic and African *C. mimosoides*, whilst the Asiatic and African *C. nigricans* has the venation of the American *C. Chamæcrista*.

Although I have seen nothing from the Old World corresponding to the widely spread American *C. Chamæcrista* or *C. glandulosa*, two of the numerous forms of the Asiatic and African *C. mimosoides* appear to be represented in America: one is the *C. hecatophylla* figured by Colladon, from one of the W. Indian islands, and afterwards correctly reduced by De Candolle himself to *C. mimosoides*, of which I have seen a single specimen amongst Appun's Guiana plants; the other is the *C. Æschynomene*, DC., more common in tropical America than *C. hecatophylla*, but still apparently not abundant, which I am unable to distinguish from the Asiatic *C. Wallichiana*, universally admitted to be a variety of *C. mimosoides*.



As a general result, we may observe that the genus *Cassia* appears to have its great centre in tropical America, especially luxuriating in diversity of forms in the rocky ridges of Central Brazil, becoming more rare in the more temperate regions of North and South America, and unknown in the cooler Andine elevations—more sparingly domiciled in Australia and Africa, although still with a considerable degree of idiosyncrasy, but represented only by very few species in Asia, and that without any very special type, except, perhaps, that of the *Planæ* (*C. auriculata*).

Proceeding to the Enumeration of the species, I would refer for the generic character to Benth. et Hook. Gen. Pl. i. 571; but for its subdivision the detailed examination of species has induced me to modify the sections as follows:—

Subgenus vel Sectio I. *FISTULA*. Staminum 3 inferiorum filamenta longa arcuata, antheræ rimis dehiscentes; superiorum 7 filamenta brevia, antheræ poris basalibus dehiscentes, v. summæ 1–3 imperfectæ. Legumen longum, teres v. crasso-compressum, durum, indehiscens. Semina horizontalia, transversa. Species 1–20.

Subgenus II. *SENNA*. Antheræ perfectæ 7 v. 10 apice poro simplici v. duplici, rarius rimis brevibus dehiscentes. Legumen teres v. compressum, sutura una v. utraque dehiscente valvulis haud elasticis, v. rarius indehiscens. Seminum funiculus filiformis. Species 21–183.

Sectio 2. *CHAMÆFISTULA*. Legumen teres turgidum v. leviter compressum. Semina transversa, horizontalia. Folia interglandulosa v. eglandulosa. Species 21–64.

Sectio 3. *ONCOLOBIUM*. Legumen inter illa *Chamæfistula* et *Chamæsenna* varians. Semina transversa v. obliqua. Folia basiglandulosa. Species 65–75.

Sectio 4. *PROSPERMA*. Legumen subteres tetragonum v. articulato-compressum, sæpius angustum. Semina longitudinalia. Folia interglandulosa. Species 76–89.

Sectio 5. *CHAMÆSENNA*. Legumen compressum, sæpius planum. Semina transversa v. obliqua, verticaliter compressa. Folia interglandulosa v. eglandulosa. Species 90–163.

Sectio 6. *PSILORHEGMA*. Antheræ perfectæ 10 (in præcedentibus 7). Legumen *Chamæsenna*. Foliolorum glandulæ variæ. Species 164–183.

Subgenus III. *LASIORHEGMA*. Antheræ perfectæ 10 v. abortu pauciores, rimis brevibus terminalibus raro ad latera decurrentibus dehiscentes, suturis lateralibus sæpius villosobarbatis. Legumen elastice bivalve. Seminum funiculus brevissimus. Species 184–338.

Sectio 7. *APOUCOUITA*. Arbores. Racemi breves e ramis annotinis vetustioribusve oriundi. Species 184–186.

Sectio 8. *ABSUS*. Herbæ frutescens. Racemi terminales interdumque etiam in axillis superioribus, sæpissime viscosi. Species 187–259.

Sectio 9. *CHAMÆCRISTA*. Herbæ frutescens. Pedicelli solitarii v. pedunculo communi brevissimo subfasciculati, axillares v. supraaxillares. Species 260–338.

### Subgenus vel Sectio I. *FISTULA*, DC.

Genus *Bactrylobium*, Willd.; *Cathartocarpus*, Pers.

Arbores v. rarius frutes elati. Glandulæ petiolares nullæ. Racemi pluri- v. multiflori e ramulis annotinis v. vetustioribus oriundi, v. ad basin innovationum axillares v. terminales simplicesque. Sepala obtusa. Stamina 3 inferiora filamentis elongatis arcuatis



basi sæpe biplicatis medio interdum nodoso-incrassatis, antheris ovatis oblongisve introrsum rimis 2 ab apice plus minus descendentes dehiscentibus; 4–6 intermedia filamentis multo brevioribus rectis filiformibus vel nonnullis incrassatis, antheris basi breviter bilobis ibidemque poris parvis dehiscentibus; 3–1 summa minora, antheris sæpius cassis. Legumen elongatum, pendulum, teres v. crasso-compressiusculum, lignosum v. durum, sæpissime indehiscens, maturum laminis transversis inter semina septatum, locellis sæpius pulpa repletis v. substantia cellulosa sicca fartis. Semina transversa, in locellis solitaria, funiculo filiformi affixa, septulis parallele compressa. Cotyledones planæ, interdum obliquæ v. rarius subflexuosæ.

\* *Bracteæ minimæ longe ante anthesin caducæ.*

† *Foliola paucijuga, sæpius ampla (excepta C. Kotschyana) glabriuscula, jugis distantibus.*

1. *C. FISTULA*, Linn.! *Spec. Pl.* 540. Foliola 4–8-juga (vulgo 5–6-juga), petiolo tereti. Legumen teres, læve, 1–2-pedale.—*Benth.!* in *Mart. Fl. Bras. Cæsalp.* 92.

*Bactyrilobium Fistula*, Willd. Enum. Hort. Berol. 440.

*Cathartocarpus Fistula*, Pers. Syn. i. 459.

*Cassia excelsa*, H. B. et K.! Nov. Gen. et Sp. vi. 339.

*C. Bonplandiana*, DC. Prod. ii. 490.

*Cathartocarpus excelsus*, G. Don, Gen. Syst. ii. 453.

*Cassia rhombifolia*, Roxb.! Fl. Ind. ii. 334.

*Cathartocarpus rhombifolius*, G. Don, Gen. Syst. ii. 453.

*Cassia fistuloides*, Collad. Hist. Cass. 87, t. 1.

*Cathartocarpus fistuloides*, G. Don, Gen. Syst. ii. 454.

*Hab.* Tropical Asia, frequently planted, but also truly indigenous; in tropical Africa cultivated or escaped from cultivation, and possibly indigenous; in America only where planted.

This species, which, like most of its nearest allies, is described as a most beautiful tree when covered with its golden racemes, is much planted in tropical countries for ornament as well as for use. It appears, however, to have a very wide range as truly indigenous in the lower hills of East India and of the Indian archipelago. From Africa we have no evidence of its being otherwise than in a cultivated state; but it is there replaced by the *C. Mannii*, with more numerous leaflets and shorter racemes, and *C. Sieberiana*, with more developed and more or less persistent bracts. From the West Indies, Central America, Columbia, and Brazil, specimens have been frequently sent; but, turning to the accounts given by resident botanists, they all speak of it as an introduced tree. I have also no hesitation in including amongst these introduced individuals of *C. Fistula* the *C. fistuloides*, Collad., described from Moçino and Sessé's rather rude drawing, copied into Colladon's memoir. It is evident that the so-called bipinnate leaf is a young branch with two leaves. I have myself seen specimens of *C. Fistula* with side branches bearing only two or three leaves, with the terminal bud so small as to be easily overlooked by a careless artist, and thus well representing the drawing in question.

2. *C. MANNII*, Oliv.! *Fl. Trop. Afr.* ii. 272. Foliola 6–10-juga, petiolo tereti. Racemi 3–6-pollicares.

*Hab.* Tropical Africa.

3. *C. SPRUCEANA*, Benth.! in *Mart. Fl. Bras. Cæsalp.* 92. Foliola 3–5-juga, breviter acuminata, petiolo supra late canaliculato. Sepala interiora 5–6 lin. longa. Legumen tereti-compressiusculum, suturis prominulis, 1–2-pedale.



*Hab.* Tropical America: N. Brazil, *Spruce*, n. 2558.

Arbor 30-pedalis, coma patula, ramulis foliisque novellis minute sericeo-puberulis, adultis glabratiss. Foliola 3-5-juga sæpius 4-juga, longiuscule petiolulata, ovali-elliptica, breviter acuminata, basi angustata v. cuneata, 3-5-pollicaria, tenuiter coriacea, supra nitida venulosa, subtus opaca venis primariis elevatis venulis minus conspicuis. Petiolus communis 6-10-pollicaris, supra late canaliculatus, eglandulosus. Stipulæ minutæ, caducissimæ. Racemi ad basin innovationum axillares v. infra folia nati, laxi, 6-9-pollicares. Bracteæ parvæ, ovato-orbiculares, obtusæ, concavæ, longe ante anthesin caducæ. Pedicelli 1-1½-pollicares. Sepala ovata, obtusissima, 5-6 lin. longa. Petala lutea venis rubris, obovali-oblonga, subpollicaria, in unguem contracta. Stamina 3 longiora petalis subæquilongia, filamentis basi replicatis medio parum incrassatis, antheris utrinque obtusis dorso hirtellis; staminum 5 intermediorum filamenta 2 filiformia petalis paullo breviora, 3 crassa adhuc breviora; stamina 2 superiora seu staminodia minima, filamentis basi dilatatis, antheris parvis cassis. Legumen 1-2-pedale, tereti-compressiusculum, glabrum, perfectum fere pollicem latum sæpe tamen angustius, suturis utrinque prominulis. Semina pulpa nidulantia.

Plate 60. *C. Spruceana*: fig. 1, five of the stamens, 1 long, 3 intermediate, and 1 short; figs. 2, 3, portions of the pod; fig. 4, seed; fig. 5, the same, transverse section.

4. *C. SAGOTIANA*, *Benth.!* in *Mart. Fl. Bras. Cæsalp.* 93. Foliola 3-4-juga, obtusa, coriacea, petiolo supra late canaliculato. Sepala interiora circa 3 lin. longa.

*Hab.* Tropical America: French Guiana, *Sagot*, n. 802.

Very near *C. Spruceana*, but with more obtuse and coriaceous leaflets, less veined above and usually whitish underneath; the flower smaller, the intermediate anthers with longer basal lobes, &c. The two species are distinguished from all other *Fistulas* by the broadly channelled common petioles of the leaves.

5. *C. KOTSCHYANA*, *Oliv.!* *Fl. Trop. Afr.* ii. 271. Foliola 4-8-juga, obtusa, subtus innovationesque aureo- v. sericeo-tomentosa.

*Hab.* Tropical Africa.

6. *C. BREWSTERI*, *F. Muell.!* in *Benth. Fl. Austral.* ii. 282. Foliola 2-4-juga, glabra. Filamenta staminum longiorum medio nodoso-incrassata, in præcedentibus undique filiformia v. vix medio crassiora.

*Cathartocarpus Brewsteri*, *F. Muell. Fragm.* i. 110.

*Hab.* Tropical Australia.

†† *Foliola oblonga, subtus pubescentia, jugis numerosis approximatis.*

7. *C. GRANDIS*, *Linn. f. Suppl.* 230. Antheræ pilosæ. Ovarium tomentosum. Legumen lignosum, crassum, compressiusculum, transverse venoso-rugosum, 1½-2-pedale, 1½ poll. latum.—*Fl. Bras.* 93.

*Cathartocarpus grandis*, *Pers. Syn.* i. 459.

*Cassia brasiliana*, *Lam. Dict.* i. 649.

*Cathartocarpus brasilianus*, *Jacq. Fragm.* 59, t. 85. f. 3 (legumen).

*Cassia mollis*, *Vahl, Symb.* iii. 57.

*Bactrylobium molle*, *Schrad. in Gött. Gelehr. Anz.* 1821, 713.

*Hab.* Tropical America: Central America, Ecuador, New Granada, Surinam, San Domingo, Jamaica, and perhaps North Brazil.

De Candolle, Vogel, and most authors have adopted for this species Lamarck's name of *C. brasiliana*, which, however, was only published in the 'Dictionnaire Botanique,' in 1783, whilst Linnæus the younger's name, *C. grandis*, dates from 1782. Lamarck's name, moreover, is scarcely applicable; for



although widely diffused over Central America, the West Indies, and a great portion of Columbia, it is as yet doubtful whether the species is really indigenous within the Brazilian limits. Grisebach, in his 'Flora of the British West Indies,' restores the original name.

8. *C. LEIANDRA*, Benth.! in Mart. Fl. Bras. Cæsalp. 94, t. 30. Antheræ glabræ. Ovarium pubescens. Legumen subteres, 2-2½-pedale, inter suturas læve, ad semina insigniter torulosum.

*C. moschata*, Benth.! in Hook. Journ. Bot. ii. 75, non H., B. et K.

*Hab.* Tropical America: on the Amazon, from the Rio Negro to Para.

It appears from the notes of Spruce as well as of Siber (Count Hoffmannsegg's collector) that this is the true Mari-mari of the Lower Amazon. It cannot, however, be the *C. Marimari* of Aublet, which, from his direct reference to Plumier, we must reduce to *C. biflora*. Excepting, however, *C. Apoucouita*, none of Aublet's Cassias can be positively identified; for he only copies the diagnoses of other botanists, which do not always correspond with his plants, and his specimens in the Banksian herbarium are not in general authentically named. The one there referred to *C. Marimari* is *C. multijuga*, to which even Aublet could not well apply the diagnosis he gives.

9. *C. MOSCHATA*, H., B. et K.! Nov. Gen. et Sp. vi. 358. Antheræ glabræ. Ovarium glabrum. Legumen teres, læve.

*C. moschata*, Hanb.! in Trans. Linn. Soc. xxiv. 162, t. 26.

*Cathartocarpus moschatus*, G. Don, Gen. Syst. ii. 453.

*Hab.* Tropical America: on the Magdalena and Orinoco and in British Guiana, Appun, n. 1804.

\*\* *Bracteæ conspicuæ usque ad anthesin persistentes v. rarius subdeciduæ.*

† *Species Americanæ, foliolis angustis jugis approximatis.*

10. *C. FERRUGINEA*, Schrad.! in DC. Prod. ii. 489. Foliola 10-20-juga, oblonga, supra puberula, subtus molliter pubescentia. Stipulæ angustæ. Petala vix ¾-pollicaria. Filamenta staminum longiorum vix incrassata.—*Fl. Bras.* 94.

*Bactrylobium ferrugineum*, Schrad.! in Gött. Gel. Anz. 1821, 713.

*Cathartocarpus ferrugineus*, G. Don, Gen. Syst. ii. 453.

*Cassia staminea*, Vog.! Syn. Cass. 14.

*C. javanica*, Vell. Fl. Flum. 168, Ic. iv. t. 73, non Linn.

*C. brasiliiana*, Sald. de Gama, Descr. Madeiras Rio Jan. 43 cum ic., non Lam.

*Hab.* Tropical America: Southern and Central Brazil.

11. *C. FASTUOSA*, Willd. ex Vog.! in Linnæa, xi. 654. Foliola 10-20-juga, oblonga, supra nitida, subtus pallida vix puberula. Stipulæ latiusculæ. Petala ultra pollicaria. Filamenta staminum majorum vix incrassata.—*Fl. Bras.* 95.

*Hab.* Tropical America: North Brazil, Para, and the Lower Amazon.

12. *C. LEPTOPHYLLA*, Vog.! Syn. Cass. 13. Foliola 8-12-juga, ovato-lanceolata, acutiuscula, pubescentia. Filamenta staminum majorum medio nodoso-incrassata.—*Fl. Bras.* 96.

*Hab.* Tropical America: South Brazil, Sello.

†† *Species Gerontogæ foliolis amplis v. latis, rarius angustis.*

13. *C. SIEBERIANA*, DC.! Prod. ii. 489. Foliola 6-12-juga, ampla, obtusa v. breviter



acuminata, glabriuscula. Racemi elongati, laterales. Filamenta staminum majorum haud dilatata. Legumen 2-3-pedale, teres.—*Oliv. ! Fl. Trop. Afr.* ii. 272.

*Cathartocarpus Sieberianus* and *C. conspicuus*, G. Don !, Gen. Syst. ii. 453.

*Cassia psilocarpa*, Welw. Apunt. Phyto-geogn. n. 40?

*C. javanica*, Sieb. Pl. Seneg. exs.

*C. conspicua*, Vog. Syn. Cass. 47.

*Hab.* Tropical Africa.

14. *C. AREREH*, *Del. Cent. Pl. Afr.* 29. Foliola 6-12-juga, ampla, acute acuminata, glabriuscula. Racemi breves, laterales. Bracteæ lineari-subulatæ. Filamenta staminum majorum medio dilatata.—*Oliv. ! Fl. Trop. Afr.* ii. 270.

*Cathartocarpus Atteleh*, G. Don, Gen. Syst. ii. 453.

*Hab.* Tropical Africa.

15. *C. NODOSA*, *Hamilt. ! in Roxb. Fl. Ind.* ii. 336. Foliola 6-12-juga, ampla, breviter acuminata, glabriuscula. Racemi breves, laterales. Bracteæ lanceolato-subulatæ. Flores rosei. Filamenta staminum majorum medio nodoso-dilatata.

*Hab.* Tropical Asia.

16. *C. ABBREVIATA*, *Oliv. ! Fl. Trop. Afr.* ii. 271. Foliola 6-12-juga, ovata v. ovali-oblonga, obtusa, subtus pubescentia. Racemi laterales. Bracteæ anguste lanceolatæ. Petala eleganter venosa. Filamenta staminum majorum medio subdilatata. Legumen sericeo-velutinum.

*Hab.* Tropical Africa.

17. *C. JAVANICA*, *Linn. Spec. Pl.* 542. Foliola 6-12-juga, ovata v. ovali-oblonga, obtusa, subtus pubescentia. Racemi laterales, pedicellis longis. Bracteæ basi dilatatæ. Petala avenia. Filamenta staminum majorum medio sæpius dilatata. Legumen 1-2-pedale, cylindricum, glabrum, ad semina sæpius leviter torulosum, pulpa sicca.

*Cathartocarpus javanicus*, Pers. Syn. i. 459.

*Cassia Bacillus*, Gært. Fruct. ii. 313.

*Hab.* Tropical Asia.

18. *C. MEGALANTHA*, *Dcne. ! Herb. Tim. Descr.* 136. Foliola 6-12-juga, ovali-oblonga, obtusa, subtus pubescentia. Racemi laterales. Stipulæ subreniformes. Bracteæ latisimæ, membranaceæ.

*Hab.* Timor.

19. *C. MARGINATA*, *Roxb. ! Fl. Ind.* ii. 338. Foliola 10-20-juga, ovata v. ovali-oblonga, (subpollicaria), pubescentia. Stipulæ parvæ v. caducæ. Racemi in ramulis hornotinis axillares. Flores inter minores, rosei, pedicellis brevibus. Bracteæ ovatæ, vix usque ad anthesin persistentes. Legumen 8-10-pollicare, pulpa spongiosa.

*Cathartocarpus marginatus*, G. Don, Gen. Syst. ii. 453.

*Cassia Roxburghii*, DC. ! Prod. ii. 489.

*Cathartocarpus Roxburghii*, Loud. Hort. Brit. 167.

*Hab.* Tropical Asia : Ceylon and the Indian peninsula.

This species has sometimes been taken for *C. javanica*, of which it has nearly the foliage though with rather more numerous leaflets ; but it is readily known by the axillary racemes and much smaller flowers on much shorter pedicels. The fruit, which I have not seen, is described as shorter and more slender.



+20. *C. RENIGERA*, *Wall.!* *Cat. Herb. Ind.* n. 5307. Foliola 10–20-juga, anguste oblonga (2-pollicaria), pubescenti-villosa. Stipulae amplae, reniformes. Flores . . . ? Legumen cylindricum, 1–2-pedale, laeve, glabrum.

*Hab.* Tropical Asia: Taong Dong mountain in Burmah.

Undique molliter pubescens. Foliola obliqua, parum inaequilatera, brevissime petiolulata, petiolo communi 8–10-pollicari. Stipulae membranaceae, lateraliter affixae (semicordato-reniformes), 8–10 lin. longae, apice breviter aristatae.

The species is as yet very doubtful. The specimens are very indifferent, in leaf only, and resemble on the one hand *C. megalantha* in *Fistula*, on the other *C. Timorensis* in *Chamaesenna*. The fruit is detached, but labelled by Dr. Wallich in the fruit-collection of the Linnean Society as that of *C. renigera* from Taong Dong, and is quite that of *C. Fistula*.

## Subgenus II. SENNA.

Genus *Senna*, Roxb.

Frutices, herbæ v. rarius arbores, habitu vario. Glandulae petiolares dum adsint plus minus elevatae, conicae subglobosae oblongae v. tenues stipitataeque. Racemi 2-multiflori ut plurimum ex axillis superioribus ramulorum hornotinorum, rarius ad nodos defoliatos ramorum vetustiorum oriundi, superiores v. fere omnes nonnunquam paniculam terminalem corymbosam v. pyramidatam efficientes, summi tamen decrescentes nec in racemum terminalem simplicem abeuntes. Sepala obtusa vel rarius exteriora praesertim acuta. Stamina perfecta nunc 7 v. rarius 6, 3 summis et interdum infimo ad staminodia reductis, nunc (in sect. *Psilorhegmate*) 10, aequalia v. saepius inaequalia, 3 inferiora filamentis saepius longioribus antherisque majoribus; filamenta omnia saepius anthera breviora nunc brevissima; antherae crassae, oblongo-lineares, subquadratae, apice nunc truncatae poro duplici dehiscentes, nunc saepius plus minus rostratae rostro 1–2-poroso, basi obtusae v. breviter acuteque bilobae; staminodia 3 summa filamentis brevibus antheris saepius in laminam simplicem v. bilobam dilatatis, infimum dum adsit staminibus perfectis magis conforme nisi parvum anthera cassa. Legumen forma magnopere diversa, ad suturam interiorem v. utramque dehiscens valvulis tamen haud elasticis, v. rarius indehiscens, exocarpio tunc haud lignoso demum irregulariter resoluto. Semina transversa obliqua v. longitudinalia, funiculis filiformibus.

In several species, especially amongst the *Bacillares*, *Floridæ*, and other larger *Chamaefistulae* and *Chamaesenna*, the petals usually enlarge considerably after the flower first expands, but, in some instances, appear to remain short and imperfectly coloured in some of the flowers, whilst they become fully developed in others of the same raceme, or in other specimens of the same species.

## Sectio 2. CHAMÆFISTULA.

Frutices, rarius arbores v. (in *Brachycarpis*) herbæ. Folia interglandulosa, rarius eglandulosa. Stamina perfecta 7, staminodia 3. Legumen teres, turgidum v. leviter compressum, ad suturam superiorem rarius ad utramque suturam dehiscens, v. (in *Bicapsularibus*) indehiscens. Semina transversa, septulis parallele compressa, saepe in locellis gemina, septo verticali plus minus perfecto interposito.

This section is readily distinguished from *Oncolobium* by the want of the basal petiolar gland, from *Prososperma* by the direction of the seeds, which may be observed long before the pod is ripe. But, taken as a whole, there is no character to separate *Chamaefistula* from *Chamaesenna* but the pod; and even



that is in some cases ambiguous. Each series in one section may, however, be generally distinguished from any one in the other by habit or other characters, so as to render the cases very few where the place of a flowering specimen may not be assigned without the pod.

I have adopted from De Candolle and Vogel the names as well as the distinctive characters of *Chamæfistula* and *Chamæsenna*, notwithstanding their defective composition. Misled, perhaps, by the *Chamæbuxus*, sometimes called *faux buis*, it seems to have been imagined that *χαμαί* meant *spurious* instead of *dwarf* or *prostrate*.

Series 1. Bacillares. *Foliola sæpius ampla, semper bijuga, glandula inter inferiora v. rarius inter utrumque par. Legumen ad suturam interiorem dehiscens.*

\* Genuinæ. *Antheræ perfectæ parum inæquales, 3 inferiores evidentius rostratæ. Petala infrapollicaria rarius subpollicaria.*

† *Racemi breves, rarius elongati, axillares, summis paucis paniculatis.*

21. *C. TENUIFOLIA*, Vog. ! *Syn. Cass.* 16. Molliter hirsuta. Foliola mediocria. Stipulæ setaceæ, caducissimæ. Racemi axillares, subterminalesque (?), laxè pauciflori. Legumen angustum, subteres, torulosum.—*Fl. Bras.* 96.

*Hab.* Tropical America : Brazil, prov. Rio Janeiro.

22. *C. ACUTISEPALA*, Benth. ! in *Mart. Fl. Bras. Cæsalp.* 97. Foliola ampla, glabriuscula. Sepala lanceolata, acutissima, venosa (in sequentibus omnibus obtusa).

*Hab.* Tropical America : Brazil, *Pr. Max. Newwied.*

23. *C. MACROPHYLLA*, Kunth ! *Mim.* 126, t. 38. Foliola ampla, membranacea, glabriuscula. Sepala obtusa, venis prominulis costata (in sequentibus lævia).—*Fl. Bras.* 97.

*Chamæfistula macrophylla*, G. Don, *Gen. Syst.* ii. 451.

*Hab.* Tropical America : New Granada, N. Brazil.

24. *C. SCANDENS*, Ruiz et Pav. ! in G. Don, *Gen. Syst.* ii. 440. "Caulis alte scandens." Foliola ampla, membranacea, acuminata, glabriuscula. Racemi quam in affinibus longiores laxiores.

*Hab.* Tropical America : Guayaquil, *Ruiz and Pavon.*

Foliola ovata v. ovali-elliptica, ultima 4-6-pollicaria, aristato-mucronata. Glandula conica inter inferiora. Stipulæ setaceæ. Pedunculi in axillis inferioribus 3-5-pollicares, laxè et elongate racemosi. Bracteæ lineari-subulatæ. Pedicelli pollicares longioresque. Sepala ovata, 3-4 lin. longa. Petala duplo saltem longiora. Antheræ omnes rectæ, brevissime lateque rostratæ, 3 inferiores cæteris paullo longiores. Legumen haud suppetit.

25. *C. OBLIQUA*, Ruiz et Pav. ! in G. Don, *Gen. Syst.* ii. 451. Foliola ampla, membranaceo-coriacea, acuminata, glabriuscula. Flores quam in affinibus majores, staminibus 3 inferioribus cæteris submajoribus (minus tamen quam in *Speciosis* eminentibus, et racemi omnes axillares videntur). Legumen in herb. Boissier breve, fere *C. vimineæ*, stylo insigniter apiculatum.

*Chamæfistula obliqua* et *Chamæfistula elegans*, G. Don, *Gen. Syst.* ii. 451.

*Cassia Peruviana*, Vog. *Syn. Cass.* 40.

*Hab.* Tropical America : Peru, *Ruiz and Pavon.*

Foliola ovata v. ovali-oblonga, acuminata, membranacea v. demum subcoriacea, ultima 3-4 poll. longa; glandula inter inferiora angusta. Stipulæ minutæ, setaceæ. Pedunculi axillares, petiolo longiores brevior-



resve, apice breviter racemosi. Pedicelli  $\frac{1}{2}$ -1-pollicares. Sepala anguste ovata, 3-4 lin. longa. Petala longiuscule unguiculata, 3 inferiora  $\frac{3}{4}$  pollicaria, superiora paullo minora. Antheræ 3 cæteris paullo majores longiusque stipitatae.

There are several specimens in Herb. Mus. Brit., from which I have been unable to detect any character to distinguish Don's two supposed species.

26? *C. INÆQUILATERA*, *Balb. in DC. Prod.* ii. 490 (*ex char.*). Foliola ampla, acuminata, glaberrima. Legumen longum, cylindraceo-compressiusculum, undique granuloso-scabrum (in affinibus ubi notum læve).

*Chamæfistula inæquilatera*, G. Don, *Gen. Syst.* ii. 451.

*Hab.* Tropical America: Columbia, Santa Marta (*Bertero*), near Tovar, *Fendler*, n. 1850; Mexico, prov. Oaxaca, *Liebmann*.

I do not feel certain as to having properly identified this species. The granular pod appears to distinguish it from other glabrous-leaved axillary-flowering *Bacillares*; but whether it is so or not in Bertero's original plant is not known. The specimen in De Candolle's herbarium is in flower only, and cannot in that state be distinguished from the true *C. bacillaris*.

27. *C. RUIZIANA*, *Vog. Syn. Cass.* 40. Foliola ampla, vix acuminata, glabriuscula. Flores quam in *C. obliqua* minores, antheris subæqualibus. Sepala obtusa, lævia. Legumen læve.

*Chamæfistula Ruiziana*, G. Don!, *Gen. Syst.* ii. 451.

*Cassia macrophylla*, Ruiz et Pav.! in herb. Lamb. nunc herb. Mus. Brit.

*Hab.* Tropical America: Guayaquil, *Ruiz and Pavon*; Tarapoto, *Matthews*, no. 1921.

Specimina pleraque inflorescentia excepta glabra. Foliola interdum semipedalia, quam in affinibus minus acuminata. Racemi axillares, breves, tenuissime tomentelli. Pedicelli breves. Sepala orbiculata, colorata, 2 lin. longa.

28. *C. AFFINIS*, *Benth.!* in *Mart. Fl. Bras. Cæsalp.* 98. Foliola ampla, obtusa v. vix acuminata, subtus pubescentia. Legumen subteres, utrinque acutum, elongatum (8-10-pollicare).

*Cassia C. puberulae affinis*, *Vog.!* *Syn. Cass.* 13.

*Hab.* Tropical America: Brazil, prov. Rio Janeiro and Minas Geraes.

29. *C. BERLANDIERI*, *Benth. sp. nov.* Foliola ampla, obtusa, subtus molliter pubescentia. Legumen turgidum, sæpius incurvum, 4-5-pollicare.

*Hab.* Tropical and subtropical America: Mexico near Mirador, *Liebmann*; near Tampico, *Berlandier*, n. 2294.

Ramuli subteretes, flexuosi, petiolique pubescentes. Foliola petiolulata oblique ovali-elliptica v. ovata, obtusa, basi inæquilatera, ultima 4-5 poll. longa, supra sparse pilosa demum nitidula, subtus molliter pubescentia; glandula conica, inter inferiora; petiolus communis more affinium seta terminatus. Stipulae lineari-falcatae, caducissimae. Racemi axillares, pedunculati, petiolo communi multo breviores, floribus confertis. Pedicelli pollicares longioresque. Bractea parva, angustae, caducae. Sepala interiora fere 4 lin. longa, pubescentia, exteriora paullo minora. Petala pubescentia, semipollicaria v. paullo majora. Antherae perfectae 7, parum inæquales. Ovarium villosum. Legumen cylindraceo-turgidum sæpius incurvum, obtusiusculum, læve, 4-5 poll. longum, 6-7 lin. latum, suturis vix prominulis, tardius ad suturam superiorem (interiorem) dehiscens. Semina crassiuscula.

*Liebmann's* specimens are in flower only, *Berlandier's* only in fruit; but both appear to belong to the same species.



30. *C. DENSIFLORA*, *Mart. et Gal.!* in *Bull. Acad. Brux.* xii. 304. Foliola ampla, acutiuscula, subtus molliter pubescentia. Flores parvuli. Legumen subteres, semipedale.

*Hab.* Tropical America: Mexico, prov. Oaxaca, *Galeotti*, n. 3188, *Liebmann*, *Jurgensen*, n. 51.

Ramuli subteretes, flexuosi, puberuli. Foliola oblique ovata v. ovato-lanceolata, inæquilatera et sæpe subfalcata, terminalia 3-4-pollicaria, supra pilis brevibus conspersa, subtus molliter pubescentia, utrinque viridia; glandula oblonga v. conica inter inferiora. Stipulas caducissimas non vidi. Flores parvuli in racemis axillaribus petiolo sæpius longioribus conferti. Bracteæ angustæ, caducissimæ. Pedicelli 6-9 lin. longi, pubescentes. Sepala obtusa, pubescentia, 2-2½ lin. longa. Petala vix duplo longiora, pubescentia. Antheræ perfectæ 7, parum inæquales, acuminatæ. Ovarium hirsutum. Legumen læve, suturis haud prominentibus, 5-6 lin. diametro, sericeo-villosum ex *Mart. et Gal.*, in speciminibus nostris glabratum, indehiscens? v. tardius intus dehiscens?

Evidently nearly allied to *C. oxyphylla*, but with a more axillary inflorescence, much smaller flowers, and the anthers more evidently acuminate; the pod appears also to be quite different. I have not seen *Galeotti's* typical specimens, but believe *Liebmann* to be correct in his determination of those he gathered in the same locality.

†† *Racemi in paniculam terminalem corymbosam v. oblongam basi que foliatam dispositi, inferiores pauci interdum axillares.*

31. *C. OXYPHYLLA*, *Kunth!* *Mim.* 129, t. 39. Foliola ampla, acute acuminata, subtus dense pubescentia, glandula inter inferiora. Stipulæ angustæ. Legumen ante dehiscen-  
tiam tereti-compressum. Ramuli sæpius apice insigniter flexuosi, racemis nonnullis axillaribus.

*Chamæfistula oxyphylla*, *G. Don*, *Gen. Syst.* ii. 451.

*Cassia Hartwegi*, *Benth.!* *Pl. Hartw.* 117.

*C. fagifolia*, *Bertol.* *Fl. Guatem.* 14, ex descr.

*Hab.* Tropical America: Mexico, *Liebmann*; Central America, Columbia, Guayaquil.

Although this species has been very well figured in flower by *Kunth*, I am induced to add here a representation of a fruiting specimen, as those of the Kew Herbarium are admirably calculated to show the different stages of the pod of this and allied species, from its long, straight, *Fistula*-like form when unripe to the fully expanded follicle.

Plate 61. *Cassia oxyphylla*: fig. 1, seed; fig. 2, the same, transverse section; fig. 3, embryo.

32. *C. BACILLARIS*, *Linn. fil.!* *Suppl.* 231. Foliola ampla, acuminata, glabra v. pube-  
minuta rara conspersa, glandula inter inferiora. Stipulæ setacæ. Flores ampli. Legu-  
men ante dehiscen-  
tiam teres, elongatum.—*Fl. Bras.* 98, t. 31.

*Mimosa nodosa*, *Linn.!* *Spec. Pl.* 1498 (ad stirpem hortensem nondum florentem descripta).

*Acacia nodosa*, *Willd.* *Spec. Pl.* iv. 1016.

*Cassia fruticosa*, *Mill.!* *Dict. n.* 10, *Rel. Houst.* t. 17; *Vog. in Linnæa*, xv. 67.

*Cathartocarpus bacillus*, *Pers. Syn.* i. 459.

*Chamæfistula bacillaris*, *G. Don*, *Gen. Syst.* ii. 451.

*Cassia puberula*, *H. B. et K.!* *Nov. Gen. et Sp.* vi. 341.

*Chamæfistula puberula*, *G. Don*, *Gen. Syst.* ii. 451.

*Cassia Fockeana*, *Miq.!* in *Linnæa*, xviii. 479.

*C. carthaginensis*, *Willd. herb. ex Steud. Nom. Bot. ed.* 2.

*Hab.* Tropical America: N. Brazil, Guiana, Columbia, Central America, and some of the West-Indian islands, probably indigenous; sent also from Rio Janeiro and occasionally also in East-Indian and other collections, but evidently cultivated.



Plate 62. *Cassia bacillaris*: fig. 1, two of the stamens, one long and one intermediate; fig. 2, one of the staminodia; fig. 3, ovary; fig. 4, pod; fig. 5, the same when commencing to open; fig. 6, portion of the ripe pod.

This species has been placed by Vogel with two others, *C. Humboldtiana*, DC. (*C. spectabilis*, DC.), and *C. sclerocarpa*, Vog., in a distinct subsection, *Xylobium*, with the fruit of *Fistula*, "legumine lignoso indehiscente," and the flowers and foliage of *Chamæfistula*, a combination which I had never met with; and although flowering specimens of *C. bacillaris* are common in herbaria, I could never procure the pod, for all the fruiting specimens I should otherwise have referred to it were totally at variance with the descriptions given. Upon further investigation it appeared that no botanist since the younger Linnæus had been more fortunate; all modern descriptions and figures of the fruit had been either copied from Linnæus or taken from that of *C. Fistula*, to which Linnæus says it is precisely similar. His words are:—"Legumen omnino *C. Fistulæ* ut distingui nequeat, subcurvum, cylindricum, glaberrimum, acumine filiformi terminatum, longitudine pedale, interius isthmis interceptum, quod externe tamen non apparet," *Linn. fil. Suppl.* 231. In this description the word *subcurvum* already indicates a character not found in *C. Fistula*; and having thus ascertained that this was the sole foundation for the character generally given, I turned to Dahlberg's original specimen described by Linnæus, which is in Sir J. Smith's herbarium at the Linnæan Society. I there find the pod unripe and longitudinally cut with a knife. In that state it is not unlike the unripe pod of a small *Fistula*; but I have thus been enabled to identify it with that of other fruiting specimens in the herbaria before me, especially those from Wulfschnagel's Surinam collection in Martius's herbarium, and to trace the pod to perfect maturity, when it splits along the inner suture and opens out into a kind of follicle, as in other species of the present series.

Of the three representations of the species usually cited, that of *C. fruticosa*, Mill., in 'Reliquiæ Houstonianæ,' t. 17, appears to have been taken from a specimen of the true plant; but to get it into the small compass allowed, the artist has so altered the proportions, shortening the leaflets and pod and increasing the curvature of the latter, as to make it unrecognizable. Vogel, who had at first followed others in referring *C. fruticosa*, Mill., to *C. bacillaris*, on seeing the original specimen in the Banksian herbarium found an expanded fruit so different from that of *C. Fistula* that he restored *C. fruticosa* as a distinct species (*Linnæa*, xv. 67), which must now, however, again be united with *C. bacillaris*. Jacquin's figure (*Fragmenta*, t. 85. f. 4) is only conjecturally referred by the author to *C. bacillaris*; he received the pod with the one he figures of *C. grandis* from the W. Indies as having been brought there from the American continent, without foliage or any other indication of the species they belonged to. As the pod in question was exactly like that of *C. Fistula*, and as *C. Fistula* is not American, Jacquin naturally concluded, relying on Linnæus's description, that this was *C. bacillaris*. It must, however, have been in fact either a cultivated *C. Fistula* or some American species such as *C. moschata*, which really has a similar pod. The third figure quoted, that of *Cathartocarpus bacillus*, *Bot. Reg.* t. 881, is certainly not the true plant, but most probably *C. affinis*; as, however, no specimen was preserved or described, Lindley's description having been taken from that of Linnæus, it is now impossible to identify it. The figures I now give are taken from specimens carefully compared with the original one, which is fortunately sufficiently perfect in flower and fruit to preclude all further mistake.

Specimens from Nicaragua, *Ærsted*, n. 45, from Yucatan and Tabasco, *E. P. Johnson*, n. 33, and from Chachapoyas in Peru, *Matthews*, n. 1591, evidently nearly allied to *C. oxyphylla*, but with broader leaves and numerous flowers in a dense terminal panicle, may be considered perhaps as a broad-leaved pubescent variety of *C. bacillaris*. The two species, however distinct they usually are, are sometimes difficult to determine when the specimens are imperfect. Others from Schlim, Ocaña, n. 6, have the leaves nearly of *C. rugosa*, but the paniculate flowers of *C. bacillaris* and *oxyphylla*.

33. *C. LATIFOLIA*, *G. F. W. Mey. Prim. Fl. Esseq.* 166. Foliola ampla, obtusiuscula, nitida, subglabra; glandula inter inferiora. Stipulæ latæ, foliaceæ.

*C. ornata*, *Bernh. Pl. Kappl. Surin. exs.* n. 1408.



*Hab.* Tropical America: Surinam, *Wulfschnagel*; Cayenne, *Sagot*, n. 1156; British Guiana, *Schomburgk* and others.

Besides the general aspect and broad foliage, this species is readily distinguished from all its near allies by the large broad leafy stipules.

34. *C. QUINQUANGULATA*, *Rich. in Act. Soc. Hist. Nat. Par.* 108. Ramuli angulati. Foliola ampla, acuminata, nitida, subtus minute fulvescentia; glandula tenuis inter utrumque par.—*Fl. Bras.* 99.

*C. medica*, Vell. Fl. Flum. 166, Ic. iv. t. 62.

*Hab.* Tropical America: Guiana and Brazil, also St. Christopher, *Masson in herb. Banks*.

A specimen of *Ersted's* from the island of St. Thomas, n. 34, has the foliage, the two glands, the inflorescence and flowers of *C. quinquangulata*; but the leaflets are quite glabrous on both sides, as in *C. viminea*.

35. *C. VIMINEA*, *Linn. Amœn. Acad.* v. 397. Ramuli teretes. Foliola quam in præcedentibus sæpius minora, quam in *C. chrysocarpa* acutiora, nitida, glabra v. vix minute puberula; glandula tenuis inter inferiora. Stipulæ angustæ, sæpius caducæ. Bracteæ subulatae. Panicula basi foliata. Legumen turgidulum, basi obtusissimum. Caulis sæpius scandens.—*Fl. Bras.* 100.

*C. melanocarpa*, Berter. in DC.! *Prod.* ii. 491.

*Chamæfistula melanocarpa*, G. Don, *Gen. Syst.* ii. 451.

*Cassia nitida*, Rich. in *Act. Soc. Hist. Nat. Par.* 108? ex char.

*C. fruticescens*, Bert. in *Spreng. Syst.* ii. 335, ex char.

*Hab.* Tropical America: Jamaica, Guiana, N. Brazil.

The above-quoted *C. nitida*, Rich., has been conjecturally referred to *C. Apoucouita*; but the inflorescence described by Richard is quite at variance with that of the latter species. The very short character given agrees well both with *C. viminea* and *C. undulata*; and of these two the former is the one most likely to have occurred in the collection described.

36. *C. UNDULATA*, *Benth. ! in Hook. Journ. Bot.* ii. 76. Ramuli teretes. Foliola acuminata, nitida, glabra; glandula tenuis inter utrumque par. Stipulæ lanceolatae. Bracteæ lanceolatae. Legumen turgidulum, basi obtusissimum. Frutex erectus.

*Hab.* Tropical America: Trinidad, Guiana, Panama, *Sinclair, Fendler*, n. 86.

I have seen several Columbian and other specimens apparently allied to the three preceding species or to *C. inæquilatera*, some perhaps distinct from either, but without sufficiently perfect flowers and fruit to determine.

The plant in herb. DC. from Cayenne, determined to be *C. nitida*, Rich., and *C. Apoucouita*, Aubl., is certainly *C. undulata* as to the flowering specimen, which is a good one; the loose pod in the same sheet is very different, and looks like that of *C. bacillaris*.

37. *C. CHRYSOCARPA*, *Desv. ! Journ. Bot.* iii. (1814) 72. Caulis sæpius scandens. Foliola quam in cæteris *Bacillaribus* minora, obtusa, subtus innovationes inflorescentiaque pube sæpe aurea indutæ. Stipulæ angustæ. Panicula angusta, basi foliata. Legumen basi obtusissimum, sæpius breve.—*Fl. Bras.* 100.

*Cassia chrysotricha*, Collad.! *Hist. Cass.* 99, t. 13.

*Cassia virgata*, Rich. in *Act. Soc. Hist. Nat. Par.* 108, ex char.

*Cassia chrysogyne*, Miq. ! in *Linnæa*, xviii. 581.



*Hab.* Tropical America : Guiana and North Brazil ; apparently also Cuba.

Often confounded with *C. angulata*, Vog., which has much larger flowers and the lower stamens much longer than the others. The Cuban specimens have much smaller leaves than any of the others.

\*\* *Speciosæ.* *Antherarum perfectarum 3 inferiores cæteris conspicue longiores filamentisque longioribus fultæ. Petala ultrapollicaria.*

Racemi in sequentibus in paniculam terminalem dispositi. *C. obliqua*, supra inter *Bacillares* ob inflorescentiam axillarem enumerata, quoad stamina petalæque quasi medium tenet inter *Bacillares* et *Speciosas*.

† *Foliola subtus v. utrinque molliter pubescentia.*

38. *C. ANGULATA*, Vog.! *Syn. Cass.* 16. Foliola ovata v. ovali-oblonga, paris ultimi sæpius 1–2-pollicaria. Panicula angusta basi foliata, v. parva. Bracteæ ovatæ, persistentes. Legumen elongatum, basi vix obtusum.—*Fl. Bras.* 101, t. 32.

*C. chrysotricha*, Mart.! *Herb. Fl. Bras.* 103. n. 128, non Collad.

*Hab.* Tropical America : Brazil, prov. Rio Janeiro, Minas Geraes, and Rio Negro.

39. *C. PUDIBUNDA*, Mart.! *Fl. Bras. Cæsalp.* 102. Foliola oblonga, obtusissima, paris ultimi 1–2-pollicaria. Panicula lata, brevis. Bracteæ parvæ, caducissimæ.

*Hab.* Tropical America : Brazil, prov. Bahia, Piauhy, and Minas Geraes.

40. *C. SPECIOSA*, Schrad.! in *Gött. Gelehr. Anz.* 1821, 718. Foliola obtusa v. acutiuscula, rarius acuminata, subcoriacea, venosa, paris ultimi pleraque 3–4-pollicaria, pari infimo medio petiolo inserto. Panicula ampla.—*Fl. Bras.* 102.

*Chamæfistula speciosa*, G. Don, *Gen. Syst.* ii. 451.

*Cassia micans*, Nees! in *Flora*, 1821, 303 et 329.

*C. bijuga*, Vog.! *Syn. Cass.* 17.

*C. nervosa*, Vog.! *Syn. Cass.* 39 (varietas vix distinguenda).

*Hab.* Tropical America : Brazil and Columbia.

41. *C. RUGOSA*, G. Don!, *Gen. Syst.* ii. 440. Foliola obtusa, coriacea, venoso-rugosa, paris ultimi pleraque 3–4-pollicaria, pari infimo prope basin petioli inserto. Panicula ampla.—*Fl. Bras.* 103.

*Hab.* Tropical America : Brazil, prov. S. Paolo, Minas Geraes, and Piauhy.

†† *Foliola glabra v. subtus pube minuta conspersa. Panicula ampla.*

42. *C. HOFFMANSEGGII*, Mart.! *Fl. Bras. Cæsalp.* 104. Foliola pleraque ovata, acuminata, 3–5-pollicaria. Stipulæ lineares v. setaceæ. Sepala majora semipollicaria.

*Hab.* Tropical America : North Brazil, on the Amazon, Rio Negro, and Rio Tocantin, and in Cayenne, *Rothery*, v. *Rohr* (*Herb. Brit. Mus.*), Havana, *De la Ossa* (*Herb. DC.*), and, apparently the same species, Tarapoto, *Matthews*, n. 1589.

43. *C. MACRANTHERA*, DC.! in *Collad. Hist. Cass.* 99, t. 8. Foliola pleraque ovato-lanceolata, valde obliqua, acuminata, 3–5-pollicaria. Stipulæ lineares v. setaceæ. Sepala majora,  $\frac{1}{4}$ -pollicaria.—*Fl. Bras.* 104.

*Chamæfistula prominens*, G. Don, *Gen. Syst.* ii. 451, ex char. dato.

*Cassia multiflora*, Vog.! *Syn. Cass.* 39.

*Hab.* Tropical America : Brazil, prov. Rio Janeiro, Minas Geraes, and Bahia.

44. *C. SPLENDIDA*, Vog.! *Syn. Cass.* 17. Foliola oblonga, obtusa, ultima 2 rarius 3 poll. longa. Stipulæ falcatae. Planta glaberrima.—*Fl. Bras.* 105.



*C. monaden*, Vell. Fl. Flum. 166, Ic. iv. t. 63 (ex Vog., forma foliolorum tamen potius *C. macrantheræ*).

*C. striata*, Vog. ! Syn. Cass. 39 (forma pilosula stipulis lineari-setaceis).

*Hab.* Tropical America : Brazil, prov. S. Paulo, Minas Geraes, Piauhy, and Bahia.

*Species Chamæfistularum Bijugarum non satis nota.*

45. *C. SCLEROCARPA*, Vog. Syn. Cass. 15. Foliola oblonga, obtuse acuminata, ultra 4-pollicaria, supra nitida, subtus puberula. Stipulæ lineari-falcatae, persistentes. Legumen teres, utrinque attenuatum.—*Fl. Bras.* 106.

*Hab.* Tropical America : Brazil, near Bahia, *Siber*.

I have not seen this species.

Series 2. Corymbosæ. *Foliola 3-plurijuga glandula inter inferiora v. inter pleraque paria. Sepala sæpius valde inæqualia. Antherarum perfectarum 2 rarius 3 cæteris multo longiores. Legumen rectum v. leviter incurvum, indehiscens v. tardius dehiscens, sæpius pluripollicare, in Americanis demum submembranaceum, in Africanis longius duriusque.*

\* *Americanæ v. ex America in orbe vetere inquilinæ.*

The species of this group with obtuse leaflets seem to pass into the *Chamæsennæ Platycarpæ*. Without good fruit there is, indeed, no character to separate them ; and in some species even the fruit is somewhat ambiguous.

46. *C. BICAPSULARIS*, Linn. ! *Spec. Pl.* 538. Foliola 3-5-juga, oblique obovata v. late oblonga, obtusa, glabra v. subtus pilosa, glandula inter inferiora. Racemi axillares v. in paniculam corymbosam dispositi. Legumen teres v. turgidulum, seminibus 1-2-seriatis.—*Fl. Bras.* 106.

*Senna bicapsularis*, Roxb. ! *Fl. Ind.* ii. 342.

*Cassia limensis*, Lam. *Dict.* i. 643.

*C. Chinensis*, Lam. *Dict.* i. 644, ex parte? (cfr. infra adnot. ad *C. Sopheram*).

*C. sennoides*, Jacq. ! *Ic. Rar.* t. 170.

*C. pendula*, Willd. *Enum. Hort. Berol.* 440.

*Chamæfistula pendula*, G. Don, *Gen. Syst.* ii. 452.

*Cassia glandulifera*, Reinw. in *Blume Cat. Hort. Bog.* 68, ex Miq. *Fl. Ind. Bat.* i. pars i. 92.

*C. Reinwardtii*, Hassk. *Hort. Bog. in Ann. Sc. Nat. ser. 2. xiv.* 58, ex Miq. *l. c.*

*C. coluteoides*, Collad. ! *Hist. Cass.* 102, t. 12.

*C. Alcaparillo*, H. B. et K. ! *Nov. Gen. et Sp.* vi. 355.

*C. inflata*, Spreng. ! *Syst.* ii. 336.

*Chamæfistula inflata*, G. Don, *Gen. Syst.* ii. 451.

*Cassia Berterii*, Colla, *Hort. Ripul.* 30, t. 24, ex DC. (foliolis evidentius mucronatis).

*C. Collæ*, G. Don, *Gen. Syst.* ii. 442.

*C. dormiens*, Vell. *Fl. Flum.* 167, *Ic. iv.* t. 67.

*C. crassisepala*, Benth. ! in *Linnæa*, xxii. 527.

*C. chrysoloma*, Notar. *Ind. Sem. Hort. Gen.* 1840, ex *Linnæa*, xv. *Litt. Ber.* 92 (ex char.).

Var. PUBESCENS, foliolis subtus densius piloso-pubescentibus.

*C. indecora*, H. B. et K. ! *Nov. Gen. et Sp.* vi. 355.

*Chamæfistula indecora*, G. Don, *Gen. Syst.* ii. 452.

*C. advena*, Willd. *Herb. ex Vog. Syn. Cass.* 18.

*C. ovalifolia*, Mart. et Gal. ! in *Bull. Acad. Brux.* xii. 305.

Var. TENUFOLIA, foliolis amplioribus, membranaceis obtusissimis, floribus majoribus.



Var. ?CHILENSIS, foliolis sæpius minoribus rigidioribus, floribus minoribus, legumine angustiore.

*C. flexuosa*, A. DC. ! Not. 7, Pl. Rar. Hort. Gen. 34, t. 4, non Linn.

*C. Candolleana*, Vog. ! Syn. Cass. 42.

*C. frondosa*, Hook. et Arn. ! in Hook. Bot. Misc. iii. 210, non Ait.

*C. quebracho*, Steud. 1833, ex ejusd. Nom. Bot. ed. 2.

*C. obtusa*, Closs !, in C. Gay, Fl. Chil. ii. 235.

*C. emarginata*, Closs !, in C. Gay, Fl. Chil. ii. 237.

*Hab.* Tropical and subtropical South America, very common, extending from South Brazil to the W. Indies and Central America. Frequently sent also in collections from tropical Asia, but there only in cultivation.

The var. *pubescens* occurs both in Columbia and Brazil, differing more or less from the common, more glabrous form. The West-Indian and Central-American specimens have generally the leaflets rounder and thinner than the southern ones. The var. *tenuifolia*, with larger and thinner leaflets, has a very limited Brazilian range. The var. *chilensis* appears to be common in Chile, and being there tolerably constant, I have felt much hesitation as to whether it should be regarded as a distinct species or not. The pod is sometimes scarcely above  $\frac{1}{4}$  in. in diameter, with the seeds not crowded, alternate, and mostly solitary between each two transverse septa, without any longitudinal partitions; whilst in luxuriant, especially cultivated specimens of the typical *C. bicapsularis*, the pod is turgid, above  $\frac{1}{2}$  in. in diameter, and, the crowded seeds being in nearly opposite pairs, the septa separating them become so displaced as to assume the appearance of a transverse septum between each pair, with a vertical one between the two seeds of the pair; and when this is regularly continued throughout the pod, it has the appearance of being vertically divided by a continuous longitudinal septum, whence the specific name. This difference, if constant, together with that in the foliage, would fully have justified the maintenance of the two species; but I have seen so many specimens where the foliage is intermediate, or where the arrangement of the seed is irregular, that, unless more positive characters be detected by further observation, I feel unable to recognize them as sufficiently distinct.

47. *C. CORYMBOSA*, Lam. *Dict.* i. 644. Foliola 3-juga (rarius subinde 2-juga), oblonga v. oblongo-lanceolata, obtusa v. acutiuscula, glabra; glandula inter inferiora v. omnia paria. Racemi axillares v. in paniculam corymbosam dispositi.—*Fl. Bras.* 107.

*C. corymbosa*, Jacq. *Fragm.* t. 101. f. 1; *Bot. Mag.* t. 633.

*C. crassifolia*, Ort. *Dec.* x. 122, ex DC.

*C. falcata*, Dum. *Cours.* ex DC. et *Hort.* plur. non Linn.

*Chamæfistula corymbosa*, G. Don, *Gen. Syst.* ii. 451.

*Hab.* Extratropical and subtropical South America: Buenos Ayres, South Brazil, and Bolivia.

*C. cubensis*, Hoffmans. *Verz.* 209, ex DC. *Prod.* ii. 506, is probably some garden form of *C. corymbosa* or *C. laevigata*, with an erroneous origin. It is not mentioned either by A. Richard or by Grisebach as a Cuban plant.

Var. ? PLURIJUGA, foliolis sæpius 4–5-jugis, racemis omnibus in paniculam corymbosam dispositis.

*C. floribunda*, Cav. ex Collad. ! *Hist. Cass.* 88, t. 11, non Cav. *Descr.*

*C. corymbosa*, Ort. *Dec.* 124, ex Collad.

I have seen no wild specimens corresponding with the original one from the garden of Madrid, figured by Colladon and preserved in herb. DC. Cavanilles's description (*Descr.* 132) applies evidently to the common *C. laevigata*, under which name was published in Germany the plant generally known at the



same time in Spanish gardens as *C. floribunda*; whilst that sent to De Candolle has smaller, less acuminate leaflets, with glands only between the lowest pair, and more paniculate flowers. It may be only a garden sport. The plants usually known in gardens as *C. floribunda* or *C. grandiflora* belong generally to *C. lævigata*.

48. *C. HILARIANA*, *Benth. in Mart. Fl. Bras. Cæsalp.* 108. Foliola sub-6-juga, oblongo-lanceolata, acuta, glabra; glandula inter inferiora. Racemi axillares v. in paniculam corymbosam dispositi.

*Hab.* Tropical America: S. Brazil.

I have not been able to reexamine this plant recently. I had described it from St. Hilaire's specimens many years ago; but when again at Paris, in 1869, St. Hilaire's plants never having been put in order, I was unable to find those I had examined.

49. *C. LÆVIGATA*, *Willd. Enum. Hort. Berol.* 441. Foliola 3-4-juga, ovato-lanceolata lanceolatave acuminata, glabra; glandula inter pleraque v. omnia paria. Racemi axillares v. summi in paniculam brevem dispositi.—*Fl. Bras.* 107; *Collad. Hist. Cass.* t. 5.

*Chamæfistula lævigata*, G. Don, *Gen. Syst.* ii. 452.

*Cassia floribunda*, Cav. *Descr.* 132, pro parte, non Collad.

*Chamæfistula floribunda*, G. Don, *Gen. Syst.* ii. 452.

*C. corymbosa*, Ort. *Decad.* 124, ex Cav. non Lam.

*C. grandiflora*, Desf. ! *Cat. Hort. Par.* 302.

*C. septentrionalis*, Zucc. *Cent. n.* 69, ex Collad. *Hist. Cass.* 89.

*C. elegans*, H. B. et K. ! *Nov. Gen. et Sp.* vi. 342.

*C. vernicosa*, Closs in C. Gay, *Fl. Chil.* ii. 244, ex char.

*C. tropica*, Vell. *Fl. Flum.* 166, *Ic.* iv. t. 64.

*C. Herbertiana*, Lindl. *Bot. Reg.* t. 1422 (ex ic. et descr.; specimina nulla exstant).

*Chamæfistula Herbertiana*, G. Don, *Gen. Syst.* ii. 452.

*Senna aurata*, Roxb. *Fl. Ind.* ii. 342, ex char.

*Cassia aurata*, Roxb. *Hort. Beng.* 32; *Vog. Syn. Cass.* 17.

*C. quadrangularis*, Zolling. in Miq. ! *Fl. Ind. Bat.* i. pars i. 97.

*C. hybrida*, Ten. ! *Cat. Hort. Neap.* 80.

*Hab.* Tropical and subtropical America, chiefly in waste and cultivated places—Brazil, Guiana, Columbia, Central America, Mexico, &c.; and also in similar situations in tropical Asia, Africa, and Australia, probably in most cases introduced.

Like other common weeds of cultivation, this is a variable species, but always readily recognized by its acute or acuminate glabrous leaflets, with glands between all, or all but the terminal pair. The stipules figured by Vellozo are rarely seen, as they are usually exceedingly deciduous; but I have met with some specimens in which the upper ones at least persist at the time of flowering. Although now very common in Asia, I believe it to be really indigenous in America only. Roxburgh says that his *Senna aurata* is a native of the "countries and islands to the east of Bengal;" but I am not aware of any specimens having been seen from those countries of any species closely allied to, yet different from, *C. lævigata*, and no specimens of the garden plant shortly characterized by Roxburgh have been preserved, his character at the same time perfectly agreeing with that of *C. lævigata*.

*C. elegans* and *C. Herbertiana* are both referred by Vogel to *C. floribunda*; but taking the latter name to apply to Colladon's plant, it differs, as above stated, in having the gland only between the lowest pair of leaflets as well as in general aspect. The figure and description of *C. Herbertiana* appear to me to indicate only a large-flowered form of *C. lævigata*. It is true that the plant is figured as slightly hairy, whilst *C. lævigata* is usually quite glabrous; but so also is *C. floribunda* said to be. The plant in Lindley's herbarium representing *C. Herbertiana* is *C. glauca*, a very different species, as recognized by



Lindley in his pencil correction. Some slightly hairy specimens from French gardens, representing very fairly the plate of *C. Herbertiana*, are said to be garden hybrids between *C. lævigata* and *C. tomentosa*.

Some of Zollinger's specimens, n. 1670, are accompanied by loose pods, described by Miquel, and which suggested to Zollinger the name of *C. quadrangularis*; but they are so totally different from the pods of this or any other species of *Cassia* that I suspect they have been mismatched. A specimen under the name of *C. quadrangularis*, with a young attached pod, communicated by Miquel, is certainly *C. lævigata*.

50. *C. TOMENTOSA*, Linn. f. ! *Suppl.* 231. Foliola 6–8-juga, oblonga, obtusa, supra puberula, subtus ramulique molliter tomentosa; glandula inter pleraque v. omnia paria. Racemi in paniculam corymbosam dispositi.

*C. multiglandulosa*, Jacq. Ic. Rar. i. t. 72.

*C. lutescens*, G. Don!, Gen. Syst. ii. 442.

*C. Wightiana*, Grah. ! in Wall. Cat. Herb. Ind. n. 5329.

*C. albida*, Ort. Dec. viii. 92, ex Collad. Hist. Cass. 104.

*Hab.* Tropical America: valleys of the Andes, from Tucuman and Bolivia to Central America. Introduced into tropical Asia and tropical and southern Africa.

\*\* Africanæ, legumine sæpius longiore duriore ei *Fistularum nonnullarum similiore*.

51. *C. PETERSIANA*, Bolle in Peters, *Mossamb. Bot.* 13. Foliola 6–10-juga, ovato-lanceolata, acuta v. acuminata. Stipulæ reniformes, persistentes. Racemi in paniculam terminalem dispositi.—*Oliv. ! Fl. Trop. Afr.* ii. 272.

*Hab.* Tropical Africa, Madagascar.

52. *C. GORATENSIS*, Fresen. in *Flora*, 1839, 53. Foliola 6–8-juga, ovali-oblonga, obtusissima. Racemi in ramis annotinis laterales. Stipulæ subulatæ, deciduæ.—*Oliv. ! Fl. Trop. Afr.* ii. 273.

*C. singueana*, Delile?, Cent. Pl. Afr. 28.

*Hab.* Tropical Africa.

53. *C. TETTENSIS*, Bolle in Peters, *Mossamb. Bot.* 14. Foliola 7–12-juga, oblonga, obtusa, mucronulata, pubescentia. Stipulæ deciduæ. Racemi axillares, glanduloso-puberulæ.—*Oliv. ! Fl. Trop. Afr.* ii. 273.

*Hab.* Tropical Africa.

*C. Sabak*, Delile, Cent. Pl. Afr. 28, described from specimens without flowers or fruit, may very possibly be one of the three preceding species.

Series 3. *Excelsæ*. Foliola multijuga, petiolo eglanduloso. Antheræ perfectæ (7) inter se subæquales, obtusissimæ. Staminodia biloba. Legumen elongatum, subcylindricum, durum, indehiscens v. tardius ad suturam interiorem dehiscens. Racemi inferiores axillares, superiores in paniculam brevem v. elongato-pyramidatam dispositi.

The two species of this group, readily known by their stamens, have the habit, foliage, and inflorescence of the *Chamæsennæ Paniculatæ*, with a pod approaching in some measure to that of the *Fistula*.

54. *C. EXCELSA*, Schrad. ! in *Gött. Gelehr. Anz.* 1821, 717. Foliola 10–20-juga, elliptico-oblonga, pleraque obtusa. Legumen ad semina torulosum.—*Fl. Bras.* 109, t. 33.

*C. fastigiata*, Nees!, in *Flora*, 1821, 303, 329.

*Chamæfistula excelsa*, G. Don, Gen. Syst. ii. 452.

*C. multiflora*, Scheele in Linnæa, xvii. 337? (descr. in omnibus convenit exceptis glandulis).



*Hab.* Tropical America: Brazil, prov. S. Paulo, Minas Geraes, Alagoas, Ceara, and Bahia.

55. *C. SPECTABILIS*, DC. ! *Cat. Hort. Monsp.* 90. Foliola 8–15-juga, ovato-lanceolata, acuta. Legumen læve v. vix torulosum.

*C. spectabilis*, Collad. ! *Hist. Cass.* t. 7.

*C. speciosa*, H. B. et K. ! *Nov. Gen. et Sp.* vi. 338, non Schrad.

*C. Humboldtiana*, DC. *Prod.* ii. 489.

*Cathartocarpus Humboldtianus*, Loud. *Hort. Brit.* 167.

*Cathartocarpus speciosus*, G. Don, *Gen. Syst.* ii. 453.

*Cassia Trinitatis*, Reichb. in Sieb. ! *Pl. Trin. exs. n.* 57; *Vog. Syn. Cass.* 46.

*Cathartocarpus Trinitatis*, G. Don, *Gen. Syst.* ii. 453.

*Hab.* Tropical America: Columbia, W. Indies, Central America, and perhaps Guiana. Most of the specimens from Guiana, formerly referred to *C. Trinitatis* by myself and others, belong to *C. lucens*, which, with nearly the same foliage and inflorescence, has very different stamens and fruit.

Series 4. *Brachycarpæ*. *Foliola uni-plurijuga, glandula inter inferiora v. pleraque paria. Sepala angusta, subæqualia. Antheræ perfectæ (7) inter se subæquales v. 2–3 inferiores longiores, vix rostratæ. Legumen breve ( $\frac{1}{2}$ –2-pollicare), incurvum v. rarius rectum, turgidulum v. subteres, submembranaceum, demum sæpius bivalve. Racemi axillares sæpe pauciflori, v. pluriflori in paniculam corymbosam dispositi.*

This group forms, as it were, the passage from *Chamæfistula* to *Oncolobium*. *C. Lindheimeriana* and *C. Mexicana* have much of the aspect of *C. Dombeyana*, or some varieties of *C. bicapsularis* among the *Chamæfistula Corymbosæ*, whilst their fruit approaches that of some *Oncolobia*; they are, however, readily distinguished from the latter section by the want of the gland on the petiole below the leaflets, and from both by the narrow, nearly equal calyx-lobes.

\* *Herbæ rhizomate perenni. Foliola unijuga.*

56. *C. PUMILIO*, A. Gray !, *Pl. Lindh. in Bost. Journ. Nat. Hist.* vi. 180. Foliola linearia, glabriuscula. Pedunculi 1-flori. Legumen inflato-globosum v. ovoideum, semipollicare.

*Hab.* Subtropical North America: West Texas and New Mexico.

57. *C. RÆMERIANA*, Scheele in *Linnæa*, xxi. 457. Foliola lanceolata, parce adpresse pilosula. Pedunculi 2–4-flori, ad apices ramorum subcorymbosi. Legumen subpollicare.

*Hab.* Subtropical North America: Texas.

58. *C. BAUHINIOIDES*, A. Gray !, *Pl. Lindh. in Bost. Journ. Nat. Hist.* vi. 180. Foliola obliqua, ovato-oblonga, obtusa, molliter villosa. Pedunculi axillares, subbiflori. Legumen subpollicare, hispidum.

*Hab.* Subtropical North America: West Texas and New Mexico.

59. *C. NANA*, Benth. ! in *Mart. Fl. Bras. Cæsalp.* 110. Foliola obliqua, ovata, obtusa, marginata, subtus pilosula. Pedunculi axillares, pauciflori. Legumen sesquipollicare, glabrum.

*Hab.* Subtropical South America: South Brazil.

\*\* *Frutices v. rarius herbæ, elatæ. Folia bi-plurijuga.*

60. *C. CROTALARIOIDES*, Kunth !, *Mim.* 132, t. 40. Tomentosa v. sericeo-villosa. Foliola



3-4-juga (subinde 2-juga), ovali-oblonga. Racemi pluriflori, foliis sublongiores. Legumen subpollicare.

*Chamæfistula crotalarioides*, G. Don, Gen. Syst. ii. 452.

*Cassia apiculata*, Mart. et Gal. ! in Bull. Acad. Brux. x. ii. 304.

*Hab.* Mexico, *Coulter, Galeotti*, n. 3218, and others.

61. *C. VOGELIANA*, *Schlecht. in Linnæa*, xii. 342. Caulis pilis longis patentibus hirsutus. Foliola 3-4-juga, ovali-oblonga, sericeo-pilosa. Pedunculi pauciflori, ad apices ramorum corymbosi. Flores quam in præcedentibus majores. Legumen infrapollicare.

*Hab.* Mexico, *Coulter, Gregg, Galeotti*, n. 3372.

62. *C. LINDHEIMERIANA*, *Scheele in Linnæa*, xxi. 457. Herbacea, elata. Foliola 5-6-juga, oblique ovato-oblonga, obtusa v. acutiuscula, sericeo-villosa v. tomentosa; glandula inter pleraque v. omnia paria. Racemi laxè pluriflori, ad apices ramorum corymbosi. Legumen 1-2-pollicare.

*Hab.* Subtropical North America: Texas and Mexico.

63. *C. ARGENTEA*, *H. B. et K! Nov. Gen. et Sp.* vi. 358. Fruticosa. Foliola 3-4-juga, oblique ovato-oblonga, obtusa, sericeo-pubescentia, subtus argentea; glandula inter par infimum. Racemi laxè pluriflori, ad apices ramorum corymbosi. Legumen gracile, 2-3-pollicare.

*Hab.* Subtropical North America: Mexico.

The specimens of this and *C. Lindheimeriana* closely resemble each other; but *C. argentea* is described as a much-branched shrub of 3 or 4 feet, whilst Lindheimer states his plant to have erect, simple, herbaceous stems of 4 to 6 feet from a perennial rootstock. *C. argentea* has, moreover, fewer leaflets, more silvery underneath, the glands only between the lowest pair, and the pod longer and more slender.

64. *C. MEXICANA*, *Jacq. Hort. Schænbr.* ii. t. 203? Pubes ramorum et inflorescentiæ subviscidula. Foliola 4-7-juga, oblongo-elliptica v. ovalia, vix obliqua, obtusa v. mucronata, subtus sericeo-pubescentia. Racemi pluriflori, summi corymbosi. Legumen 2-pollicare, arcuatum.

*C. fætidissima*, Ruiz et Pav. ! in G. Don, Gen. Syst. ii. 441.

*Hab.* Tropical America: Mexico, *Parkinson, Liebmann*; "New Spain," *Pavon*; S. Domingo, *Bertero*.

Var. ? GRANDIFLORA, sepalis semipollicaribus.

*Hab.* Mexico, between Vera Cruz and Orizaba, *Fred. Müller*; Alpatlahua, *Liebmann*.

### Sectio 3. ONCOLOBIUM.

Herbæ suffrutices fruticesve. Folia basiglandulosa. Stamina perfecta 7; staminodia 3. Legumen subteres v. compressum, sæpe arcuatum, ad suturam utramque dehiscens (v. interdum vix dehiscens?), breve v. elongatum, interdum ut in *Prosospermis* angustissimum. Semina transversa v. obliqua, nunc omnia v. in parte leguminis inferiore septis parallele compressa, nunc omnia v. in parte leguminis superiore valvis parallele compressa, v. omnia oblonga haud compressa. Cotyledones planæ v. rarius obliquæ v. flexuosæ.

I have taken Vogel's name for this section, although I have differently circumscribed it, as in both cases the common *C. occidentalis* may be considered the original species. Vogel considered it a subdivision of *Chamæfistula*, "legumine membranaceo e compresso tumido," adding "semina superiora sæpe verticalia, inferiora semper horizontalia," the latter character separating it from *Chamæsenna*, the



former from the other subsections of *Chamæfistula*. But now that the allied species are much better known, we find that this absolute reliance upon the pod and seeds would widely separate *C. occidentalis* from *C. Sophera* on the one hand, and from *C. ligustrina* and its allies on the other, which are so closely connected with it that Vogel himself, as well as many others, have doubted whether they may not be varieties; whilst of the five species collected together by Vogel as forming the subsection, only two strictly belong to it; for one of the others, *C. cana*, which he had not seen, proves to belong to *Prososperma*, another, *C. tomentosa*, has often the pod quite like that of some varieties of *C. bicapsularis*, and the third, *C. ruscifolia*, appears to me to be a cultivated form of *C. Sophera*. It has appeared to me that a much more natural and better-defined group can be obtained by taking the basal gland on the petiole below the leaflets as the essential character distinguishing it from all others of the subgenus *Senna*, the pod having an intermediate character between those of *Chamæfistula* and *Chamæsenna*, passing in several species, especially in *C. occidentalis* itself, from the one to the other. The only species somewhat ambiguous as to the gland are *C. oblongifolia*, in which a single leaflet, or even a pair, are sometimes developed at the gland, and *C. bahamensis* in *Chamæsenna*, where the lowest pair of leaflets is sometimes though rarely deficient, leaving the gland on the petiole as in *Oncolobium*. These two species are in other respects allied to each other, and connect the two sections.

\* *Foliola 4-9-juga, obtusa.*

65. *C. OBLONGIFOLIA*, Vog. ! *Syn. Cass.* 23. Frutex elatus. Foliola 7-9-juga (rarius 3-6-juga), oblonga, obtusa, glabra v. subtus ad costam barbata. Racemi ad apices ramorum subpaniculati. Legumen 3-4 poll. longum, 4 lin. latum.—*Fl. Bras.* 110.

*Hab.* Tropical and subtropical South America: South Brazil, and prov. Rio Janeiro and Minas Geraes.

66. *C. NEGLECTA*, Vog. ! in *Linnæa*, x. 394. Frutex. Foliola 4-6-juga, oblonga v. ovalia, obtusa, subtus dense molliterque pubescentia. Racemi in axillis superioribus v. ad apices ramorum subcorymbosi. Legumen lineare.—*Fl. Bras.* 111.

*Hab.* Subtropical South America: South Brazil, *Sello*; Tucuman, *Tweedie*.

67. *C. SULCATA*, DC. ! *Cat. Hort. Monsp.* 90. Herba v. suffrutex foetens. Foliola 6-9-juga, ovali-oblonga, obtusa, subtus pubescentia. Racemi axillares, breves, pauciflori, summi conferti. Legumen longissimum (6-10 poll. longum vix 2 lin. latum).—*Fl. Bras.* 112.

*C. sulcata*, Collad. ! *Hist. Cass.* t. 6.

*C. cernua*, Balb. ! *Cat. Hort. Taur.* 1813, 22.

*Hab.* Tropical America: Brazil, prov. S. Paolo and Minas Geraes.

\*\* *Foliola 4-6-, rarius plurijuga, sæpius acute acuminata (in C. Sophera ad \*\*\* vergentia).*

68. *C. LEPTOCARPA*, Benth. ! in *Linnæa*, xxii. 528. Herba v. suffrutex foetens. Foliola 5-7-juga, ovato-lanceolata, acute acuminata, glabra v. subtus pilosa. Racemi axillares, breves. Legumen longissimum (6-10 poll. longum, 1-1½ lin. latum).—*Fl. Bras.* 112.

Var. *HIRSUTA*, ad *C. hirsutam* vergens sed legumine longo tenui distincta.

*Hab.* Tropical America: Brazil, prov. Rio Janeiro and Minas Geraes, and a narrower-leaved form in Peru, Central America, and New Mexico, most, but not all, of the northern and western specimens belonging to the hirsute variety.

The long linear pod of this and the preceding species are like those of several species of *Prososperma*; but the transverse or oblique seeds, as well as the gland, are those of *Oncolobium*. Wright's New-Mexican specimens (n. 1032) are glabrous, and closely resemble those from Rio Janeiro.



69. *C. OCCIDENTALIS*, Linn. ! *Spec. Pl.* 539. Herba foetens, sæpe elata, annua (rarius perennis v. suffrutex ?). Foliola 4–6-juga, ovato-lanceolata v. lanceolata, acuta v. acuminata, glabra, subciliata. Racemi axillares, breves, summi conferti. Legumen 3–5 poll. longum, 2½–4 lin. latum, maturum crasso-compressum, late marginatum.—*Fl. Bras.* 112.

*C. occidentalis*, Bot. Reg. t. 83; Vell. Fl. Flum. Ic. iv. t. 66.

*Senna occidentalis*, Roxb. ! *Fl. Ind.* ii. 343.

*Cassia falcata*, Linn. ! *Spec. Pl.* 539.

*C. planisiliqua*, Linn. *Spec. Pl.* 540, ex parte.

*C. longisiliqua*, Linn. f. *Suppl.* 230; DC. ! *Prod.* ii. 497.

*C. foetida*, Pers. *Syn.* i. 457 (sub *C. occidentale*); Roxb. ! *herb. olim.*

*C. geminiflora*, Schrank, *Hort. Monac.* t. 26, *fide* DC.

*C. obliquifolia*, Schrank. in *Denkschr. Bot. Ges. Regensb.* ii. 40, ex char.

*C. linearis*, Mich. *Fl. Bor. Amer.* i. 261.

*C. caroliniana*, Walt. *Fl. Carol.* 134.

*C. ciliata*, Raf. *Fl. Ludov.* ex Torr. et Gr.

*Hab.* Tropical America, Asia, and Africa; very abundant in waste and cultivated places: probably of American origin, and not yet received from Australia.

The foliage and inflorescence of this species are generally nearly those of *C. laevigata*, except as to the gland, which is always below the lowest pair of leaflets, and usually very near the base of the petiole, not between the leaflets. The pod, when ripe and in a good state, is longer, narrower, more flattened and incurved than in *C. Sophera*, and, when young, very flat; it is then like those of *C. ligustrina* and *C. Marylandica*; but it thickens as it ripens, and the seeds, at least in the lower part of the pod, become more or less flattened and parallel with the transverse septa; in the upper part they are sometimes flattened in the contrary direction (parallel with the valves), as in *C. ligustrina*. But herbarium specimens are not unfrequent which, from their imperfect state, appear quite ambiguous between these species as to the fruit, and must be classed according to the still more uncertain characters of foliage and habit.

*C. planisiliqua*, Linn., has been referred here in the 'Botanical Register,' followed by others, on the authority of a determination in the Banksian herbarium, whilst *C. planisiliqua*, Lam. *Dict.* i. 645, has been supposed to be a different plant, to which De Candolle gave the name of *C. Plumieri*, and which has been referred by Grisebach to *C. glauca*. The fact is that the Linnæan and the Lamarckian supposed species are identical, Lamarck having merely copied Linnæus's diagnosis, which applies to *C. occidentalis*, and translated Plumier's description, which Linnæus had copied, both referring to Plumier's plate, ed. *Burm.* t. 77. What the latter represents it is impossible to determine, but certainly neither *C. occidentalis* nor *C. glauca*. The leaves are those of *C. Fistula*, the flowers quite unintelligible, the fruit more like that of the section *Fistula* than of any other, described as flat, whence the name, but figured as nearly terete, and filled with a series of unintelligible circles, described as *ossicles* or seeds, but more likely to be the transverse septa of the *Fistula* section, as they overlap each other. The whole species must therefore be passed over as an inexplicable puzzle, founded on the diagnosis of one species, with the representation of another cooked up by an inaccurate artist, and encumbered by the description of the fruit of a third species. The plant representing *C. planisiliqua* in the Linnæan herbarium is *C. siamea*, which is certainly not the one from which he took his diagnosis.

70. *C. SOPHERA*, Linn. *Spec. Pl.* 542 (*non herb. Linn.*). Frutex (v. suffrutex ?). Foliola 5–12-juga, ovato-lanceolata v. lanceolata, acuta v. acuminata, glabra, subciliata. Racemi axillares, breves, summi conferti. Legumen 2–4 poll. longum, maturum turgidum v. subteres, late marginatum, nunc obscure tetragonum.

*Senna Sophera*, Roxb. ! *Fl. Ind.* ii. 347.



*Chamæfistula Sophera*, G. Don, Gen. Syst. ii. 452.

*Cassia sopheroides*, Collad. Hist. Cass. 133.

*C. Canca*, Cav. Descr. 132, ex char.

*C. ruscifolia*, Jacq. Ic. Rar. i. t. 71, ex icone.

*C. lanceolata*, Forsk. Fl. Æg. Arab. ex parte; Bisch. ! in Bot. Zeit. 1850, 897, t. 10, non aliorum.

*C. ligustrina*, Forsk. ! in herb. Mus. Brit.

*Senna esculenta*, Roxb. ! Fl. Ind. ii. 346.

*Cassia esculenta*, Roxb. ! Hort. Beng. 31.

*C. ægyptiaca*, Willd. Enum. Hort. Berol. 442, ex char. et fide Vog.

*C. robinoides*, Willd. *l. c.*

*C. Barclayana*, Sweet. Fl. Austral. t. 32.

*C. schinifolia*, A. DC. ! Not. 7; Pl. Rar. Hort. Gen. 35.

*C. atropurpurea*, Span. in Linnæa, xv. 201, ex char.

**Var. TORULOSA**, foliis fere *C. occidentalis*, legumine tereti subtoruloso.

*C. chinensis*, Jacq. Coll. i. 64; Ic. Rar. t. 73 (forma hortensis, speciosa, racemis fere in paniculam terminalem confertis).

*Chamæfistula chinensis*, G. Don, Gen. Syst. ii. 452.

*Cassia indica*, Poir. Dict. Suppl. ii. 127.

*C. torosa*, Cav. Descr. 131, ex char.

*C. torulosa*, Poir. Dict. Suppl. ii. 126 (nomine Cavanillesco mutato).

*Chamæfistula torosa*, G. Don, Gen. Syst. ii. 452.

**Var. LIGUSTRINOIDES**, inflorescentia magis corymbosa.

*C. coromandeliana*, Jacq. Fragm. 67, t. 100, ex char. et ic.

*Chamæfistula coromandeliana*, G. Don, Gen. Syst. ii. 452.

*Cassia frutescens*, Mill. ! Dict. n. 2.

*C. patula*, Ait. ! Hort. Kew. ed. 1. ii. 51.

**Var. PURPUREA**, ramis (fide Roxb.) purpurascens, foliolis sæpius minoribus, ramulorum interdum obtusis.

*Senna purpurea*, Roxb. ! Fl. Ind. ii. 342.

*Senna Sophera*, var. *pupurascens*, Roxb. ! *l. c.* 347.

*Cassia purpurea*, Roxb. ! Hort. Beng. 31.

*Hab.* Tropical Asia, Africa, and Australia; more rare in tropical America, chiefly in Central America, the West-Indian Islands, and Columbia; in all continents most frequently only as cultivated or escaped from cultivation, with some evidence of being really indigenous in Australia, and more doubtfully so in Asia and America.

I have in the former part of this paper alluded to the uncertainty which prevails as to the origin of this species and the degree of affinity which it bears to *C. occidentalis*, an uncertainty which there must always be great difficulty in clearing up. Almost the whole of the long list of supposed species enumerated as synonyms have been described from garden specimens. The best observers describe *C. Sophera* as shrubby and *C. occidentalis* as annual; but from some collector's notes or gardener's observations it would appear that the former may flower the first year so as to appear annual, and that *C. occidentalis*, when large, may become more or less woody at the base. Roxburgh describes both his *S. Sophera* and *S. purpurea* as annual. The pod of the var. *torulosa* is described and figured with much more elevated transverse ridges than any I have seen. This appears to be a garden variety, with the foliage of *C. occidentalis*; the only Chinese specimens I have seen are the true *C. occidentalis* with a flattened pod, which is a weed of waste places in S. China as in other parts of tropical Asia. The var. *ligustrinoides* has the



inflorescence nearly of *C. ligustrina*, but the pod (in the few specimens in which I have seen it ripe) of *C. Sophera*. To this form belong those American specimens which may possibly be indigenous.

Among the numerous synonyms I have quoted, *C. atroviridis*, Span., has been referred by Miquel (Fl. Ind. Bat. i. pars i. 93) doubtfully to *C. alata*; but Spanoghe's character is totally at variance with that species. *C. aegyptiaca* and *C. robinoides*, Willd., had been referred by Vogel, who had seen the specimens, at first to *C. ligustrina*; but he afterwards (Linnæa, xv. 69) transfers them to *C. Sophera*, which is much more in accordance with the characters given. *C. chinensis*, Jacq., may not really belong to any wild form of this species, but represents probably a luxuriant garden variety. *C. chinensis*, Lam. Dict. i. 644 (altered to *C. grandiflora*, in Pers. Syn. Pl. i. 457), referred to *C. Sophera* by Vogel, is made up of a description drawn from a garden plant, which appears to me to refer rather to *C. bicapsularis*, with a reference to Rumphius's figure, iv. t. 33, which appears to represent *C. glauca*. *C. chinensis*, Collad. Hist. Cass. t. 10, is more probably *C. occidentalis*. At any rate the name must be altogether suppressed as designating only garden varieties. No *Cassia* is known from China, except the common Asiatic weeds *C. Tora*, *C. occidentalis*, *C. mimosoides*, &c.

71. *C. PUBESCENS*, Jacq. *Fragm.* 46, t. 57. Herba v. suffrutex foetens. Foliola 4–6-juga, ovato-lanceolata, acute acuminata, subtus pubescentia. Racemi corymbosi. Legumen quam in *C. occidentali* longius, angustius magisque arcuatum.—*Fl. Bras.* 113.

*Hab.* Tropical America: Brazil, near Rio Janeiro.

Of this I have only seen very few specimens, said to be wild, in Martius's herbarium; but they agree so well with Jacquin's figure and description that I have very little doubt of their identity. The form and number of leaflets &c. are those of *C. occidentalis* and of *C. hirsuta*, the pod and indumentum are intermediate between those two species, the inflorescence different from both.

72. *C. HIRSUTA*, Linn. *Spec. Pl.* 540. Herba foetens, undique hirsuta. Foliola 3–5-juga, ovata v. ovato-lanceolata, acuta v. acute acuminata. Racemi axillares, breves, summi conferti. Legumen lineare, turgidum v. subteres (6–8 poll. longum, 2–3 lin. latum), hirsutum.—*Fl. Bras.* 114, t. 34.

*C. venenifera*, Rodsch, in G. F. W. Mey. Prim. Fl. Esseq. 167, fide Griseb.!

*C. caracasana*, Jacq. Hort. Schoenbr. t. 270.

*C. tomentosa*, Wall.! Cat. Herb. Ind. n. 5304, non Linn.

*C. pubigera*, Lag. Gen. et Sp. Pl. Nov. 14, ex char.

*Hab.* Tropical America: in waste and cultivated places; common in many parts of Peru, but extends from Brazil and Bolivia to Mexico.

\*\*\* Foliola 6–9-juga, acuta v. acutiuscula, glabra v. ciliata.

73. *C. MARYLANDICA*, Linn. *Spec. Pl.* 541. Foliola oblonga v. oblongo-lanceolata. Racemi axillares, breves, subsessiles, multiflori, summi conferti. Flores flavi. Legumen lineare, planum (3–4 poll. longum, circa 3 lin. latum), glabrum v. pilosum.—*Torr. et Gr. Fl. N. Amer.* i. 395.

*C. reflexa*, Salisb. Prod. 326.

*C. acuminata*, Mœnch, Meth. 273.

*Hab.* Extratropical N. America: United States.

The plant representing *C. Sophera* in the Linnæan herbarium may be a garden variety of *C. marylandica*. Salisbury's and Mœnch's synonyms are merely arbitrary changes of names, because they disapproved of the Linnæan one.

74. *C. LIGUSTRINA*, Linn.! *Spec. Pl.* 541. Foliola oblonga v. oblongo-lanceolata. Racemi in paniculam corymbosam dispositi. Flores flavi quam in *C. Marylandica* majores.



Legumen planum v. valvulis convexiusculis, glabrum, 3–4 poll. longum, circa 3 lin. latum.

*C. ligustrina*, Bot. Reg. t. 109; Bot. Mag. t. 1829.

*Hab.* Tropical and subtropical N. America: Cuba, *Wright*, n. 149 and 1190, Bahamas, and perhaps Jamaica.

The foliage of this species is often very nearly that of *C. Sophera*, but usually has the still more numerous leaflets of *C. marylandica*, of which it has very nearly the pod, but is readily known by the larger, more showy yellow flowers in a compact terminal corymbose panicle. It has been frequently misunderstood, owing to an erroneous description of the fruit taken from the plate in the 'Hortus Elthamensis' representing the foliage and flowers of *C. ligustrina*, with a loose fruit copied from Plumier, but belonging to some other species (apparently *C. angustifolia*, Vahl).

75. *C. STENOPHYLLA*, *Benth.* Foliola angustissime linearia. Racemi corymbosi.

*C. decipiens*, Griseb. ! Enum. Pl. Cub. 79, non Desv.

*Hab.* Tropical America: Cuba, *Wright*, n. 1601.

Frutex videtur glaberrimus, ramulis tenuibus. Foliola 6–10-juga, linearia, acuminata, 2–3 poll. longa, vix 1 lin. lata, jugis secus petiolum tenuem 4–6-pollicarem distantibus; glandula supra basin petioli nunc brevis crassaque, nunc sæpius tenuis elongata. Racemi in axillis superioribus pedunculati, pauciflori, foliis multo breviores. Flores fere *C. occidentalis*. Legumen 4–5 poll. longum, 3 lin. latum, rectum, junius compressum, demum turgidulum.

#### Sectio 4. PROSOSPERMA.

Herbæ, suffrutices fruticesve. Folia interglandulosa. Stamina perfecta 6–7; staminodia 3. Legumen lineare, sæpius tetragonum, rectum v. arcuatum, ad suturam utramque dehiscens (rarius vix dehiscens?). Semina longitudinalia, oblique quadrata, cotyledonibus latissimis, undulato-plicatis.

Series 1. Toræ. *Herbæ suffruticesve. Pedunculi breves, 1–2-flori. Foliola 2–3-juga.*

76. *C. PENTAGONIA*, *Mill. ! Dict.* ed. 8. n. 18. Herba glabriuscula. Foliola pleraque 3-juga. Legumen utrinque acutum, alis 4 longitudinalibus herbaceis 1–2 lin. latis instructum.—*Fl. Bras.* 114, t. 34.

*Hab.* Tropical America: Brazil, prov. Minas Geraes, Central America.

Miller's plate, t. 82, contains a figure of a detached fruit of this plant. The flowering specimen figured may be the same also, if we suppose it to be a little exaggerated as to foliage, and the inflorescence to be supplied by the artist's imagination.

77. *C. TORA*, *Linn. ! Spec. Pl.* 538. Herba glabra v. adpresse pubescens. Foliola pleraque 3-juga. Legumen elongatum, angustum, tereti-tetragonum, arcuatum v. rectiusculum.—*Fl. Bras.* 115.

*Senna Tora*, Roxb. ! *Fl. Ind.* ii. 340.

*Cassia obtusifolia*, Linn. *Spec. Pl.* 539.

*C. Tagera*, Lam. *Dict.* i. 643, Collad. aliique non Linn.

*C. humilis*, Collad. ! *Hist. Cass.* 96.

*C. gallinaria*, Collad. *l. c.*

*C. fœtida*, Salisb. *Prod.* 325.

*C. Tala*, Desv. ! *Journ. Bot.* iii. (1814) t. 73.

*C. Sunsub*, Forsk. *Fl. Æq. Arab.* 86.

*C. toroides*, Roxb. ! *Hort. Beng.* 31.



*Senna toroides*, Roxb. ! Fl. Ind. ii. 341.

*Chamæfistula contorta*, G. Don !, Gen. Syst. ii. 452.

*Cassia contorta*, Vog. Syn. Cass. 20.

*C. candenatensis*, Dennst. in Steud. Nom. Bot. ed. 2, ex ic. cit.

*Hab.* Tropical and subtropical America, Asia, Africa, and Australia, generally common in cultivated and waste places, extending as far north as South Carolina, *Bartram* in herb. Mus. Brit.

The American *C. obtusifolia* has been generally distinguished from the Asiatic *C. Tora* by the curved, not straight, pods; but both are common in Asia, and the pod is sometimes curved or straight on the same plant, depending apparently sometimes on the degree of maturity or upon circumstances of weather or soil during growth, although there may really be also a variety where it is more usually straight than curved. The precise shape of the gland and its presence at the lowest pair only or at both pairs of leaflets, by which attempts have been made to distinguish some of the proposed species, are always exceedingly variable.

78. *C. PILIFERA*, Vog. ! Syn. Cass. 23. Herbacea v. basi frutescens, caule longe patentim piloso. Foliola 2-juga. Legumen elongatum, angustum, tereti-tetragonum, rectum v. arcuatum.—*Fl. Bras.* 115.

*C. maritima*, Willd. in Vog. Syn. Cass. 23.

*Hab.* Tropical and subtropical America: Brazil from Montevideo to Bahia and Matto-grosso, Bolivia, Central America.

79. *C. MUCRONIFERA*, Mart. ! Fl. Bras. *Cæsalp.* 116. Basi frutescens molliter tomentoso-pubescent. Foliola 3-juga. Stipulæ persistentes. Flores ampli. Legumen *C. Toræ*.

*Hab.* Tropical America: Brazil, prov. Bahia and Minas Geraes.

This has much the aspect of the pubescent form of *C. leiophylla*, but with a very different pod.

Series 2. Confertæ. *Frutices suffruticesve undique sericeo- v. stellato-tomentosi. Flores parvi in racemum brevem sessilem v. pedunculatum conferti.*

80. *C. SERICEA*, Swartz, Fl. Ind. Occid. 724. Rufo- v. fulvo-sericea. Foliola 3-5-juga. Legumen lineari-tetragonum, suturis continuis, inter suturas transverse inter semina impressum.—*Fl. Bras.* 146, t. 35.

*C. ornithopoides*, Lam. Dict. i. 466.

*C. sensitiva*, Jacq. Collect. ii. 362; Ic. Rar. t. 459.

*C. ciliata*, Hoffm. Verz. ex char. in DC. Prod. ii. 493.

*C. uniflora*, Mill. ! Dict. n. 5, non Spreng.

*C. monantha*, DC. Prod. ii. 506.

*Hab.* Tropical America: Brazil, W. Indies, Central America, Mexico.

Miller's typical specimen of *C. uniflora* is not really single-flowered, but in most of the axils only one pod has been formed; in one axil there are two pods, and there are the remains of the other flowers.

81. *C. VILLOSA*, Mill. ! Dict. n. 4. Undique pilis stellatis tomentoso-villosa. Foliola 3-5-juga, acuminata. Legumen inter semina constrictum, articulatum, articulis mono-spermis ovalibus plano-compressis medio ad semen elevatis.—*Hook. Ic. Pl.* t. 1060.

*C. astroites*, Cham. et Schlecht. in Linnæa, v. 597.

*Chamæfistula astroites*, G. Don, Gen. Syst. ii. 451.

*Cassia geniculata*, Ruiz et Pav. ! in G. Don, Gen. Syst. ii. 440.



*Hab.* Tropical America : Mexico, prov. Oaxaca, *Liebmann, Andrieux*, n. 418, and others. The pod in this species, very unlike that of any other *Cassia*, might readily be taken at first sight for that of a *Desmodium*.

Series 3. *Laxifloræ*. *Frutices foliolis subtus v. utrinque sericeis tomentosus v. rarius subglabris. Flores ampli, racemis laxis.*

\* *Stipulæ setaceæ, persistentes v. caducæ.*

82. *C. HYPOLEUCA*, *Mart. ! Fl. Bras. Cæsalp.* 117. Foliola 4–6-juga, supra glabra nitida, subtus cano-tomentosa. Legumen 4-pollicare, fere 2 lin. latum.

*Hab.* Tropical America : Brazil, prov. Minas Geraes.

83. *C. DYSOPHYLLA*, *Benth. ! in Mart. Fl. Bras. Cæsalp.* 117. Foliola 3–5-juga, utrinque molliter sericea v. velutina. Legumen 4–6-pollicare, vix 2 lin. latum.

*Hab.* Tropical America : Brazil, prov. Goyaz ; British Guiana, *Schomburgk*.

\*\* *Stipulæ foliaceæ, oblique reniformes, persistentes.*

84. *C. VELUTINA*, *Vog. ! Syn. Cass.* 24. Foliola 3–4-juga, late oblonga, supra sericeo-puberula, subtus rufo-tomentosa. Legumen semipedale, vix 2 lin. latum.—*Fl. Bras.* 118.

*Hab.* Tropical America : Brazil, prov. Piauhy and Matto Grosso.

85. *C. CANA*, *Nees ! et Mart. in Nov. Act. Nat. Cur.* xii. 34. Foliola 4–6-juga, oblonga, supra nitida subglabra, subtus canescenti-tomentosa. Legumen 3–5-pollicare, vix 2 lin. latum.—*Fl. Bras.* 118.

*Hab.* Tropical America : Brazil, prov. Bahia and Minas Geraes.

86. ? *C. LONGEGLANDULOSA*, *Benth. ! in Mart. Fl. Bras. Cæsalp.* 119. Ramuli fusco-pilossissimi. Foliola 6–10-juga, oblonga, pilosula, glandulis elongatis. Legumen ignotum.

*Hab.* Tropical America : Brazil, on the Amazon.

A remarkable and very distinct species, of somewhat doubtful affinity, the fruit being as yet unknown.

87. *C. APPENDICULATA*, *Vog. ! Syn. Cass.* 24. Foliola 3–4-juga, obovata, obtusissima v. emarginata, supra glabra nitidula, subtus pubescentia. Legumen semipedale, angustum.—*Fl. Bras.* 119, t. 36.

*C. australis*, *Vell. Fl. Flum.* 166, Ic. iv. t. 65, non *Sims*.

*Hab.* Tropical America : Brazil, prov. Rio Janeiro.

Series 4. *Coriaceæ*. *Frutices glaberrimi, foliolis rigide coriaceis. Flores ampli, racemis paniculatis. Species legumine ignoto quoad affinitatem subincertæ.*

I have unfortunately seen no fruit of either of the two following very remarkable species. The very coriaceous glabrous foliage is that of some species of *Abrus* ; but the flowers are very different, and are nearest in structure to those of *C. dysophylla* and *C. velutina*, which induces me to refer them to *Prososperma*.

88. *C. GORIFOLIA*, *Benth. in Mart. Fl. Bras. Cæsalp.* 120. Foliola bijuga, late ovata, 2–3-pollicaria. Stipulæ latissimæ, rigide foliaceæ, 1–2-pollicares.

*Hab.* Tropical America : Central Brazil, *Pohl*.

89. *C. GARDNERI*, *Benth. in Mart. Fl. Bras. Cæsalp.* 120. Foliola bijuga, suborbiculata, pollicaria. Stipulæ nullæ v. minutæ caducissimæque.

*Hab.* Tropical America : Brazil, prov. Bahia.



Sectio 5. CHAMÆSENNA.

Frutices, rarius arbores, v. in *Brachycarpis Pictisque* paucis herbæ. Folia interglandulosa v. eglandulosa, rarius nulla (ad squamas minutas reducta). Stamina perfecta 7 (rarius 6 infimo minore imperfecto), staminodia 3. Legumen compressum, ad suturam utramque dehiscens; valvulæ nunc planæ marginibus incrassatis v. nerviformibus, nunc convexæ vix marginatæ, interdum medio ad semina elevata subcristatæ v. longitudinaliter alata. Semina transversa v. obliqua, valvulis parallele compressa, rarius oblongo-subteretia v. leviter septis parallele compressa.

Like *Chamæfistula*, *Chamæsenna* as a whole is an artificial section, which, as a matter of convenience, I have adopted from De Candolle and Vogel with some slight modifications. The following groups as between themselves appear to be more natural, although not always definitely characterized; but the *Platycarpæ*, for instance, pass into the *Chamæfistulæ Corymbosæ*, and are often undistinguishable from them except by the pod, and the *Floridæ Paniculatæ* are represented in *Chamæfistula* by the *Excelsæ*. There are, however, no *Chamæsennas* corresponding to the *Bacillares*; for, in the few cases where the leaflets are reduced to two pairs with a gland between the lowest as in *C. multiflora* or *C. glaucescens*, their shape and general habit are totally different from those of the *Bacillares*; and in *Chamæsenna* neither the *Leptocarpæ*, *Pictæ*, or *Brachycarpæ*, nor the *Floridæ* (except the *Paniculatæ*) are at all likely to be mistaken for *Chamæfistulas*.

A. Folia interglandulosa (glandula inter par infimum, rarius inter paria plurima v. omnia foliolorum), rarius nulla.

Series 1. *Pachycarpæ*. *Antheræ erostres obtusæ v. poro (simplici v. duplici) parum prominulo v. in cupulam sessilem expanso. Legumen nunc breve latumque, nunc longius et angustius, valvulis tunc sæpius convexiusculis marginibus latis v. parum prominulis, in perpaucis ei Rostratarum simile. Foliola pauci- v. rarius multijuga, obtusa v. acutiuscula, sæpe crassiuscula. Stipulæ (excepta C. stipulari) lineares setacæ v. caducissimæ.*

The species of this group are none of them Brazilian or Guianese; and some of them are extratropical. They extend along the western side of the Andine range, without ascending high into the mountains, from temperate Chili to Peru, reappearing in Central America and Mexico; and one species, *C. bahamensis*, which connects the group with the *Leptocarpæ*, is found in two distinct varieties, or perhaps species, in Florida and in the Bahamas. The group generally shows a pod less flattened than that of other *Chamæsennas*, and often nearly that of *Oncolobium*; in some species, however, it is very flat but broad and short, with thin edges; very rarely, as in *C. bahamensis*, it seems to vary in the same species from the narrow flat pod with raised margins of *C. biflora* to the shape more common in *Pachycarpæ*, with convex valves not bordered. Although, therefore, I have named the group after the pod, I have taken the most definite distinctive character from the anthers; there are a few species, indeed, in which the pod is unknown, and which are therefore only conjecturally placed in the group.

\* *Foliola acuta, submembranacea. Species Chilenses.*

90. *C. STIPULACEA, Ait. ! Hort. Kew. ed. 1. ii. 52. Foliola 4-8-juga, ovato- v. oblongo-lanceolata, acuta, glabra v. pubescentia. Stipulæ foliaceæ. Legumen breve, latum, tenue.*

*C. fætida, Ruiz et Pav. !, G. Don, Gen. Syst. ii. 443.*

*C. opaca, Grah. ex char. in Vog. Syn. Cass. 42.*

*Hab.* Extratropical South America: Chile, near Valparaiso.

The broad stipules are those of the *Auriculatæ*; but the pod and the habit are quite different. I have been unable to find Graham's description of *C. opaca* in the 'Edinburgh New Philosophical Journal.'



Vogel has omitted to refer to the year; and I have looked through Graham's accounts of new and rare plants from the Edinburgh garden without success.

91. *C. CRUIKSHANKSII*, *Hook. et Arn.!* in *Hook. Bot. Misc.* iii. 210. Folia *C. stipulaceæ*, sed stipulæ parvæ, angustæ, caducæ. Legumen ignotum.

*Hab.* Extratropical South America: Chile, near Valparaiso.

A specimen from Bolivia, *Bridges*, in herb. Lindley, appears to be the same as *C. Cruikshanksii*, but with rather smaller flowers; they, however, are scarcely yet expanded.

\*\* *Foliola pauca v. plurima, crassiuscula, obtusa v. acutiuscula. Legumen latiusculum, sæpius biconvexum. Species Chilenses v. Peruviana.*

92. *C. HOOKERIANA*, *Gill.!* in *Hook. Bot. Misc.* iii. 210. Foliola 8–12-juga, oblongo-lanceolata, crassiuscula, glabra. Bracteæ lineari-lanceolatae, glabræ. Flores parvuli. Legumen rectum.

*Hab.* Extratropical South America: Argentine prov. S. Luis.

93. *C. CUMINGII*, *Hook. et Arn.!* in *Hook. Bot. Misc.* iii. 211. Foliola 4–6-juga, anguste oblonga v. linearia, glabra. Racemi folio longiores. Bracteæ lineari-setaceæ.

*C. acuta*, *Meyen*, *Reise*, 1376 ex descr. *Vog.* in *Pl. Meyen.* 40.

*Hab.* Extratropical South America: Chile, near Coquimbo.

94. *C. ARNOTTIANA*, *Gill.!* in *Hook. Bot. Misc.* iii. 211. Foliola 4–6-juga, cuneato-obovata, glabra. Racemi folio longiores. Bracteæ oblongæ, obtusæ, caducæ. Legumen biconvexum.

*C. andina*, *Philippi!*, in *Linnaea*, xxviii. 685.

*Hab.* Extratropical South America: Chile and Buenos Ayres.

95. *C. GLAUDESCENS*, *Benth.*, sp. nov. Foliola 2-juga, oblonga v. oblongo-lanceolata. Racemi subcorymbosi. Legumen biconvexum.

*Hab.* Extratropical South America: Chile, near Copiapo, *Pearce*.

Frutex 1–3-pedalis, dense ramosus, glaber v. minute pubescens, ramis foliisque viridi-glauciscentibus. Foliola 2-juga, oblonga v. oblongo-lanceolata, mucronato-acuta v. obtusiuscula, crassiuscula, 6–9 lin. longa; glandula tenuis inter inferiora. Stipulæ desunt. Racemi in axillis supremis subcorymbosi, pluriflori. Sepala angusta, colorata, 3 lin. longa. Petala aurea, oblonga, 4–5 lin. longa. Filamenta parum inæqualia; antheræ 3 cæteris longiores, omnes erostres, superiores vix brevissime appendiculatæ; staminodiorum laminæ oblongæ, obtusæ. Legumen glabrum, vix curvulum, acuminatum, 2–2½ poll. longum, 4–5 lin. latum, marginibus nerviformibus, valvulis membranaceis convexis. Semina transversa v. leviter obliqua, crassa, leviter valvulis parallele compressa.

This species closely connects the *Chamæsennæ Platycarpæ* with the *Chamæfistulæ Brachycarpæ*.

96. *C. AREQUIPENSIS*, *Meyen* in *Vog. Syn. Cass.* 43, et *Pl. Meyen.* 41. Foliola 10–12-juga (6–14-juga ex *Vog.*) oblonga, pilis appressis canescentia. Racemi folio longiores. Bracteæ angustæ, caducissimæ. Legumen biconvexum.

*Hab.* Tropical America: Peru near Arequipa, *Meyen*, *Pearce*.

97. *C. LATOPETIOLATA*, *Domb.!* in *Vog. Syn. Cass.* 29. Foliola 8–12-juga, oblonga v. oblongo-lanceolata, glabra. Stipulæ falcatae, lineares v. lanceolatae, nunc latiusculæ acuminatæ, caducæ v. persistentes. Racemi corymbosi. Flores majusculi. Legumen longiuscule stipitatum, apice rotundatum, biconvexum, 3–5-pollicare.



*Hab.* Tropical America: Andes of Peru, *Dombey*; Bolivia, *Mandon*, n. 1506; and Ecuador, *Jameson*, n. 214.

Var. Foliolis pollicaribus longioribusve, glandulis brevissimis.

*Hab.* Peru, *Pavon*.

98. *C. VERSICOLOR*, *Meyen in Vog. Syn. Cass.* 29, et *Pl. Meyen.* 39. Foliola 8–15-juga, angustè oblonga v. oblongo-lanceolata, glabra. Stipulæ falcatae, lineares, caducae. Racemi corymbosi. Flores quam in *C. latopetiolata* minores. Legumen brevissime stipitatum, acutiusculum, marginatum, subplanum v. demum biconvexum.

*Hab.* Tropical America: Andes of Bolivia, *Meyen*, *D'Orbigny*, *Mandon*, n. 751, *Bridges*, n. 10.

99. *C. BIROSTRIS*, *Domb. in Vog. Syn. Cass.* 43. Foliola 8–14-juga, ex ovali oblonga, subtus pubescentia; glandula inter inferiora. Stipulæ caducae. Bracteae acutae, subsistentes. Flores parvuli. Legumen latius quam in sequentibus, tenuius quam in praecedentibus.

*Hab.* Tropical America: Peru and Bolivia, *Pavon*, *Matthews*, n. 477, *Lechler*, n. 1932; Chinchin (not Chile), *Dombey*.

\*\*\* Foliola pauca v. plurima, quam in \*\* tenuiora saepiusque latiora et obtusiora. Legumen (ubi notum) quam in \*\* angustius, crassius tamen quam in Rostratis. Species 4 priores Peruvianae v. Chilenses; 4 posteriores Americae centralis v. borealis subtropicae incolae.

(Legumen in *C. birostri* latiusculum. Foliola in *C. bahamensis* var. *floridana* saepe crassiuscula.)

100. *C. CONJUGATA*, *Ruiz et Pav.!* MS. Foliola 1–2-juga, obovata, obtusa, glabra. Legumen latiusculum, planum.

*Hab.* Tropical America: Peru, *Ruiz and Pavon* in herb. Lambert, now Brit. Mus.; Cobija, *Gaudichaud*.

Frutex ramosissimus, glaber v. parce pubescens. Foliola 1–2-juga, brevissime petiolulata, oblique obovata v. oblonga, obtusissima, basi inaequilatera,  $\frac{1}{2}$ – $\frac{3}{4}$  v. rarius 1 poll. longa, concoloria, praeter costam subavenia, utrinque glabra v. subtus pilis brevibus conspersa; glandula tenuis v. stipitata, breviter conica inter inferiora. Petiolus  $\frac{1}{2}$ –1-pollicaris. Stipulæ minutae, caducae. Racemi in axillis superioribus laxè pauciflori, pedicellis 2–4 distantibus 3–8 lin. longis. Sepala valde inaequalia, interiora orbiculata, 2–3 lin. longa, exteriora brevia, angusta. Petala venis intensius coloratis picta, majora vix semipollicaria. Antherae apice cupuliferae erostres, 2 majores longius stipitatae. Legumen planum, membranaceum, 2–3 poll. longum, 4–5 lin. latum, rectum v. interdum valde curvatum.

101. *C. MANDONI*, *Benth.*, sp. n. Glaberrima. Foliola 2–4-juga, oblonga v. ovali-oblonga, obtusa, subtus pallida; glandula tenuis inter omnia paria. Racemi paniculati. Flores quam in *C. versicolori* paullo majores. Legumen breviter stipitatum, planum, membranaceum, glabrum, 3 poll. longum, 6 lin. latum.

*Hab.* Tropical America: Bolivia near Sorata, prov. Larecaja, *Mandon*, n. 751 bis.

This has the glabrous foliage and the flowers of *C. versicolor* with the leaflets of *C. aurantia* ( $\frac{3}{4}$ – $1\frac{1}{2}$  in. long), but with glands between all the pairs instead of between the lowest pair only, as in those two species and most of their allies.

102. *C. COQUIMBENSIS*, *Vog. Syn. Cass.* 27. Foliola 4–6-juga, obovato-oblonga, glabra v. subtus puberula. Racemi laxiflori. Bracteae lineari-subulatae.



*C. frondosa*,  $\beta$ , Hook. et Arn. ! in Hook. Bot. Misc. 210.

*C. flaccida*, Closs ! in C. Gay, Fl. Chil. ii. 238.

*Hab.* Extratropical S. America : Chile, Coquimbo, *Cuming*, *C. Gay*, *Gaudichaud*, and others ; also apparently Quillota, *Bertero*, n. 896.

103. *C. AURANTIA*, *Ruiz et Pav.* ! *G. Don*, *Gen. Syst.* ii. 441. Foliola 5–7-juga, oblonga, obtusa, pubescentia. Racemi laxiflori, folio longiores. Bracteae parvae, caducae.

*C. Dombeyana*, Vog. ! Syn. Cass. 28.

*Hab.* Tropical America : Peru or Bolivia.

Frutex habitu fere *C. bicapsularis*, undique pube brevi molli, in pagina superiore foliolorum tamen tenuiore canescens. Foliola 5–7-juga, breviter petiolulata, oblique oblonga, obtusa, basi valde inaequilatera, nunc 1–1½ poll. longa, nunc vix pollicaria ; glandula tenuis inter infima. Stipulae parvae, setaceae caducissimae. Pedunculi omnes axillares, supra medium laxe racemosi. Bracteae parvae, lineari-setaceae, caducae. Pedicelli ½–1-pollicares. Sepala valde inaequalia, interiora orbiculata 3 lin. longa, exteriora brevia oblonga. Petala semipollicaria, venosa. Antherae apice cupuliferae, duae circa 3 lin. longae filamentis longiusculis, quatuor breviores filamentis brevissimis.

*Dombey's* specimen in herb. Lindl. has rather smaller leaflets than *Pavon's*, but appears to be the same plant. As suggested by Vogel, it has some general resemblance to *C. mexicana* ; but the calyx is very different, the peduncles and racemes are also longer in proportion to the leaves. The pod is unknown.

104. *C. BAHAMENSIS*, *Mill.* ! *Dict.* n. 9. Foliola 3–5-juga, latiuscula, oblonga, obtusa v. mucronato-aristulata, glabra v. pilosula ; glandula nunc inter par infimum, nunc in petioli parte nuda. Racemi pauciflori, corymboso-paniculati. Legumen angustum.

*C. angustisiliqua*, Shuttlew. ! in Rug. Pl. Florid. exs. n. 197, non Lam.

*Hab.* Subtropical N. America : Bahama Islands and Florida.

Frutex glaberrimus v. pilis paucis adpressis conspersus. Foliola petiolulata, basi obliqua, ½–1-pollicaria, rigidule membranacea ; glandula obtusa nonnunquam (pari infimo foliolorum abortiente ?) infra foliola sita. Inflorescentia fere *C. ligustrinae*, sed flores multo minores. Petala pallida, picta. Antherae 2 longe stipitatae, arcuatae, 2½–3 lin. longae, suberostres, uniporosae, 4 subsessiles, rectae. Legumen fere *C. biflorae*, 3–4 poll. longum, 1½–2 lin. latum.

The variable position of the gland, either between the leaflets of the lower pair or on the leafless lower portion of the petiole, is the same as in *C. oblongifolia*, only that in the latter case it is only very rarely between the leaflets, and the pod and arrangement of the seeds are those of *Oncolobium* ; whilst in *C. bahamensis* the gland is only rarely below the leaves and the pod is quite that of *Chamaesenna*.

Var. ? *LATIFOLIA*, foliolis 2–4-jugis, ¾–1½-pollicaribus late oblongis ovalibusve obtusissimis vix mucronatis, racemis plurifloris, floribus majoribus, legumine 4–5 poll. longo 3–4 lin. lato saepe incurvo.

*Hab.* Bahamas, *Swainson*, also in herb. *Mus. Brit.*

This may possibly prove a distinct species ; if so, it would assume the name of *C. pallens*, given to it by *Dryander* in herb. Banks.

105. *C. BOTTERIANA*, *Benth.*, sp. nov. Foliola 3-juga, obovali-oblonga, obtusa, glabriuscula ; glandula inter infima. Racemi elongati, axillares, multiflori. Bracteae lineares. Antherae 3 majores erostres. Legumen lineare, latiusculum.

*Hab.* Tropical or subtropical N. America : Mexico, on Mount Orizaba, *Botteri*, n. 784 ; between San Blas and Tepic, *Coulter* ; near San José del Oro, *Karwinski*.

Frutex videtur habitu *C. bicapsulari* subaffinis, ramulis pubescentibus. Foliola membranacea, ¾–1½-pollicaria. Stipulae caducae. Racemi foliis aequilongi v. longiores. Bracteae parvae, subpersistentes.



Sepala circa 3 lin. longa. Petala semipollicaria, tenuiter venosa. Legumen 3–4 poll. longum, 3–4 lin. latum, planum, crassiusculum.

Botteri's specimens have in some herbaria, under the same number, 784, one also of *C. leiophylla*, Vog.

106. *C. SKINNERI*, *Benth.*, sp. n. Foliola 5–6-juga, anguste obovata v. cuneato-oblonga, subtus pubescentia. Pedunculi axillares, pauciflori. Petala maxima, subavenia, stipitata.

*Hab.* Guatemala, *Skinner*.

Frutex ramulis petiolis inflorescentiaque pilis brevibus pubescentibus. Foliola obtusissima, ultima pollice longiora, infra medium valde angustata, basi inæquilatera, brevissime petiolulata, inferiora decrescentia magis ovalia, omnia supra glabra, margine subtusque ad venas piloso-pubescentia; glandula tenuis inter paria 1–2 inferiora. Petioli communes vix 2-pollicares. Stipulæ lineari-setaceæ, elongatæ, subpersistentes. Pedunculi foliis breviores, apice confertim 2–5-flori. Bracteæ lineares. Pedicelli pollicares. Sepala interiora suborbiculata, 3–4 lin. longa, exteriora minora. Petala parum inæqualia, maxima fere 1½-pollicaria, patentissima. Antheræ 3 majores fere 5 lin. longæ, vix acuminatæ, pilis paucis conspersæ. Legumen (si rite huc relatum in herb. Lindl.) planum, vix dehiscens, 4 lin. latum.

A well-marked species, with the foliage nearly of some varieties of *C. bicapsularis*, but with the large flowers almost of the *Bacillares Speciosæ*. The pods accompanying the specimens are not attached to them, but, from the peduncles &c., appear really to belong to them. They are broken so as not to tell their real length, but are quite those of the *Chamæsennæ* of some of the following groups.

Series 2. *Aphyllæ*. *Folia nulla v. ad squamulas minutas reducta. Pedunculi ad nodos solitarii v. gemini, sæpissime biflori. Antheræ vix rostratæ. Legumen lineare, planum, marginatum.*

107. *C. APHYLLA*, *Cav. Ic. vi. 41, t. 561.* Glaberrima, aphylla. Rami tenues, apice sæpe spinescentes.

*Hab.* Extratropical S. America: Mendoza and Buenos Ayres.

108. *C. CRASSIRAMEA*, *Benth. ! in Hook. Ic. Pl. t. 1063.* Glaberrima, aphylla. Rami valde incrassati.

*Hab.* S. America: Andes of Salta, and dry hills, San Vicente, *Pearce*; Bolivia, prov. Tarija, *Weddell*.

Series 3. *Rostratæ*. *Antheræ staminum 2–3 inferiorum rostro cylindrico porifero terminatæ. Legumen sæpius angustum, valvulis planis marginibus incrassato-nerviformibus. Foliola pauci- v. multijuga, membranacea, obtusa v. rarius acutiuscula. Stipulæ lineares setaceæ v. caducissimæ.*

\* *Pedunculis solitariis geminisve bifloris v. rarius hinc inde subumbellatim 3–4-floris.*

109. *C. LEIOPHYLLA*, *Vog. ! Syn. Cass. 25.* Glabra (in forma typica). Foliola 2–3-juga, obtusissima. Sepala interiora semipollicaria. Legumen 3–4-pollicare, 2½–3½ lin. latum, arcuatum, marginatum.—*Fl. Bras. 120.*

*Hab.* Tropical America: Brazil.

Var.? *PUBESCENS*. Undique molliter pubescens; cætera omnia formæ glabræ Brasiliensis.

*C. pumila*, *Mart. et Gal. ! in Bull. Acad. Brux. x. pars ii. 307, non DC.*

*Hab.* Tropical America: Peru, near Tarapoto, *Spruce*, n. 4299; Central America, Nicaragua, *Ersted*; "New Spain," *Pavon*; near Jalapa, *Galeotti*, n. 3312.

The aspect, especially of the pubescent variety, is very nearly that of *C. mucronifera*, in *Prososperma*;



and the pod, more curved, with more oblique seeds than is usual in the *Rostratæ*, and perhaps rather thicker, approaches that of *Oncolobium*; but the flowers are very nearly those of *C. multiflora* and *C. biflora*.

110. *C. MULTIFLORA*, Mart. et Gal. ! in Bull. Acad. Brux. x. pars ii. 307. Glabra. Foliola 2- rarius 3-juga. Sepala interiora  $\frac{1}{4}$ -pollicaria. Legumen angustum, continuum.

*Hab.* Tropical America : Mexico, prov. Oaxaca, Liebmann, Andrieux, n. 416; Galeotti, n. 3145.

This is very nearly allied to *C. biflora*; but the leaflets appear to be constantly in two or rarely three pairs only, and the larger prominent flowers give the specimens a different aspect.

111. *C. BIFLORA*, Linn. ! Spec. Pl. 540. Pubescens v. glabrata. Foliola 4-10-juga (ramulorum rarius 2-3-juga), latiuscula, glabra v. subtus pubescentia. Legumen angustum, continuum.—*Fl. Bras.* 121.

*C. biflora*, Bot. Mag. t. 810; Bot. Reg. t. 1310.

*C. galegifolia*, Linn. ! Syst. Nat. ed. 10, 1017.

*C. tenuissima*, Linn. Spec. Pl. 541, ex char. et ex Vog.

*C. angustisiliqua*, Lam. Dict. i. 649, excl. ic. Plumieri.

*C. Marimari*, Aubl. Pl. Gui. 382, ex ic. Plumieri citata, t. 78. f. 1.

*C. crista*, Jacq. ! Ic. Rar. i. 8, t. 74.

*C. frondosa*, Ait. ! Hort. Kew. ed. 1. ii. 53.

*C. semperflorens*, DC. ! Cat. Hort. Monsp. 90.

*C. pallida*, Vahl, Ecl. iii. 12, ex descr.

*C. geminiflora*, Moç. et Sess. in Collad. Hist. Cass. 103, t. 3, ex ic. et descr.

*C. acapulcensis*, H. B. et K. ! Nov. Gen. et Sp. vi. 353.

*C. nemorosa*, H. B. et K. ! l. c.

*C. venustula*, H. B. et K. ! l. c. 352.

*C. Berteriana*, Balb. in DC. ! Prod. ii. 496.

*C. oxyadena*, DC. ! Prod. ii. 495, excl. syn. Desv. et Mill.

*C. fulgens*, Macfad !, Fl. Jam. i. 342.

*C. xiphioidea*, Bertol. Fl. Guatemal. 15 ? ex descr.

Var. *ROSTRATA*, glandula compressa latiuscula (in forma typica sæpius tenuis, acuta et erectiuscula, variat tamen latior et obtusa).

*C. rostrata*, Mart. ! Voigt in Syll. Pl. Nov. Soc. Ratisb. ii. 55; Verhandl. Preuss. Gartenb. Gesellsch. iii. t. 7.

*C. aversiflora*, Hook. ! Bot. Mag. t. 2138 (floribus solito majoribus).

*Hab.* Tropical America : Peru, Columbia, Central America, Mexico, and West Indies; the variety *rostrata* almost confined to Brazil, and the only one there.

A specimen of *C. biflora* in the Linnean herbarium is marked "*galegifolia*," in Linnæus's own handwriting. This name is, it is true, crossed out by Sir J. E. Smith; but the plant appears to be really the one Linnæus had in view.

*C. angustisiliqua*, Lam. Dict. i. 649, to which Vogel refers *C. Berteriana*, DC. Prod. ii. 496, from St. Domingo, would appear to be founded chiefly on one of the forms of *C. biflora* with many leaflets and short glands, several West-Indian specimens agreeing well with the descriptions given; but the figure of Plumier's referred to, t. 78. f. 2, is quite different, and appears to me to be a rude representation of *C. siamea*, probably from some West-Indian botanic garden, whence several of Plumier's figures were evidently taken. Plumier, however, describes the pod as terete, although the lower pods of his figure



seem to represent the flat pods with thickened margins of *Chamæsenna*. Perhaps Plumier may have transposed his memoranda, and should have described the pod of t. 77 as terete and that of t. 78. f. 2 as flat. In that case his descriptions would agree better with his drawings, and we should refer the former to *C. Fistula*, the latter to *C. siamea*, both of them in cultivation only in the West Indies.

I should have hesitated to refer the Brazilian *C. rostrata* to *C. biflora*, the broad obtuse gland being very constant in the former, and the narrow erect gland very general in the latter, but that I have met with several Central-American and West-Indian specimens in which the gland becomes dilated and obtuse, although, perhaps, not quite so much so as in the Brazilian ones. The species varies very much in the size and number of the flowers.

The Asiatic *C. divaricata*, Nees, from the Indian archipelago, closely resembles in many respects the same var. *rostrata* of *C. biflora*, connecting it in some measure with *C. glauca*, next to which it is placed below in the section *Psilorhegma*; for the anthers, although very unequal, are all perfect.

112. *C. POLYPHYLLA*, Jacq. *Coll.* iv. 104,  *Ic. Rar.* t. 460. Pubescens. Foliola 5–15-juga (sæpius 10–12-juga), parva, 2–3 lin. longa, margine ciliata, cæterum glabra v. subtus pilosula, foliis sæpius ad nodos fasciculatis. Cætera *C. bifloræ*. “Legumen semipedale.”

*C. marginata*, Willd. *Enum. Hort. Berol.* 444, ex Vog.

*Hab.* Tropical America: Portorico, *Pavon*, and also perhaps some other West-Indian islands.

*Pavon*'s specimen from herb. Lambert, now in herb. Mus. Brit., answers precisely to Jacquin's figure. Two others in herb. Hook., one from Jamaica, *Distin*, the other from St. Domingo, *Mackenzie*, have not the leaves clustered, and the leaflets are rather larger, but much smaller and more numerous (8 to 12 pairs) than in *C. biflora*, to which Grisebach would refer them. These specimens seem to me to connect the two species, but to be nearer to *C. polyphylla* than to *C. biflora*. The pod is rather broad.

113. *C. VICIÆFOLIA*, *Benth.*, sp. n. Molliter pubescens. Foliola 5–7-juga, angusta, supra puberula, subtus molliter tomentosa. Legumen elongatum, inter semina articulatim secedens.

*Hab.* Tropical America: Columbia, *Fendler*, n. 2230, 2231.

Frutex ramulis petiolisque molliter rufo- v. canescenti-pubescentibus. Foliola oblonga, obtusiuscula, mucronata, basi obliqua, ultima pollicaria v. paullo longiora, inferiora decrescentia. Stipulæ subulatae. Pedunculi ad nodos vetustos plerique biflori. Flores ampli *C. multifloræ*. Sepala valde inæqualia, interiora orbiculata, 3–4 lin. longa. Petala majora pollicaria. Antheræ longiores tenuiter longeque rostratae, 4 intermediae paullo minores, rostro brevissimo inflexo. Legumen semipedale v. longius, 3–3½ lin. latum, planum.

The foliage is nearly that of *C. incarnata*, but more pubescent; the inflorescence that of *C. biflora*. The character derived from the articulation of the pod requires perhaps further confirmation. It appears to be constant in the few specimens I have seen of this species; but I have sometimes, though rarely, seen symptoms of it in other species allied to *C. biflora*.

114. *C. FOLIOLOSA*, *Benth.*, sp. n. Foliola 20–30-juga, lineari-oblonga, conferta, glabra; glandula inter inferiora.

*Hab.* Guatemala, *Skinner in herb. Lindley*.

Tota glaberrima v. pilis paucis parvis præsertim in inflorescentia conspersa. Foliola obtusa, basi parum inæquilatera, sessilia, 4–6 lin. longa, crassiuscula, uninervia; glandula longiuscula acuta inter par infimum. Petiolus communis subpollicaris. Stipulæ rigidule setaceæ, subpersistentes. Pedunculi axillares biflori versus apices ramorum conferti et flores omnino *C. bifloræ*. Antheræ 3 inferiores majores, rostro tereti apice subdilato. Legumen junius planum, pilis adpressis conspersum, perfectum, haud suppetit.



This differs from all the biflorous *Rostratæ* in its numerous small leaflets, which give it, at first sight, the aspect of some of the smaller-leaved states of *C. multijuga*; but they are still smaller and more compact, and the inflorescence and flowers are those of *C. biflora*.

\*\* *Flores in pedunculo plurimi racemosi v. conferti.*

† *Foliola 6–12-juga, inflorescentia pube eglandulosa.*

115. *C. INCARNATA*, Pav. ! in herb. Lamb. nunc Mus. Brit. Foliola 7–10-juga, anguste oblonga, obtusa, subtus puberula; glandula inter inferiora. Stipulæ falcatae, lineares v. lanceolatae, aristatae, subpersistentes. Pedunculi apice confertim pluriflori. Legumen rectum.

*C. versicolor*, Benth. ! Pl. Hartw. 128, non Meyen.

*Hab.* Tropical America: Peru and Bolivia.

Frutex 6–8-pedalis, pluribus notis *C. bifloræ* affinis, petiolis angustis et inflorescentia diversus. Ramuli petioli inflorescentiaque tenuiter puberula subcanescentia. Foliola breviter petiolulata, obtusa v. obtusiuscula, 6–9 lin. longa, basi parum inæquilatera, utrinque concoloria, venis tenuibus. Pedunculi axillares, pollicares, 5–7-flori; bractæ minutæ, caducæ; pedicelli subpollicares. Sepala tenuia, interiora orbiculata, 3–4 lin. diametro, exteriora dimidio minora. Petala majora  $\frac{3}{4}$ -pollicaria. Antheræ majores tenuiter longeque rostratae. Legumen rectum, planum, marginatum, 3–4 poll. longum, 2½ lin. latum.

116. *C. ROBINLÆFOLIA*, Benth., sp. n. Foliola 6–10-juga, elliptico-oblonga, acuta, molli-ter pubescentia; glandulæ inter omnia v. pleraque paria.

*C. biflora*, Griseb. ! Cat. Pl. Cub. 79, non Linn.

*Hab.* Tropical America: Columbia, Ocaña, Schlim, n. 2; Cuba, Wright, n. 2370.

Frutex ramulis petiolisque brevissime tomentoso-pubescentibus. Foliola longiuscula, petiolulata, oblongo-elliptica, acuta v. acutiuscula, mucronata, basi inæquilatera v. subæqualia, 1–2-pollicaria, inferiora decrescentia, supra venosa pube minuta conspersa, subtus pallida densius pubescentia. Petiolus communis 3–5-pollicaris. Glandulæ tenues, stipitatae. Stipulæ setacæ, incurvæ, longiusculæ, caducæ. Pedunculi axillares, racemoso- 4–10-flori, inferiores folio multo breviores, floribus paucis subconfertis, superiores floribus numerosioribus folia sæpe superant. Pedicelli subpollicares. Bractæ minutæ, caducissimæ. Sepala interiora orbiculata, 3 lin. longa, exteriora minora, angusta. Petala majora pollicaria. Antheræ 3 majores longe angusteque rostratae. Staminodiorum laminæ late oblongæ. Legumen planum, marginatum, 3–5 poll. longum, 3–3½ lin. latum.

The Cuban specimens were referred by Grisebach to *C. biflora*, to which they certainly bear considerable affinity; but they appear to me to be sufficiently distinct in foliage and inflorescence to justify the establishing them as a distinct species. The Columbian specimens closely resemble the Cuban ones.

117. *C. RIEDELII*, Benth. ! in Mart. Fl. Bras. Cæsalp. 122. Foliola 10–12-juga, oblonga, subglabra; glandulæ inter omnia paria.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

118. *C. SPINESCENS*, Hoffm. ex Vog. Syn. Cass. 27, et in Linnæa, xi. 675. Folia spinis 2 stipularibus recurvis stipata; foliola 5–6-juga, ovata v. ovato-oblonga, acuta v. acuminata, glabra, subtus pallida, 1–3 poll. longa; glandulæ inter omnia paria. Inflorescentia puberula.

*Hab.* Tropical America: Brazil near Para, Hoffmannsegg in herb. Willd.

I have not seen this species, which is evidently a very distinct one, remarkable for its spinescent stipules, the only other prickly species being the *C. aculeata*, in which, however, the aculei are numerous and scattered. In the latter species, also, the habit and characters are those of the *Pictæ*, whilst *C. spi-*



*nescens*, from Vogel's very full and satisfactory description, is evidently one of the *Rostratæ*. Finding no specimens in any of the Brazilian collections I had before me in working up the genus for the 'Flora Brasiliensis,' I unfortunately overlooked it.

†† *Foliola 8-20-juga, inflorescentia glanduloso-pubescentis.*

119. *C. TRACHYPUS*, *Mart. ! Fl. Bras. Cæsalp.* 122. Foliola 8-12-juga, obtusa, glabra, subtus pallida; glandulæ inter omnia v. pleraque paria. Inflorescentia glanduloso-pubescentis, viscidula.

*Hab.* Tropical America: Brazil, prov. S. Paulo, Minas Geraes, Ceara, and Piauhy.

120. *C. ACURUENSIS*, *Benth. ! in Mart. Fl. Bras. Cæsalp.* 122. Foliola 10-20 juga, oblonga, obtusa, subtus v. utrinque pubescentia; glandulæ inter plurima v. fere omnia paria. Inflorescentia glanduloso-pubescentis, viscidula.

*Hab.* Tropical America: Brazil, prov. Bahia.

††† *Foliola 18-60-juga, inflorescentiæ pubes e glandulosa.*

121. *C. MULTIJUGA*, *Rich. in Act. Soc. Hist. Nat. Par.* 108. Ramuli tomentoso-pubescentes glabrative. Foliola 18-40-juga, lineari-oblonga, semipollice longiora, glabra v. subtus pubescentia; glandula inter par infimum. Racemi ample paniculati.—*Fl. Bras.* 132/t. 37.

*C. calliantha*, G. F. W. Mey. Prim. Fl. Esseq. 169.

*C. Richardiana*, Kunth!, *Mim.* 139, t. 42.

*C. Selloi*, G. Don!, *Gen. Syst.* ii. 442.

*C. fulgens*, Wall. ! *Cat. Herb. Ind.* n. 5310.

*C. magnifica*, Mart. ! *herb., Fl. Bras.* 106. n. 141.

*C. semifalcata*, Vell. *Fl. Flum.* 167; *Ic.* 4, t. 68.

*C. ampliflora*, Steud. ! in *Flora*, 1843, 760.

Var. *LINDLEYANA*, ramulis petiolis inflorescentiaque molliter fulvo-tomentosis.

*C. Lindleyana*, Gardn. ! in *Hook. Lond. Journ.* ii. 341.

*Hab.* Tropical America: from South Brazil, Tucuman, and Eastern Peru to Guiana, Columbia, and Central America; also Mexico and West Indies, but perhaps there cultivated only.

122. *C. VERRUCOSA*, *Vog. ! Syn. Cass.* 38. Tenuiter tomentella v. glabra. Foliola 30-60-juga, linearia, pleraque semipollice breviora. Cætera *C. multijugæ*.—*Fl. Bras.* 133.

*C. centijuga*, Wawra in *Flora*, 1864, 248.

*Hab.* Tropical America: Brazil, prov. Rio Janeiro and Bahia.

This may be a variety only of the common *C. multijuga* with more numerous leaflets, the *C. centijuga* of Wawra (if I am correct in referring to it Pecholt's specimens in herb. Mart.) having sometimes more than 60 pairs.

123. *C. MUTISIANA*, *Kunth!, Mim.* 142, t. 43. Ramuli pilis longis patentibus hirsutissimi. Foliola 40-50-juga, linearia, subtus pubescentia; glandulæ inter omnia paria.

*Hab.* Tropical America: Columbia.

Series 4. *Auriculatæ*. *Antheræ suberostres*. *Legumen planum, latiusculum, marginatum*. *Foliola pauci- v. plurijuga*. *Stipulæ foliaceæ, semicordatæ v. oblique reniformes*.

The three species I have here collected have a very different aspect from that of the other interglandular



*Chamæsennas*. The American one has the habit of the shrubby *Prosospermas*, the Asiatic and African ones approach more to the *Psilorhegmas*; and all have the pod of some species of the latter section. The stipules distinguish them from all other *Chamæsennas* except *C. stipularis*, which might, indeed, be included in the present group, but that its general habit and affinities seem to be rather with the other Chilian species with which I have associated it.

\* *Brasiliana, foliolis majusculis, 3-4-jugis.*

124. *C. RENIFORMIS*, *G. Don, Gen. Syst.* ii. 440. Pubescens. Foliola 3-4-juga. Stipulae foliaceae, subreniformes, persistentes. Racemi subcorymboso-paniculati. Legumen latiusculum.—*Fl. Bras.* 124.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

\*\* *Gerontogea, foliolis 8-14-jugis.*

125. *C. AURICULATA*, *Linn. Spec. Pl.* 542. Foliola 8-12-juga, ovalia, obtusa, glabra v. subtus pubescentia. Stipulae foliaceae, rotundato-semicordatae.

*Senna auriculata*, *Roxb. ! Fl. Ind.* ii. 349.

*Hab.* Tropical Asia: East-Indian peninsula.

There is no specimen of this species in the Linnæan herbarium.

126. *C. DELAGOENSIS*, *Harv. ! Fl. Cap.* ii. 272. Foliola 8-14-juga, oblongo-lanceolata, acuta v. acuminata, glabra v. subtus puberula. Stipulae foliaceae, falcatae, semicordatae.

*Hab.* Subtropical South Africa: Delagoa Bay, *Forbes.*

#### B. Eglandulosæ.

Series 5. Floridæ. *Folia eglandulosa. Racemi axillares v. in paniculam terminalem corymbosam v. amplam dispositi. Legumen sæpius elongatum, planum, marginibus incrassatis.*

\* *Parvifoliae, foliolis parvis pauci- v. multijugis.*

† *Legumen elongatum, marginibus nerviformibus.*

127. *C. WISLIZENI*, *A. Gray !, Pl. Wright.* i. 60 (*Smiths. Contr.* iii.). Foliola 4-7-juga, obovata v. late oblonga, sub-3-linearia. Racemi axillares, pedunculati, pauciflori. Flores majusculi. Legumen planum, 3-4 poll. longum, 3-4 lin. latum, marginibus nerviformi-incrassatis.

*Hab.* Subtropical North America: New Mexico and West Texas.

†† *Legumen brevius, latiusculum, suturis membranaceo-alatis.*

128. *C. GALEOTTIANA*, *Martens ! in Bull. Acad. Brux.* x. 2, 305. Foliola 4-7-juga, obovata, quam in *C. polyantha* minora et magis coriacea. Legumen idem.

*Hab.* Tropical America: Mexico, *Galeotti*, n. 3227, *Liebmann.*

129. *C. POLYANTHA*, *Moç. et Sess. in Collad. ! Hist. Cass.* 112, t. 2. Pubescens. Foliola 8-14-juga, oblonga, raro semipollicem longa. Flores parvuli, racemis corymboso-paniculatis.

*C. Browniana*, *Kunth !, Mim.* 135, t. 41.

*Hab.* Tropical America: Mexico, prov. Oaxaca.



\*\* Molles. *Foliola paucijuga, canescentia, subtus v. utrinque molliter pubescentia v. villosa. Legumen elongatum, planum, crassiusculum, valvulis coriaceis, marginibus crassis nec nerviformibus.*

130. *C. LÆTA, H. B. et K.! Nov. Gen. et Sp. vi. 340. Foliola 3-4-juga, ampla, acuminata, (3-5-pollicaria,) supra parce subtus molliter tomentosa.*

*Cathartocarpus lætus, G. Don, Gen. Syst. ii. 454.*

*Hab.* Tropical America: near Guayaquil.

We have no specimen of this species; but from a cursory glance at the one in the Humboldtian herbarium at Paris it appeared to me to be allied to, but distinct from, the two following, and remarkable for the size of the leaflets.

131. *C. EMARGINATA, Linn.! Spec. Pl. 538. Foliola 3-5-juga, rarius hinc inde bijuga, lata, obtusissima, supra pubescentia, subtus molliter tomentosa. Racemi breves, axillares v. ad nodos defoliatos fasciculati. Bracteæ parvæ, caducæ.*

*C. arborescens, Mill.! Dict. n. 15.*

*C. elliptica, H. B. et K.! Nov. Gen. et Sp. vi. 356.*

*C. canescens, H. B. et K.! Nov. Gen. et Sp. vi. 357.*

*C. grisea, A. Rich. Fl. Cub. i. 493, ex char.*

*C. chrysophylla, A. Rich. Fl. Cub. i. 500, ex char.*

*Hab.* Tropical America: Columbia, Central America, West Indies.

This species varies much in the breadth of the leaves. The anthers are sometimes quite glabrous, sometimes sprinkled with rather rigid short hairs.

132. *C. ATOMARIA, Linn. Mant. 68. Foliola 3-4- rarius 5-juga, ovata v. ovali-elliptica, acutiuscula v. acuminata, (1-3 poll.,) molliter pubescentia. Inflorescentia flores et legumina C. emarginatæ.*

*C. nutans, Collad. Hist. Cass. 113, t. 4.*

*C. mollissima, Humb. et Bonpl. in Willd. Enum. Hort. Berol. 440, ex descr.*

*C. graveolens, Colla, Hort. Ripul. App. ii. 343? ex descr. (specimina descripta nondum floruerunt).*

*Hab.* Tropical America: Mexico, Central America, Guayaquil, *Pavon*.

Very closely allied to *C. emarginata*, differing in the less obtuse, often acute or acuminate leaflets. Linnæus's specimen is a young seedling in leaf only, but it appears to be the same plant as the one grown in the Montpellier and other Continental botanic gardens as *C. atomaria*.

Var. *GLABRATA*, racemis longioribus multifloris, foliolis amplis obtusioribus.

*Hab.* "New Spain," *Pavon in herb. Boiss.*

133. *C. PERALTEANA, H. B. et K.! Nov. Gen. et Sp. vi. 356. Foliola 4-juga, oblonga, obtusa, supra puberula, subtus canescenti- v. aureo-pubescentia. Racemi folia æquantes.*

*Hab.* Tropical America: Mexico, near Campeachy.

134. *C. ANDRIEUXII, Benth. in herb. DC. Foliola 3-4-juga, ovata v. obovato-oblonga, obtusa, mollia, supra velutina, subtus dense cano-tomentosa v. lanata. Racemi elongati, floribundi, bracteis persistentibus. Legumen longum, pubescens.*

*Hab.* Tropical America: Mexico, *Andrieux, n. 414, Bates.*

Ramuli petioli inflorescentiaque dense mollissimeque pubescentes v. lanati. Foliola breviter petiolulata, crassa, mollissima,  $\frac{1}{2}$ -1-pollicaria, petiolo communi (in ramulis floridis) 2-2 $\frac{1}{2}$ -pollicari. Racemi pedunculati, conferti, nunc breves folia parum excedentes, nunc 4-5-pollicares dense floribundi. Flores majusculi. Bracteæ oblongæ, acuminatæ, concavæ, diu persistentes, rufo-lanatæ. Pedicelli  $\frac{1}{2}$ -1-pollicares. Sepala mem-



branacea, lanata, inæqualia, 3-5 lin. longa. Petala 6-9 lin. longa. Antheræ 7 parum inæquales, obtusæ. Legumen villosum, rectum, planum, marginatum, subsemipedale, 4 lin. latum, valvulis membranaceis.

135. *C. LIEBMANNI*, *Benth.*, sp. n. Foliola 6-10-juga, ovalia v. oblonga, obtusa, supra subvelutina, subtus canescenti-tomentosa v. villosa. Racemi laxi, foliis breviores. Bracteæ lanceolatae, subpersistentes. Legumen pubescens.

*Hab.* Tropical America: Mexico, prov. Oaxaca, *Liebmann*.

Ramuli petioli et inflorescentia molliter rufo-pubescentes. Folia 6-8 poll. longa; foliola  $\frac{3}{4}$ -1 $\frac{1}{4}$  poll. longa, mollia, basi obliqua. Racemi pedunculati, pedicellis  $\frac{1}{2}$ - $\frac{3}{4}$  poll. longis. Sepala crassiuscula, mollia, rufo-pubescentia, 2 $\frac{1}{2}$ -3 lin. longa. Petala subduplo longiora.

\*\*\* Paniculatae. *Foliola nunc ampla plurijuga, nunc oblonga multijuga. Racemi in paniculam amplam pyramidatam dispositi.*

† *Americanæ.*

136. *C. SAPINDIFOLIA*, *Vog.!* *Syn. Cass.* 34. Foliola 4-6- (rarius 2-3-)juga, ovata v. ovali-oblonga, 3-5-pollicaria, glabra.—*Fl. Bras.* 124.

*Hab.* Tropical America: Brazil, prov. Bahia.

137. *C. SYLVESTRIS*, *Vell. Fl. Flum.* 169;  *Ic.* iv. 78. Foliola 7-8-juga, ovato-oblonga v. lanceolata, basi subcordata, 2-4-pollicaria, subtus ferrugineo- v. sordide tomentosa. Legumen variat 4-8 poll. longum, 5-12 lin. latum.—*Fl. Bras.* 126, t. 38.

*Hab.* Tropical America: Brazil, prov. Minas Geraes, Goyaz, and Mattogrosso, Bolivia, Santa Anna, Chiquitos, *D'Orbigny*.

*C. punctata*, Scheele, in *Linnaea*, xvii. 336 (non *Vog.*), may possibly be a form of *C. sylvestris*, too imperfectly described for identification.

138. *C. RACEMOSA*, *Mill.!* *Dict. ed.* 8, n. 19. Foliola 8-10-juga, oblongo- v. ovato-lanceolata, sæpius acuta, 2-4-pollicaria, glabra v. subtus minute puberula.—*Fl. Bras.* 126.

*C. lucens*, *Vog.!* *Syn. Cass.* 46.

*C. trinitatis*, *Benth.!* in *Hook. Journ. Bot.* ii. 77, non *Reichb.*

*C. floribunda*, *Griseb. Pl. Lechl.* n. 2507, non *Cav.*

*Hab.* Tropical America: North Brazil, British Guiana, Columbia, Peru, and perhaps introduced into Asiatic Gardens, a specimen from Siam, *Schomburgk*, n. 251, in excellent flower and fruit, being undistinguishable from those American ones which have rather broad leaflets.

139. *C. DOMINGENSIS*, *Spreng.!* *Neue Entd.* iii. 55. Foliola 4-8-juga, ovato-lanceolata v. lanceolata, cuspidata, glabra, 1 $\frac{1}{2}$ -2-pollicaria, cætera *C. racemosæ* nisi calyx glabrior et flores paullo minores. Legumen 2-3 poll. longum, 4-5 lin. latum.

*Hab.* Tropical America: Hayti, *Bertero*, *Swartz*; Cuba, *Wright*, n. 150.

This is very closely allied to *C. racemosa*, differing chiefly in the somewhat fewer leaflets and more glabrous calyx. The fragmentary fruiting specimen in the Banksian herbarium which, on a hasty glance, *Vogel* referred to *C. domingensis*, evidently belongs to some Dalbergieous or Sophoreous shrub.

†† *Gerontogea.*

140. *C. SIAMEA*, *Lam. Dict.* i. 648. Foliola 6-10-juga, rarius plura, ovali-oblonga, obtusa, subcoriacea, glabra, sub-2-pollicaria.

*C. florida*, *Vahl, Symb.* iii. 57.

*C. Sumatrana*, *Roxb.!* *Hort. Beng.* 31.

*C. gigantea*, *Berter.!* in *DC. Prod.* ii. 492.



*Senna sumatrana*, Roxb.! Fl. Ind. ii. 347.

*Chamæfistula gigantea*, G. Don, Gen. Syst. ii. 452.

*Cassia arborea*, Macfad.!, Fl. Jam. i. 343.

*Hab.* Tropical Asia: Eastern archipelago and East India, but in many places introduced. Introduced also into Tropical America.

This has long been grown in gardens both in East India and in Jamaica and other American settlements. It appears to be truly indigenous in Ceylon, the Indian and Malayan peninsulas, the Eastern archipelago, and Siam, whence we have had specimens from Sir R. Schomburgk under the nos. 122 and 212.

141. *C. MONTANA*, Heyne! in Roth. Nov. Sp. Pl. 214. Foliola 10–16-juga, anguste oblonga, obtusa, glabra, nunc vix pollicaria, nunc 1–2-pollicaria. Stipulæ caducissimæ, parvæ, rarius basi subdilatatae.

*C. setigera*, DC.! Prod. ii. 499.

*Senna glauca*, Roxb.! Fl. Ind. ii. 351.

*Hab.* Tropical Asia: E. Indian peninsula.

A specimen in fruit from Nossibé, off the coast of Madagascar, Boivin, in herb. Hook., is very much like this species, but with a much broader pod.

142. *C. LAXIFLORA*, Benth.! Fl. Austral. ii. 283. Foliola 10–20-juga, anguste oblonga, obtusa, molliter tomentoso-pubescentia, vix pollicaria. Bracteæ inconspicuæ.

*Hab.* Tropical Australia.

143. *C. TIMORENSIS*, DC.! Prod. ii. 499. Foliola 10–20-juga, anguste oblonga, obtusa, subtus pubescentia, vix pollicaria. Stipulæ reniformes, caducæ v. rarius subpersistentes, interdum in panicula terminali ad basis racemorum bracteas simulantes.

*C. palmata*, Wall.! Cat. Herb. Ind. n. 5306.

*Hab.* Tropical Australia, Ceylon, Burmah, Eastern Archipelago.

Series 6. Pictæ. *Folia eglandulosa v. rarius glandulæ minutæ parum conspicuæ inter foliola. Racemi in summis axillis v. pseudo-terminales, ante anthesin bracteis latis membranaceis imbricatis sæpius strobilacei, per anthesin elongandi. Petala venis intense coloratis picta. Legumen sæpe latum, planum v. valvulis medio ad semina elevatis cristatis v. longitudinaliter alatis.*

\* *Subglabra, legumine alato.*

144. *C. ALATA*, Linn. Spec. Pl. 541. Foliola 8–14-juga, ampla, obovata v. oblonga, obtusissima. Stipulæ obliquæ, acuminatæ, persistentes at parvæ. Bracteæ amplæ.—*Fl. Bras.* 126; *Oliv.*! *Fl. Trop. Afr.* ii. 275.

*C. bracteata*, Linn. f. Suppl. 232.

*C. herpetica*, Jacq.! Obs. ii. 24, t. 45. f. 2 (ic. partis folii tantum).

*Senna alata*, Roxb.! Fl. Ind. ii. 349.

*Hab.* Tropical Asia, Africa, and America.

\*\* *Pubescentes, rarius subglabræ, legumine exalato.*

145. *C. RETICULATA*, Willd. Enum. Hort. Berol. 443. Foliola 9–12-juga, oblonga, obtusa v. mucronata. Stipulæ lanceolato-falcatae, subpersistentes. Bracteæ amplæ. Legumen transverse inter semina leviter elevatum.—*Fl. Bras.* 127.

*C. strobilacea*, H. B. et K.! Nov. Gen. et Sp. vi. 347.

*C. Tarantan*, H. B. et K.! l. c. 348.



*C. dumetorum*, Bert.! in DC. Prod. ii. 499.

*Hab.* Tropical America: N. Brazil, Guiana, Columbia, and Central America.

146. *C. PISTACIÆFOLIA*, *H. B. et K.!* *Nov. Gen. et Sp.* vi. 349. Fruticosa v. arborea. Foliola 6–12-juga (rarius 4–5-juga), oblonga, obtusa,  $1\frac{1}{2}$ –3-pollicaria, coriacea, glabra v. subtus pubescentia. Stipulæ caducissimæ. Racemi ad apices ramorum conferti, subpaniculati, pubescentes. Bracteæ 2–3 lin. longæ, caducæ v. obsoletæ. Legumen 2–3-pollicare, planissimum.

Var. GLABRA.

*C. fraxinifolia*, *H. B. et K.!* *Nov. Gen. et Sp.* vi. 349.

*C. cuspidata*, Willd. Enum. Hort. Berol. 443, ex Vog.

*Hab.* Tropical America: Columbia, *Humboldt and Bonpland*; Antioquia, *Triana*.

The leaflets appear to vary considerably on different branches, from few and large to numerous and small, quite glabrous or pubescent underneath, especially when young.

147. *C. NOTABILIS*, *F. Muell.!* *Fragm.* iii. 28. Villosæ. Foliola 9–15-juga, ovato-lanceolata v. oblonga, acuta v. infima obtusa cum mucrone. Stipulæ angustæ, caducæ. Racemi longe pedunculati. Bracteæ lanceolatae, caducæ.—*Benth. Fl. Austral.* ii. 284.

*Hab.* Tropical Australia.

148. *C. VENUSTA*, *F. Muell.!* *Fragm.* i. 165. Sequenti *C. didymobotryæ* simillima, nec distinguenda nisi foliis majoribus, foliolis 1–2-pollicaribus, floribus per contra dimidio minoribus.—*Benth. Fl. Austral.* ii. 284.

*Hab.* Tropical Australia.

149. *C. DIDYMOBOTRYA*, *Fresen. in Flora*, 1839, 53. Foliola 7–15-juga, oblonga,  $\frac{3}{4}$ – $1\frac{1}{2}$  pollicaria. Stipulæ cordato-ovatae, aristatae, subpersistentes. Bracteæ ovatae, caducissimæ. Legumen planum.—*Oliv.!* *Fl. Trop. Afr.* ii. 276.

*Hab.* Tropical Africa.

150. *C. MARTIANA*, *Benth.!* in *Mart. Fl. Bras. Cæsalp.* 127. Foliola 15–20-juga, oblongo-lanceolata, acuta v. obtusiuscula. Stipulæ foliaceæ, semicordatae, persistentes. Bracteæ amplæ. Leguminis valvulae ad semina singula convexæ.

*Hab.* Tropical America: Brazil, prov. Bahia.

\*\*\* *Glaberrimæ, legumine exalato.*

151. *C. ACULEATA*, *Benth.!* in *Mart. Fl. Bras. Cæsalp.* 128, t. 39. Aculei sparsi. Foliola 10–14-juga, oblonga, spinoso-mucronata. Stipulæ cordato-ovatae, 1–2-pollicares. Bracteæ ovatae. Legumen planum.

*Hab.* Tropical America: Brazil, prov. Piauhy and Goyaz.

152. *C. PARADICTYON*, *Vog.!* *Syn. Cass.* 45. Herbacea v. suffruticosa. Foliola 4–8-juga, ampla, obovata v. late oblonga, obtusissima. Stipulæ cordato-ovatae, infrapollicares. Bracteæ ovatae v. ovato-oblongæ.—*Fl. Bras.* 128.

*Hab.* Tropical America: South Brazil.

153. *C. MAGNIFOLIA*, *F. Muell.!* *Fragm.* i. 166. Foliola 4–8-juga, late ovata, obtusissima, coriacea. Stipulæ ovatae, marginibus basi recurvis. Legumen planum.—*Benth. Fl. Austral.* ii. 283.

*Hab.* Tropical Australia.



154. *C. PODOCARPA*, *Guill. et Perr.!* *Fl. Seneg.* 259. Foliola 3–5-juga, ampla, ovalia obtusa, membranacea. Stipulæ parvæ, semiovales, reflexæ, caducæ. Bracteæ ovatæ. Leguminis valvulæ ad semina singula transverse elevatae.—*Oliv.!* *Fl. Trop. Afr.* ii. 276.

*C. Afzeliana*, *Vog.!* in *Linnaea*, xv. 70.

*Hab.* Tropical Africa.

155. *C. NICARAGUENSIS*, *Benth.*, sp. n. Foliola 10–15-juga, oblonga, mucronato-acuta. Stipulæ reniformi-falcatae, acuminatae. Bracteæ amplæ. Leguminis valvulæ medio ad singula semina elevatae.

*Hab.* Tropical America, Mexico, and Central America, *Seemann*, *Ærsted*.

Foliola quam in *C. picta* multo angustiora, subsessilia. Stipulæ maximæ, sæpe pollicares, semicordato-reniformes, acutissime acuminatae. Bracteæ  $\frac{3}{4}$ –1-pollicares. Legumen 3–4 poll. longum, 6–8 lin. latum.

156. *C. PEARCII*, *Benth.*, sp. n. Foliola 6–8-juga, ovata v. ovali-oblonga, obtusa, aristato-mucronata. Stipulæ caducissimæ. Bracteæ ovatæ. Antheræ majores basi longe aristato-sagittatae.

*Hab.* Tropical America: Bolivia, La Bama, at an elevation of 9000–10000 feet, *Pearce*.

Frutex 6–10-pedalis, undique glaberrimus. Foliola sessilia, basi semicordata,  $1\frac{1}{2}$ –3-pollicaria, rigida, venosa, læte virentia. Petiolus communis teres, eglandulosus. Racemi in axillis supremis subterminalesque, elongati. Bracteæ ovatæ, acuminatae, membranaceæ, coloratae, 3–4 lin. longæ, caducissimæ. Pedicelli semipollicares v. paullo longiores. Sepala petaloidea, interiora  $\frac{3}{4}$ -pollicaria. Petala venosa, calyce paullo longiora. Antheræ 2 majores 7–8 lin. longæ, incurvæ, auriculis longis acutissimis basi sagittatae, infima brevis sterilis auriculis divaricatis, 4 intermediæ 3 lin. longæ, auriculis brevibus; staminodia 3 laminis deltoideis. Ovarium glabrum. Legumen haud suppetit.

157. *C. PICTA*, *G. Don!*, *Gen. Syst.* ii. 444. Foliola 4–6-juga, ovali-elliptica, obtusa v. emarginata, membranacea. Stipulæ caducissimæ. Bracteæ ovatæ. Leguminis valvulæ medio ad semina in lineam continuam longitudinalem elevatae.

*C. applanata*, *N. J. Anders.!* *Galap. Veget.* 254.

*Hab.* Tropical America: Ecuador and Galapagos Islands.

Series 7. Brachycarpæ. *Folia eglandulosa. Racemi axillares, per anthesin elongandi. Bracteæ membranaceæ in racemo nascente alabastra occludentes ut in Pictis, per anthesin caducæ. Legumen breve, latum, arcuatum, obliquum v. rectum, planissimum v. valvulis medio ad semina elevatis subcristatis. Species omnes gerontogæ. (Genus Senna, Batka.)*

The synonymy and distinctive characters of the species of this section have been most carefully and accurately worked up by Wenzel Batka, of Prague, from whose 'Monographie des Cassien Gruppe Senna,' 1866, I have chiefly taken the following abstract, omitting several of the purely pharmaceutical synonyms, for the details of which I must refer to his work. I cannot, however, agree with him in raising the group to the rank of a genus: all the characters he gives pass so gradually into the usual *Cassia* characters through several species of the *Pictæ* group (little or not at all known to Batka) that Vogel and others of his predecessors, in admitting a section *Senna*, have included in it more or less of those connecting species; and Vogel finally expressed his opinion that *Senna* must be given up as a section distinct from *Chamasenna*.

\* 158. *C. PLEUROCARPA*, *F. Muell.!* *Fragm.* i. 223. Glabra. Foliola sub-5-juga, oblongo-lineararia. Legumen rectum, valvulis medio ad semina singula cristatis.—*Benth. Fl. Austral.* ii. 284.

*Hab.* Tropical and extratropical Western Australia.



Although the pod in this species is straighter than in any of the African and Asiatic ones, yet it clearly forms one of the group. In Lindley's herbarium there is a specimen from Swan River, *Mangles*, with narrower leaflets and longer leaves and racemes than in any others, which appears to belong to this species; but the pod is not sufficiently advanced to determine it accurately.

159. *C. ADENENSIS*, *Benth.* Foliola 3–8-juga, ovata, glabra. Legumen stylo laterali, subfalcatum, planum, ecristatum.

*Senna Hookeriana*, Batka!, Monogr. Senn. 37, 52, t. 5.

*Hab.* Tropical Asia: Aden.

160. *C. OBOVATA*, *Collad.! Hist. Cass.* 92, t. 15. Foliola 3–7-juga, obovata, glabra. Legumen falcatum, valvulis medio ad semina singula cristatis.—*Oliv.! Fl. Trop. Afr.* ii. 277.

*C. senna*, Linn. Spec. Pl. 539, ex parte.

*C. ligustrina*, Mill. ! Dict. n. 12, et auct. nonnull. antiq. non Linn.

*C. porturegulensis*, Bancr. Nat. Hist. Gui. ex Batka.

*C. Burmanni*, Wall. in Madr. Journ. ex Batka.

*Senna obtusa*, Roxb. ! Fl. Ind. ii. 344.

*Cassia obtusa*, Roxb. ! Hort. Beng. 31; Wight, Ic. t. 757.

*C. arachoides*, Burch. ! Trav. i. 341.

*Senna obovata*, Batka!, Monogr. Senn. 32, 46, t. 3, cum syn. plur. pharmacolog.

*Hab.* Tropical and Southern Africa and Western Asia to the Indian peninsula; the Asiatic specimens mostly with smaller flowers than the African ones.

161. *C. HOLOSERICEA*, *Fresen. in Flora*, 1839, 54. Foliola 5–8-juga, obovata ovata v. oblonga, pubescentia. Legumen planum, ecristatum, falcatum.

*C. pubescens*, R. Br. ! in Salt's Exped. App. 64 (nomen tantum); *Oliv.! Fl. Trop. Afr.* ii. 278, non Jacq.

*C. Saltiana*, Steud. Nom. Bot. ed. 2.

*C. cana*, Wender. in Linnæa, xii. 22, non Nees.

*C. Schimperii*, Steud. Nom. Bot. ed. 2; Bisch. in Bot. Zeit. 1850, 884.

*Senna ovalifolia*, Batka!, Monogr. Senn. 35, 50, t. 4.

*Hab.* Tropical Africa.

A specimen of this species is in the Copenhagen herbarium with Forskâhl's label "*Cassia Aschrek*, from Moor;" but the short character he gives, *Fl. Æg. Arab.* 86, must be taken, partly at least, from some very different species.

162. *C. ACUTIFOLIA*, *Delile, Fl. Æg.* ii. 259, t. 27. Foliola 4–5-juga, acuta, puberula v. glabra. Legumen stylo laterali, subfalcatum, planum, 9–12 lin. latum.—*Oliv.! Fl. Trop. Afr.* ii. 278.

*C. senna*  $\beta$ , Linn. Sp. Pl. 539.

*C. lanceolata*, Collad. ! *Hist. Cass.* 93, t. 15. C., et auct. plur. non Forsk.

*C. lenitiva*, Bisch. in Bot. Zeit. 1850, 885, ex Batka.

*C. orientalis*, Pers. Syn. Pl. i. 457, pro parte ex Batka.

*Senna acutifolia*, Batka!, Monogr. Senn. 27, 41, t. 1.

*Hab.* Tropical Africa.

163. *C. ANGUSTIFOLIA*, *Vahl, Symb.* i. 29. Foliola 5–8-juga, acuta, glabra. Legumen stylo sublaterali, rectiusculum, planum, 7–8 lin. latum.—*Oliv. Fl. Trop. Afr.* ii. 279.

*C. lanceolata*, Royle!, *Illustr.* t. 37, et auct plur. non Forsk.

*C. ligustrinoides*, Schrank in Denksch. Akad. Münch. vi. 179, ex Batka.

*C. decipiens*, Desv. ! *Journ. Bot.* iii. (1814) 73.



*C. Ehrenbergii*, Bisch. in Bot. Zeit. 1844, 51, ex Batka.

*C. medicinalis*, Bisch. in Bot. Zeit. 1850, 887, ex Batka.

*Senna angustifolia*, Batka!, Monogr. Senna, 30, 44, t. 2.

*Senna officinalis*, Roxb.! Fl. Ind. ii. 346.

*Hab.* Tropical Africa.

#### Sectio 6. PSILORHEGMA.

Stamina 10, omnia perfecta, filamentis brevibus; antheræ æquales v. inferiores paullo longiores, apice truncatæ v. in rostrum brevissimum contractæ, loculis primum poris oblongis seu rimis brevissimis terminalibus dehiscentibus, demum secus suturas laterales sæpe plus minus hiantibus. Legumen et semina *Chamæsennæ*. Folia interglandulosa v. eglandulosa. Racemi axillares v. ad apices ramorum subcorymboso-conferti, pedicellis ad apicem pedunculi subumbellatim confertis. Species omnes gerontogæ, imprimis Australasiæ.

Series 1. Interglandulosæ. *Glandulæ ovatæ oblongæ v. tenues, inter foliolorum par infimum v. paria plurima v. omnia.*

\* *Pedunculi 2-3-flori.*

164. *C. LEPTOCLADA*, Benth.! *Fl. Austral.* ii. 290. Glabra, glauca. Foliola 2-juga, obovata v. oblonga, obtusissima. Pedunculi brevissimi, pedicellis filiformibus. Legumen rectum, orbiculare v. oblongum.

*Hab.* Tropical Australia, north coast.

165. *C. GONIOIDES*, A. Cunn.!; Benth. in *Hook. Ic. Pl.* xi. 48, t. 1061. Glabra v. pubescens. Foliola 2-3-juga, lanceolata v. ovato-lanceolata, acutissima. Pedunculi petiolo æquilongi. Legumen valde arcuatum.

*Hab.* Tropical Australia: N.W. coast, A. Cunningham (accidentally overlooked in *Fl. Austral.*).

166. *C. DIVARICATA*, Nees! in *Syll. Pl. Nov. Ratisb.* i. 94. Foliola 8-12-juga, oblonga, obtusa, subtus pallida v. glauca. Flores ampli. Antheræ inæquales, majores subrostratæ. Legumen elongatum, angustum.

*C. adenantha*, Zoll. et Mor.! *Verz.* 2.

*C. bifida*, Zoll. in *Nat. en Geneesk. Arch.* iv. 68, ex Miq.! *Fl. Ind. Bat.* i. pars i. 98.

*Hab.* Tropical Asia: Eastern archipelago.

This species closely resembles in foliage and inflorescence the Brazilian *C. biflora* var. *rostrata*. The gland is the same, but sometimes placed a little below the lowest pair of leaflets. The flowers are rather longer; and the stamens, though similar in shape and inequality, appear to be always all ten perfect, and the lateral ridges often split open. The pod is much longer.

\*\* *Pedunculi subumbellatim v. racemoso-pluri- v. multiflori.*

167. *C. DEPLANCHEI*, Benth., sp. n. Foliola 2-3-juga, obovata v. ovalia, supra nitida, subtus pallida. Flores parvuli, subumbellati. Legumen latiusculum, rectum v. leviter incurvum.

*Hab.* New Caledonia, Deplanche, n. 342.

Very near *C. Gaudichaudi*; but the leaflets are fewer, broader, more coriaceous, the racemes more umbel-like, the flowers fewer, and the common peduncle very short. The flowers and fruit are otherwise the same in both.



168. *C. GAUDICHAUDI*, *Hook. et Arn. ! Bot. Beech. Voy.* 81. Foliola 3–5-juga, elliptico-oblonga v. ovalia, obtusa, concoloria, glabra v. pubescentia. Flores parvuli, racemosi. Legumen latiusculum, rectum v. leviter incurvum.

*Hab.* Sandwich Islands.

This varies much in the breadth of the pod as well as in the foliage, glabrous or pubescent.

169. *C. GLAUCA*, *Lam. Dict.* i. 647. Foliola 4–10-juga, ovalia v. elliptico- v. obovato-oblonga, obtusa, supra glabra, subtus glauca, sæpius puberula. Flores majusculi. Bracteæ acuminatæ. Legumen rectum, elongatum, latiusculum, costis transversis extus inter semina siccitate prominulis.

*C. surattensis*, Burm. *Fl. Ind.* 97.

*C. arborescens*, Vahl, *Symb.* iii. 56 (glandula inter par infimum).

*Senna arborescens*, Roxb. ! *Fl. Ind.* ii. 345.

*Cassia fastigiata*, Vahl, *Symb.* iii. 57, ex deser. (glandulis inter omnia paria).

*C. speciosa*, Roxb. ! *Hort. Beng.* 31.

*Senna speciosa*, Roxb. ! *Fl. Ind.* ii. 347.

*Cassia suffruticosa*, Kœn. ! in *Roth. Nov. Sp. Pl.* 213; *Benth. Fl. Austral.* ii. 285.

*C. enneaphylla*, Kœn. ex W. et Arn. *Prod. Fl. Penins. Ind. Or.* 289.

*C. discolor*, Desv. ! *Journ. Bot.* iii. (1814) 73.

*C. sulphurea*, DC. ! in *Collad. Hist. Cass.* 84.

*C. Sieberi*, Presl, ex ejusd. *Bot. Bem.* 64.

*C. Horsfieldii*, Miq. ! *Fl. Ind. Bat.* i. pars i. 99.

*C. acclinis*, F. Muell. ! *Fragm. Phyt. Austral.* iv. 13.

*Hab.* Tropical Asia and Australia, and long since cultivated in gardens in the West Indies, as well as in tropical Asia.

Although *C. glauca* and *C. suffruticosa* are usually considered distinct species, the former with leaves often twice as large as in the latter and much more glaucous underneath, I have been quite unable to distribute our numerous Indian specimens even into two distinct varieties. The Australian specimens belong chiefly to the *suffruticosa* type; they are much more variable than the Indian ones, but not in the direction of the large *glauca* type.

The garden specimen representing *C. glauca* in herb. DC. *Prod.* is a form of *C. lævigata*; and, on the other hand, there are in herb. Hook. specimens of the true *C. glauca*, marked as from the woods of Tucuman and Cordova, *Tweedie*; but probably there is here some mistake.

170. *C. RETUSA*, *Soland. !; Vog. in Linnæa*, xv. 72. Undique molliter pubescens. Foliola 4–6-juga, obovata v. cuneata, sæpius emarginata. Flores mediocres. Bracteæ acuminatæ. Legumen rectum.—*Benth. Fl. Austral.* ii. 285.

*Hab.* Tropical Australia, N.E. coast.

171. *C. AUSTRALIS*, *Sims, Bot. Mag.* t. 2676. Glabra v. laxè pubescens. Foliola 6–12- (sæpius 8–10-)juga, oblongo-lanceolata v. rarius linearia, obtusa v. acuta. Bracteæ parvæ, latæ, obtusæ. Legumen rectum v. arcuatum.—*Benth. Fl. Austral.* ii. 285; *Bot. Reg.* t. 1322.

*C. umbellata*, Reichb. *Icon. Exot.* t. 206.

*C. Schultesii*, Colla, *Hort. Ripul. App.* ii. 344, et iii. t. 10.

*C. Barrenfieldii* (serius in *C. Fieldii* mutata), Colla, *Hort. Ripul. App.* iv. 23, t. 11.

*C. coronilloides*, A. Cunn. ! *Benth. in. Mitch. Trop. Austral.* 384.

*C. Fraseri*, A. Cunn. ex Vog.



Var. *REVOLUTA*, foliolis angustis acutis, margine revolutis.

*C. revoluta*, F. Muell. ! in Trans. Vict. Inst. 1852, 120.

*C. aciphylla*, Benth. ! in A. Gray, Bot. Amer. Expl. Exped. i. 465.

*Hab.* Extratropical and subtropical E. Australia.

172. *C. CHATELAINIANA*, *Gaud. in Freyc. Voy.* 485, t. 111. Glabra. Foliola 3–5-juga, linearia, obtusa. Bracteæ ovatæ, obtusæ. Legumen rectum, latiusculum.—*Benth. Fl. Austral.* ii. 286.

*Hab.* Extratropical W. Australia.

Series 2. Subverrucosæ. *Glandulæ v. nullæ v. obscuræ depressæ adnatæque.*

173. *C. GLUTINOSA*, *DC. ! Prod.* ii. 495. Glutinosa, glabra. Foliola 4–5-juga, anguste oblonga v. oblongo-linearia. Legumen rectum.—*Benth. Fl. Austral.* ii. 286.

*Hab.* Tropical Australia, N. coast.

Vogel distinguished a narrow-leaved state of this plant under the name of *C. quadriflora*.

174. *C. PRUINOSA*, *F. Muell. ! Fragm.* iii. 48. Glauca, cæterum glabra. Foliola 3–5-juga, oblongo-elliptica. Stipulæ foliaceæ, semicordatæ. Legumen rectum.—*Benth. Fl. Austral.* ii. 286.

*Hab.* Tropical and subtropical Australia: N.W. coast and Central Australia.

175. *C. CIRCINATA*, *Benth. ! in Mitch. Trop. Austral.* 384. Glabra v. canescens. Folia phyllodinea, lineari-teretia, fere filiformia, foliolis nullis. Pedunculi 1–2-flori. Legumen valde arcuatum v. annulare.—*Benth. Fl. Austral.* ii. 286.

*Hab.* Tropical and subtropical E. and Central Australia.

176. *C. PHYLLODINEA*, *R. Br. App. Sturt's Exped.* 15. Incana v. subsericea. Folia phyllodinea, linearia, verticaliter compressa, foliolis nullis. Pedunculi pluriflori. Legumen rectum v. leviter incurvum.—*Benth. Fl. Austral.* ii. 287.

*Hab.* Extratropical Subcentral and Southern Australia.

177. *C. EREMOPHILA* (*lapsu calami C. nemophila*), *A. Cunn. ! in Vog. Syn. Cass.* 47. Glabra v. vix canescens. Foliola 1–2-juga, lineari-subteretia. Legumen rectum. Pedunculi, ut et in 4 sequentibus, apice pluriflori.—*Benth. Fl. Austral.* ii. 287.

*C. canaliculata*, R. Br. in App. Sturt's Exped. 14.

*C. heteroloba*, Lindl. ! in Mitch. Three Exped. ii. 122.

Var. *PLATYPODA*, petiolo verticaliter compresso.

*C. platypoda*, R. Br. in App. Sturt's Exped. 15.

Var. *ZYGOPHYLLA*, foliolis magis compressis.

*C. zygophylla*, Benth. ! in Mitch. Trop. Austr. 288.

*Hab.* Extratropical and subtropical E. and Central Australia.

178. *C. ARTEMISIOIDES*, *Gaudich. in DC. Prod.* ii. 495. Incana v. subsericea. Foliola 3–6-juga, lineari-teretia, canaliculata. Legumen rectum, haud latum.—*Benth. Fl. Austral.* ii. 288.

*C. teretifolia*, Lindl. ! in Mitch. Three Exped. i. 289.

*C. teretiuscula*, F. Muell. ! in Linnæa, xxv. 389.

*Hab.* Extratropical and subtropical Subcentral Australia.



179. *C. STURTTII*, *R. Br. in App. Sturt's Exped.* 14. Glabra, glauca v. canescens. Foliola 3–6-juga, lineari-lanceolata cuneata, elliptica v. fere obovata. Legumen rectum v. leviter curvulum, latiusculum.—*Benth. Fl. Austral.* ii. 288.

*Hab.* Extratropical and subtropical Subcentral Australia.

180. *C. DESOLATA*, *F. Muell. ! in Linnæa*, xxv. 389. Junior canescens, demum glabrescens. Foliola 1–3-juga, ovata, obovata v. late oblonga. Legumen *C. Sturtii*?—*Benth. Fl. Austral.* ii. 289.

*Hab.* Tropical and extratropical Australia: N.W. coast, Central and Southern Australia.

181. *C. OLIGOPHYLLA*, *F. Muell. ! Fragn.* iii. 49. Glabra v. minute pubescens. Foliola 1–2-juga, late obovata. Legumen rectum, latum, obtusissimum.—*Benth. Fl. Austral.* ii. 289.

*Hab.* Tropical Australia, N.W. coast.

182. *C. OLIGOCLADA*, *F. Muell. ! Fragn.* iii. 49. Molliter pubescens. Foliola 2–4-juga, elliptico-oblonga. Pedunculi 4–6-flori. Legumen breve arcuatum, pubescens.—*Benth. Fl. Austral.* ii. 289.

*Hab.* Tropical Australia, N. and N.W. coast and in the northern interior.

183. *C. LEPTOCLADA*, *Benth. ! Fl. Austral.* ii. 290. Glabra, glauca, ramis tenuibus. Foliola 2-juga, obovata v. oblonga. Glandulæ ovoideæ. Stipulæ minutæ. Pedunculi 2-flori.

*Hab.* Tropical Australia, N. coast.

### Subgenus III. LASIORHEGMA.

Frutices, herbæ v. rarius arbores. Glandulæ petiolares dum adsint depressæ adnatæ, v. scutelliformes sessiles v. stipitatae. Inflorescentia in sectionibus diversis diversa. Stamina 10, omnia perfecta v. rarius nonnulla deficientia v. ad staminodia difformia reducta; filamenta brevia; antheræ lineari-oblongæ, subcompressæ, loculis vertice rimis brevibus oblongis apertis, rarius demum secus suturas laterales altius dehiscentibus. Legumen compressum, basi apiceque sæpius obliquum, elastice bivalvatim dehiscens. Semina transversa v. obliqua, valvulis parallele compressa, funiculis brevissimis adnatis triangularibusve, rarius brevissime linearibus. Cotyledones planæ.

### Sectio 7. APOUCOUITA.

Arbores fruticesve. Glandulæ depressæ, scutellatæ v. verruciformes nunc inter v. infra paria foliolorum inferiora v. omnia, nunc obscuræ v. deficientes. Racemi breves e ramis annotinis v. vetustioribus ad nodos defoliatos oriundi. Stamina 10, perfecta; antheræ secus suturas laterales plus minus dehiscentes. Leguminis valvulæ coriaceæ, duræ. Species omnes Americanæ.

184. *C. APOUCOUITA*, *Aubl. ! Pl. Gui.* 379, t. 146. Foliola 2–6-juga, ovata v. ovali-elliptica, acuminata v. rarius obtusiuscula, vix coriacea, venis subdistantibus anastomosantibus; glandulæ interjugales v. nullæ.—*Fl. Bras.* 129, t. 40.



*C. acuminata*, Willd. Spec. Pl. ii. 517.

*C. nitida*, Rich. in Act. Soc. Hist. Nat. Par. 108, ex DC. sed char. potius *C. vimineam* indicat.

*C. ramiflora*, Vog. ! Syn. Cass. 48.

*C. adenopoda*, Miq. ! in Linnæa, xix. 436.

*C. ensiformis*, Vell. Fl. Flum. 170; Ic. iv. t. 79.

*Hab.* Tropical America: Brazil from Rio Janeiro to the northern frontier; French Guiana, *Aublet*.

185. *C. HYMENEÆFOLIA*, *Benth. ! in Mart. Fl. Bras. Cæsalp.* 130. Foliola 1–3-juga, falcato-ovata, acuminata, coriacea, subtus pallida, venis crebris subparallelis; glandula infrajugali.

*Hab.* Tropical America: N. Brazil, on the Rio Uaupés.

186. *C. ADIANTIFOLIA*, *Benth. ! in Mart. Fl. Bras. Cæsalp.* 130. Foliola 20–30-juga, longa, obtusa, valde inæquilatera, coriacea, subtus tomentosa; glandula infrajugali.

*Hab.* Tropical America: Rio Uaupés, *Spruce*, n. 2437.

Arbor pulchra, 20-pedalis, ramulis petiolis inflorescentiaque pube minuta ferruginea tomentellis. Folia ad apices ramorum conferta; foliola obtusa, valde inæquilatera,  $\frac{1}{2}$ – $\frac{3}{4}$  poll. longa, petiolo communi 4–6-pollicari. Stipulas non vidi. Racemi ad nodos vetustos defoliatos laterales, sæpe fasciculati, breves, laxè pauciflori, pedunculo communi  $\frac{1}{2}$ –1 poll., pedicellis 1–1 $\frac{1}{2}$  poll. longis. Sepala ovata, obtusiuscula, 1 $\frac{1}{2}$  lin. longa. Petala aurea, brevissime unguiculata, majora obovata 6–7 lin. longa, summum latius vix ultra 4 lin. longum. Stamina 10, æquilonga, filamentis brevissimis, antheris crassis 2 $\frac{1}{2}$  lin. longis obtusis ab apice fere usque ad basin rimis lateralibus dehiscentibus. Legumen ab ovario paullo acutum ei *C. Apoucouita* simile; perfectum haud suppetit.

Tab. 63. fig. 1, flower (the upper petal represented rather too long); fig. 2, two of the stamens; fig. 3, ovary (longitudinal section).

### Sectio 8. ABSUS.

Frutices suffruticesve Americanæ decandræ v. herbæ annuæ gerontogæ pentandræ. Glandulæ petiolares nullæ, v. rarius infra juga foliolorum depressæ v. adnatæ. Racemi simplices v. ramosi, terminales v. simulque in axillis superioribus, inflorescentia uti interdum fere tota planta plus minus glutinosa v. viscosa. Bracteolæ 2 oppositæ v. alternæ parvæ versus apicem pedicelli sæpissime adsunt, caducæ v. rarius persistentes. Sepala obtusa v. acuta. Petala sæpius parum inæqualia, inferiora majora, summum intimum concaviusculum longiusque unguiculatum. Antheræ ad lineam suturalem lateralem villis minutis albis barbellatæ. Leguminis valvulæ coriacæ, duræ v. tenues.

Series 1. Absoideæ. *Foliola bijuga, membranacea, sæpius juniora saltem subtus v. utrinque pubescentia (excepta C. barbata), pollice breviora v. vix longiora, petiolo (excepta C. Abso) eglanduloso.*

\* *Herba annua gerontogea, floribus parvis pentandris.*

187. *C. ABSUS*, *Linn. ! Spec. Pl.* 537. Foliola obovata. Racemi terminales v. oppositifolia.—*Oliv. ! Fl. Trop. Afr.* ii. 279; *Jacq. f. Ecl.* t. 53.

*Senna Absus*, *Roxb. ! Fl. Ind.* ii. 340.

*C. Thonningii*, *DC. ! Prod.* ii. 500.

*C. coccinea*, *Wall. ! Cat. Herb. Ind.* n. 5315.



*Grimaldia opifera*, Schrank in Denkschr. Akad. Münch. 1808, 109, t. 3.

*Cassia exigua*, Roxb. Hort. Beng. 31.

*Senna exigua*, Roxb. Fl. Ind. ii. 339.

*Hab.* Waste and cultivated places, tropical Africa, Asia, and Australia.

\*\* *Herbæ perennes suffrutices fruticesve Americani, floribus decandris.*

† *Foliola in petiolo communi breviter petiolulata.*

188. *C. HISPIDULA*, *Vahl, Ecl.* iii. 10. Caules procumbentes v. divaricato-ramosi, viscoso-pubescentes et setoso-hispiduli v. rarius glabrati. Foliola obovata v. suborbiculata. Racemi terminales v. oppositifolii, laxiflori.—*Fl. Bras.* 131, t. 35.

*C. hispida*, Collad. ! Hist. Cass. 118.

*C. lotoides*, H. B. et K. ! Nov. Gen. et Sp. vi. 361.

*C. leiantha*, Benth. ! in Hook. Journ. Bot. ii. 78 (varietas caule inflorescentiaque glabratis).

*C. fagonioides*, Vog. ! Syn. Cass. 50 (varietas pubescens, foliolis floribusque minoribus).

*C. procumbens*, Mill. ! Dict. ed. 8. n. 20.

*C. tetraphylla*, Collad. Hist. Cass. 130.

*Hab.* Tropical America: common in North Brazil, Guiana, Columbia, and Central America.

189. *C. PAUCIFLORA*, *H. B. et K. ! Nov. Gen. et Sp.* vi. 360. Viscoso-pubescent, procumbens adscendens v. suberecta. Foliola oblonga, obtusa v. acuta, sæpius parva. Racemi terminales, breves, pauciflori.—*Fl. Bras.* 131.

*C. camporum*, Benth. ! in Hook. Journ. Bot. ii. 79.

*C. punctulata*, Hook. et Arn. ! Bot. Beech. 420 (varietas major, foliolis longioribus acutis, floribus majoribus).

*Hab.* Tropical America: common in Central America and Mexico, more rare in Brazil.

190. *C. VISCOSA*, *H. B. et K. ! Nov. Gen. et Sp.* vi. 360. Frutex erectus, viscoso-pubescent. Foliola obovata obcordata v. late cuneata. Racemi breves, pluriflori, axillares terminalesque.—*Fl. Bras.* 132.

*C. cuneifolia*, Vog. ! Syn. Cass. 51, et in Linnæa, xi. 695.

*C. viscoso-pilosa*, Steud. ! in Flora, 1843, 760.

*Hab.* Tropical America: Central and North Brazil, Guiana, and Columbia.

191. *C. JACOBINEA*, *Benth. ! in Mart. Fl. Bras. Cæsalp.* 132. Frutex erectus, sordide viscoso-pubescent. Foliola oblonga v. ovali-oblonga, glanduloso-mucronata, supra nitida, subtus pubescentia,  $\frac{1}{2}$ – $\frac{3}{4}$ -pollicaria. Racemi terminales, breves, laxe pauciflori. Sepala mucronato-acuta.

*Hab.* Tropical America: Brazil, prov. Bahia.

192. *C. ACOSMIFOLIA*, *Mart. ! Fl. Bras. Cæsalp.* 133. Frutex erectus, ramulis gracilibus subglabris. Foliola oblonga v. ovali-oblonga, supra nitidula, subtus pubescentia, subpollicaria. Racemi terminales, breves, laxe pauciflori.

*Hab.* Tropical America: Brazil, prov. Minas Geraes and Bahia.

193. *C. BARBATA*, *Nees et Mart. ! in Nov. Act. Nat. Cur.* xii. 32. Frutex erectus, ramulis pubescentibus hirtellisve. Foliola ovali-oblonga v. elliptica, supra glabra v. utrinque hir-



tella, 1–3-pollicaria. Racemi terminales, elongati, laxiflori, v. in axillis superioribus breviores.—*Fl. Bras.* 133.

*Hab.* Tropical America: Brazil, prov. Rio Janeiro, Minas Geraes, and Bahia.

†† *Foliola in petiolo communi sessilia.*

194. *C. DESERTORUM*, *Mart. ! Fl. Bras. Cæsalp.* 133. Frutex erectus, viscido-pubescentibusque. Foliola obovata v. ovali-oblonga, demum glabrata. Racemi breves. Petala calyce subdimidio longiora.

*Hab.* Tropical America: Brazil, prov. Goyaz, Minas Geraes, Piauhy, and Bahia.

Evidently a very variable species, but only known from unsatisfactory specimens.

195. *C. BREVICALYX*, *Benth. ! in Mart. Fl. Bras. Cæsalp.* 134. Frutex erectus, ramulis viscido-pubescentibus. Foliola obovato-suborbicularia, glabra v. subtus pilosula. Racemi breves. Petala calyce subtriplo longiora.

*Hab.* Tropical America: Brazil, prov. Piauhy.

Remarkable for the broad obtuse sepals, much shorter in proportion to the petals than in any other *Absus*.

Series 2. Unijugæ. *Foliola unijuga, rigidule membranacea v. coriacea, petiolo eglanduloso.*

\* *Ramuli viscoso-pubescentes, villosi v. glutinoso-setosi.*

† *Foliola in caule sessilia, petiolo communi ad tuberculum vix prominulum reducto.*

196. *C. MONTICOLA*, *Mart. ! Fl. Bras. Cæsalp.* 134. Foliola obovato-suborbiculata, basi semicordata. Racemi terminales, breves.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

197. *C. ANDROMEDEA*, *Mart. ! Fl. Bras. Cæsalp.* 135. Foliola cuneato-oblonga, nitidula. Racemi terminales, breves, subcorymbosi.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

198. *C. GEMINATA*, *Benth. ! in Mart. Fl. Bras. Cæsalp.* 135. Foliola (*C. viscosæ*) cuneato-obovata, viscido-pubescentia. Racemi in axillis superioribus laxiflori, paniculam elongatam foliosam efficientes.

*Hab.* Tropical America: Brazil, prov. Goyaz.

†† *Foliola ad apicem petioli communis, 3–6 lin. longi.*

199. *C. SCABRA*, *Pohl ! in Mart. Fl. Bras. Cæsalp.* 135. Foliola oblongo-elliptica, 4–5-pollicaria, supra scabra, subtus pubescentia. Racemi breves, in corymbum terminalem multiflorum conferti.

*Hab.* Tropical America: Brazil, prov. Goyaz.

200. *C. OBTECTA*, *Benth. ! in Mart. Fl. Bras. Cæsalp.* 136. Foliola suborbiculata, 1½–2½-pollicaria, supra pubescentia, subtus tomentosa. Stipulæ foliaceæ, late subreniformes. Racemi breves, corymboso-conferti.

*Hab.* Tropical America: Brazil, prov. Minas Geraes and Goyaz.

201. *C. ECHINOCARPA*, *Benth. ! in Mart. Fl. Bras. Cæsalp.* 136. Foliola suborbiculata, pollicaria, nigro-ciliata, glabra. Ramuli setosissimi. Stipulæ parvæ. Racemi terminales.

*Hab.* Tropical America: interior of Brazil.



\*\* *Ramuli et folia glaberrima; foliola coriacea.*

† *Petiolus communis 1-6 lin. longus.*

202. *C. CÆSPITOSA*, *Benth.!* in *Mart. Fl. Bras. Cæsalp.* 136. Foliola lineari-cuneata, vix semipollicaria. Racemi terminales, breves, pauciflori.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

203. *C. LAVRADIOIDES*, *Benth.!* in *Mart. Fl. Bras. Cæsalp.* 137. Foliola obovato-cuneata,  $1\frac{1}{2}$ -2-pollicaria. Racemi terminales, laxi.

*Hab.* Tropical America: Central Brazil.

204. *C. LINEARIFOLIA*, *G. Don, Gen. Syst.* ii. 446. Foliola linearia, acuminata, 2-3-pollicaria. Racemi terminales v. in axillis superioribus.—*Fl. Bras.* 137.

*Hab.* Tropical America: Brazil.

†† *Petiolus communis elongatus.*

205. *C. DENTATA*, *Vog.!* *Syn. Cass.* 49. Foliola falcato-lanceolata, 2-3-pollicaria, dentata, petiolo longo gracili. Racemi pauciflori.—*Fl. Bras.* 137.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

206. *C. INCURVATA*, *Benth.!* in *Mart. Fl. Bras. Cæsalp.* 137. Foliola late falcato-ovata, sub-3-pollicaria, integerrima, petiolo rigido. Racemi breves, in paniculam basi foliatam dispositi.

*Hab.* Tropical America: Brazil, prov. Goyaz.

207. *C. COTINIFOLIA*, *G. Don, Gen. Syst.* ii. 445. Foliola orbiculata, sub-2-pollicaria. Racemi simplices v. basi ramosi, multiflori.—*Fl. Bras.* 138, t. 41.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

Series 3. Baseophylleæ. *Foliola 1-8-juga, coriacea, glabra, petiolo communi glandula una pluribusve depressis adnatisque instructo. Racemi sæpius breves.*

\* *Foliola in petiolo sessilia, 1-2-juga.*

208. *C. BLANCHETI*, *Benth.!* in *Hook. Journ. Bot.* ii. 78. Foliola unijuga, orbiculato-reniformia, petiolo subnullo in caule sessilia. Frutex diffusus, rigidus. Racemi breves, in corymbum terminalem conferti.—*Fl. Bras.* 138.

*Hab.* Tropical America: Brazil, prov. Bahia and Minas Geraes.

209. *C. VAUTHIERI*, *Benth.!* in *Mart. Fl. Bras. Cæsalp.* 138. Foliola 2-juga, ovato-suborbicularia, petiolo subnullo in caule subsessilia. Rami stricti, erecti, foliosi. Racemi breves, confertiflori.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

210. *C. BRACHYSTACHYA*, *Benth.!* in *Hook. Journ. Bot.* ii. 78. Foliola vel bijuga, jugi infimi cauli approximatis, vel unijuga ad apicem petioli jugo infimo deficiente, suborbiculata v. subreniformia,  $\frac{3}{4}$ - $1\frac{1}{2}$ -pollicaria. Frutex. Racemi axillares, breves.—*Fl. Bras.* 139.

*Hab.* Tropical America: Brazil, prov. Bahia and Minas Geraes.

211. *C. CORIACEA*, *Bong.!* *Benth. in Hook. Journ. Bot.* ii. 78. Foliola 1-2-juga, a caule



*distantia*, oblongo-obovata, subpollicaria. Suffrutex procumbens. Racemi axillares v. subterminales, pauciflori.—*Fl. Bras.* 139.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

This, perhaps, amongst the *Absi*, is the one that comes the nearest to the *Chamæcristas*, having nearly the foliage of *C. Burchellii*; and in the inflorescence the common peduncle is very short, with very long pedicels, but yet rather that of *Absus* than of *Chamæcrista*.

212. *C. CYTISOIDES*, DC.! in *Collad. Hist. Cass.* 116, t. 14. Foliola 3–4-juga, obovato-orbiculata, infra pollicaria, jugi infimi cauli approximata. Frutex. Racemi terminales, breves.—*Fl. Bras.* 139.

*C. venosa*, Desv. Journ. Bot. iii. 72 (*C. glabra*, Collad. Hist. Cass. 131), ex Desv. in Ann. Sc. Nat. ser. 1. ix. 427.

*Hab.* Tropical America: Brazil.

\*\* *Foliola petiolulata*, 3–8-juga.

213. *C. POLYSTACHYA*, Benth.! in *Hook. Journ. Bot.* ii. 77. Foliola 3–4-juga, ovata, 1½–2½-pollicaria, omnia a caule distantia. Frutex. Racemi terminales et in axillis superioribus floribundi.

*Hab.* Tropical America: British Guiana.

214. *C. CRENULATA*, Benth.! in *Hook. Journ. Bot.* ii. 80. Foliola 6–8-juga, ovata v. obovata, 1–1½-pollicaria, omnia a caule distantia. Frutex. Racemi breves, in axillis summis v. ad apices ramorum conferti.—*Fl. Bras.* 140.

*Hab.* Tropical America: Brazil, prov. Goyaz.

Series 4. Paniculatæ. *Foliola 2-juga rarius 3-juga, coriacea, sæpe ampla, petiolo eglanduloso. Racemi in paniculam amplam laxam aphyllam dispositi.*

215. *C. ORBICULATA*, Benth.! in *Hook. Journ. Bot.* ii. 79. Ramuli glutinoso-scabri. Foliola suborbiculata, coriacea, 2–3-pollicaria, glabra. Sepala exteriora acutiuscula, puberula.—*Fl. Bras.* 140.

*Hab.* Tropical America: Brazil, prov. Pernambuco, Minas Geraes, and Goyaz.

216. *C. CLAUSSENI*, Benth.! in *Hook. Journ. Bot.* ii. 79. Ramuli glabri. Foliola late ovata, coriacea, 1½–2-pollicaria, glabra. Sepala membranacea, obtusa, subglabra.—*Fl. Bras.* 140.

*Hab.* Tropical America: Brazil, prov. Minas Geraes and Goyaz.

217. *C. SETOSA*, Vog.! *Syn. Cass.* 51. Ramuli viscoso-pubescentes, in forma typica setosissimi. Foliola ovato- v. elliptico-oblonga, coriacea, supra nitida, subtus rugoso-venosa et canescenti-tomentosa, 2–4-pollicaria.—*Fl. Bras.* 141, t. 41.

Var. *DETONSA*, setis nullis, cætera omnia formæ typicæ.

Var. *ANGUSTA*, foliolis angustioribus, foliorum inferiorum interdum 3-jugis; cætera varietatis *detonsæ*.

*Hab.* Tropical America: Brazil, prov. S. Paulo, Minas Geraes, and Goyaz; the two varieties both from Goyaz.

218. *C. MULTISETA*, Benth.! in *Mart. Fl. Bras. Cæsalp.* 141. Ramuli longe setosi,



cæterum glabriusculi. Foliola ovato-lanceolata, acuta, supra nitida, subtus canescenti-tomentella. Legumen setosum, inter setas glabratum.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.  
(Racemi ample paniculati in *Nigris* nonnullis plurijugis.)

Series 5. Rigidulæ. *Caules et folia glabra, setis nullis, rarius in C. densifoliæ varietate hirtella. Foliola 2-8-juga, rarissime 10-12-juga, coriacea, excepta C. gracillima semipollicaria longioraque, petiolo eglanduloso. Racemi simplices v. abbreviati.*

\* *Foliola obovata cuneata ovata v. orbiculata, obtusa.*

219. *C. CONFERTA*, *Benth.!* in *Mart. Fl. Bras. Cæsalp.* 142. Foliola bijuga, rarius 3-juga, cuneato-oblonga, tenuiter coriacea,  $\frac{1}{2}$ - $1\frac{1}{2}$ -pollicaria. Racemi breves, per anthesin subcorymbosi.

*Hab.* Tropical America: Brazil, prov. Minas Geraes and Goyaz.

220. *C. OCHNACEA*, *Vog.!* *Syn. Cass.* 51. Foliola 2-juga, rarissime 3-juga, obovato-elliptica, rigide coriacea,  $1-1\frac{1}{2}$ -pollicaria. Racemi elongati, per anthesin oblongi.—*Fl. Bras.* 142.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

221. *C. RIGIDIFOLIA*, *Benth.!* in *Mart. Fl. Bras. Cæsalp.* 142. Foliola 2-4-juga, ovalia, rigida,  $1\frac{1}{2}$ -pollicaria. Racemi breves, ad axillas conferti v. subramosi, glabri.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

222. *C. GRACILLIMA*, *Benth.!* in *Mart. Fl. Bras. Cæsalp.* 143. Foliola 2-4-juga, obovata, 3-4 lin. longa. Ramuli tenues, divaricati. Racemi breves, laxe pauciflori, glabri.

*Hab.* Tropical America: Brazil, prov. Goyaz.

223. *C. DECUMBENS*, *Benth.!* in *Hook. Journ. Bot.* ii. 79. Foliola 2-5-juga, late obovata,  $\frac{1}{2}$ - $\frac{3}{4}$ -pollicaria, præter costam subavenia. Racemi elongati, viscoso-pubescentes v. villosi.—*Fl. Bras.* 143.

*Hab.* Tropical America: Brazil, prov. Goyaz.

224. *C. LUNDII*, *Benth.!* in *Mart. Fl. Bras. Cæsalp.* 143. Foliola 5-7-juga, subcordato-orbicularia,  $\frac{3}{4}$ -1-pollicaria, rigida, marginata, venosa. Racemi elongati, viscido-pubescentes.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

225. *C. NUMMULARIFOLIA*, *Benth.!* in *Mart. Fl. Bras. Cæsalp.* 144. Foliola 6-12-juga, orbiculata,  $\frac{1}{2}$ - $\frac{3}{4}$ -pollicaria, immarginata, præter costam subavenia. Racemi elongati, viscido-puberuli.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

226. *C. DENSIFOLIA*, *Benth.!* in *Hook. Journ. Bot.* ii. 80. Foliola 5-8-juga, ovata v. orbiculata, venosissima, margine tenui. Racemi elongati, viscido-puberuli.—*Fl. Bras.* 144.

Var. undique viscoso-hirtella.

*Hab.* Tropical America: Brazil, prov. Goyaz; the viscid hirsute variety from Parana-hyba, *Burchell.*



\*\* *Foliola elliptica v. anguste oblonga, resinosa.*

227. *C. LENTISCIFOLIA*, *Benth.!* in *Mart. Fl. Bras. Cæsalp.* 144. Foliola 3–4-juga, sessilia, lineari-oblonga, obtusa,  $\frac{3}{4}$ – $1\frac{1}{4}$ -pollicaria. Racemi breves, subcorymbosi.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

228. *C. HEDYSAROIDES*, *Vog.!* *Syn. Cass.* 52. Foliola 3–6-juga, petiolulata, elliptico-oblonga, utrinque obtusa,  $\frac{3}{4}$ – $1\frac{1}{4}$ -pollicaria. Racemi multiflori, vix elongati.—*Fl. Bras.* 145.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

229. *C. PUNCTATA*, *Vog.!* *Syn. Cass.* 51. Foliola 2–4-juga, petiolulata, elliptico-oblonga v. oblanceolata, utrinque acuta, sub- $1\frac{1}{2}$ -pollicaria. Racemi terminales, simplices v. ramosi.—*Fl. Bras.* 145.

*Hab.* Tropical America: Brazil, prov. S. Paulo.

230. *C. STRICTIFOLIA*, *Benth.!* in *Mart. Fl. Bras. Cæsalp.* 145. Folia conferta; foliola 2–3-juga, anguste linearia, obtusa, coriacea, plana, undique æquilata,  $\frac{1}{2}$ –1-pollicaria, resinosa. Racemi terminales, breves, confertiflori.

*Hab.* Brazil: Rio Santa Anna.

231. *C. ERICIFOLIA*, *Benth.!* in *Mart. Fl. Bras. Cæsalp.* 145. Ramuli pubescentes. Foliola 2-juga, lineari-teretia, 3–4 lin. longa, acuta, ericoidea. Racemi terminales, breves, confertiflori. Legumen setoso-hispidum.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

Series 6. *Lucidæ. Setosæ, cæterum glaberrimæ, nitidulæ. Foliola 2–6-juga, petiolo eglanduloso. Racemi simplices.*

232. *C. LOMATOPODA*, *Benth.!* in *Mart. Fl. Bras. Cæsalp.* 146. Foliola 2-juga, ovali-oblonga, obtusa,  $1\frac{1}{2}$ –2-pollicaria, coriacea, venosa, petiolo elevato-marginato.

*Hab.* Tropical America: Brazil, prov. Goyaz and Minas Geraes.

233. *C. LAMPROSPERMA*, *Mart.!* *Fl. Bras. Cæsalp.* 146. Foliola 4–6-juga, ovali-oblonga, obtusa v. acutiuscula, membranacea, petiolo tereti.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

Series 7. *Microphyllæ. Glabræ pubescentes v. setosæ. Foliola 6–multijuga, parva, raro semipollicem excedentia, petiolo eglanduloso.*

\* *Foliola coriacea, 6–12-juga.*

234. *C. CILIOLATA*, *Benth.!* in *Mart. Fl. Bras. Cæsalp.* 146. Ramuli viscoso-pubescentes sæpeque breviter setosi. Foliola 6–12-juga, suborbiculata, ciliolata, præter costam subavenia, glabra, 3–4 lin. longa. Racemi breves. Calyces obtusissimi.

*Hab.* Tropical America: Brazil, prov. Minas Geraes and Goyaz.

235. *C. OLIGOSPERMA*, *Mart.!* *Fl. Bras. Cæsalp.* 147. Ramuli viscoso-pubescentes. Foliola 6–12-juga, oblonga v. ovata, obtusissima, coriacea, viscoso-pubescentia v. glabra, 2–3 lin., rarius 5–6 lin. longa. Racemi breves. Calyces obtusissimi.

*Hab.* Tropical America: Brazil, prov. Goyaz.

Some specimens of Burchell's from Cavalcante in Goyaz, n. 7556, appear to belong to this species,



although the leaves have twelve to thirty pairs of leaflets. They may possibly, however, be imperfectly flowering specimens of some form of *C. flicifolia*.

236. *C. INCANA*, *Vog. ! Syn. Cass.* 52. Ramuli hispidi et viscoso-tomentelli. Foliola 8–12-juga, ovata v. oblonga, obtusa v. acutiuscula, supra nitida, convexa, subtus incana, 3–6 lin. longa. Racemi elongati.—*Fl. Bras.* 147.

*Hab.* Tropical America: Brazil, probably prov. S. Paolo.

237. *C. SECUNDA*, *Benth. ! in Mart. Fl. Bras. Cæsalp.* 148. Ramuli longe setosi. Foliola 8–10-juga, ovata, semicordata, acuta, coriacea, marginata, glabra, 3–5-lineararia. Racemi breves.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

\*\* *Foliola coriacea*, 12–40-juga.

238. *C. FILICIFOLIA*, *Mart. ! Fl. Bras. Cæsalp.* 148. Ramuli viscoso-pubescentes. Foliola 20–30-juga, ovata, acutiuscula, viscido-puberula, decrescentia, majora semipollicaria. Racemi laxè subpaniculati.

*Hab.* Tropical America: Brazil, prov. Bahia and Minas Geraes.

Some specimens of Burchell's from Minas Geraes, n. 5872, belong probably to this species, although with fewer leaflets.

239. *C. NEESIANA*, *Mart. ! Fl. Bras. Cæsalp.* 148. Ramuli viscoso-pubescentes v. demum glabrati. Foliola 12–20-juga, oblonga, obtusa, pubescentia v. glabrata, majora semipollicaria. Racemi breviusculi.

*Hab.* Tropical America: Brazil, prov. Minas Geraes and Bahia.

240. *C. POHLIANA*, *Benth. ! in Hook. Journ. Bot.* ii. 80. Ramuli viscoso-pubescentes. Foliola 30–40-juga, oblonga, obtusa, decrescentia, pubescentia v. glabrata. Racemi elongandi.—*Fl. Bras.* 148, t. 42.

*Hab.* Tropical America: Brazil, prov. Minas Geraes and Goyaz.

241. *C. DECRESCENS*, *Benth. ! in Hook. Journ. Bot.* ii. 80. Glaberrima. Foliola 15–30-juga, ovato-lanceolata v. oblonga, acuta, decrescentia, majora 4–5-lineararia. Racemi laxiflori.—*Fl. Bras.* 149.

*Hab.* Tropical America: Brazil, prov. Minas Geraes or Goyaz.

\*\*\* *Foliola membranacea*, 12–20-juga.

242. *C. DALBERGLEFOLIA*, *Benth. ! in Mart. Fl. Bras. Cæsalp.* 149. Ramuli viscoso-tomentosi hispidi. Foliola 15–20-juga, oblonga, obtusa, glabra, semipollicaria v. paullo longiora. Racemi floribundi, viscoso-tomentosi hispidi.

*Hab.* Tropical America: Brazil, prov. Minas Geraes and Goyaz.

243. *C. DEBILIS*, *Vog. ! Syn. Cass.* 53. Glabra, laxè ramosa. Foliola 12–20-juga, oblonga, obtusa. Racemi laxè pauciflori, graciles, glaberrimi.—*Fl. Bras.* 149.

*Hab.* Tropical America: Brazil, prov. S. Paolo.



Series 8. Nigricantes. *Viscoso-pubescentes v. villosæ. Foliola 2–12-juga, semipollice longiora, petiolo eglanduloso.*

\* *Foliola acuta v. acuminata,  $\frac{3}{4}$ –3-pollicaria.*

244. *C. ORINOCENSIS*, Spruce!, *Pl. Exs.* n. 3249. Ramuli viscoso-puberuli setosique. Foliola 2-juga, ovata v. ovato-lanceolata, 2–3-pollicaria, rigida, ciliata, supra nitida, subtus incana. Racemi breves, pauciflori.—*Fl. Bras.* 150.

*Hab.* Tropical America: Columbia, on the Orinoco.

245. *C. LONGICUSPIS*, Benth.! in *Mart. Fl. Bras. Cæsalp.* 150. Ramuli viscido-puberuli et setoso-hispidi. Foliola bijuga, ovato-oblonga, longe acuminata, 2–3-pollicaria, membranacea, subtus pallida, pilis conspersa. Racemi breves, pauciflori. Bracteæ parvæ.

*Hab.* Tropical America: Brazil, prov. Minas Geraes or Goyaz.

246. *C. PHYLLOSTACHYA*, Benth.! in *Mart. Fl. Bras. Cæsalp.* 150. Ramuli sordide viscido-pubescentes. Foliola 2–3-juga, ovato-lanceolata,  $1\frac{1}{2}$ –2-pollicaria, subtus pallida, pubescentia. Racemi pluriflori. Bracteæ foliaceæ, late lanceolatae, persistentes.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

247. *C. ITAMBANA*, Mart.! *Fl. Bras. Cæsalp.* 151. Ramuli mollissime velutino-villosi. Foliola 3–4-juga, ovali-oblonga,  $1\frac{1}{2}$ –2-pollicaria, subtus pallida, molliter villosa. Racemi elongati, subpaniculati. Bracteæ minutæ.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

248. *C. MACHÆRIIFOLIA*, Benth.! in *Mart. Fl. Bras. Cæsalp.* 151. Ramuli viscido-tomentosi v. scabri. Foliola 4–5-juga, ovato-lanceolata,  $1-1\frac{1}{2}$ -pollicaria, pubescentia. Racemi breves, pauciflori. Bracteæ minutæ.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

249. *C. URSINA*, Mart.! *Fl. Bras. Cæsalp.* 151. Ramuli dense viscoso-tomentosi setisque brevibus hispidi. Foliola 5–6-juga, ovato-oblonga, 1–2-pollicaria, inferiora obtusa, subtus dense villosa-tomentosa, subcanescentia. Racemi paniculati, setosi, viscosissimi.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

\*\* *Foliola obtusa, crassiuscula,  $\frac{1}{2}$ –2-pollicaria.*

250. *C. EXSUDANS*, Benth.! in *Hook. Journ. Bot.* ii. 80. Ramuli viscoso-tomentosi, scabri. Foliola 2–5-juga, ovata v. late oblonga,  $1-1\frac{1}{2}$ -pollicaria, supra scaberrima, subtus canescenti-tomentosa. Racemi ramosi.—*Fl. Bras.* 152.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

251. *C. AURIVILLA*, Mart.! *Fl. Bras. Cæsalp.* 152. Ramuli tomentosi setisque basi plumosis hispidissimi. Foliola 6–8-juga, ovata v. late oblonga, subpollicaria, subtus canescentia. Racemi simplices, aureo-setosi v. villosi.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

252. *C. SOPHOROIDES*, Mart.! *Fl. Bras. Cæsalp.* 152. Ramuli tomentoso-pubescentes, subviscosi. Foliola 6–8-juga, ovata v. late oblonga, subpollicaria, utrinque sordide pubescentia, subtus pallidiora. Stipulae latæ, foliaceæ. Racemi simplices.

*Hab.* Tropical America: Brazil, prov. Bahia and Minas Geraes.



253. *C. FUSCESCENS*, *Benth.!* in *Mart. Fl. Bras. Cæsalp.* 153. Ramuli tomentosi, viscoso-hirsuti, subsetosi. Foliola 4–5-juga, anguste oblonga, 1–1½-pollicaria, supra subscabra, subtus canescentia. Racemi breves, ramosi.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

254. *C. TEPHROSLÆFOLIA*, *Benth.!* in *Mart. Fl. Bras. Cæsalp.* 153. Ramuli viscido-pubescentes villosive. Foliola 6–10-juga, oblonga, ½–1-pollicaria, subtus subcanescentia. Racemi breves, subramosi.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

255. *C. PANICULATA*, *Benth.!* in *Mart. Fl. Bras. Cæsalp.* 153. Ramuli subfloccoso-tomentosi. Foliola 8–12-juga, anguste oblonga, ½–1-pollicaria, subtus cano-tomentosa. Racemi setosi, ample paniculati.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

256. *C. ISIDOREA*, *Benth.!* in *Mart. Fl. Bras. Cæsalp.* 154. Ramuli viscoso-tomentosi sæpeque setulosi. Foliola 8–15-juga, oblonga nunc angusta, ½–1-pollicaria, pubescentia, concoloria. Racemi elongati, simplices v. laxiores, subpaniculati.

*Hab.* Tropical America: Brazil, prov. Goyaz.

\*\*\* *Foliola membranacea, obtusa v. acutiuscula, subtus pallida v. concoloria, ½–1-pollicaria, 4–10-juga.*  
(*Species foliolis bijugis inter Absoideas quærentur.*)

257. *C. BRACTEOLATA*, *Vog.!* *Syn. Cass.* 52. Foliola 5–8-juga, lanceolato-oblonga, tenuiter viscido-puberula, subtus pallida. Racemi laxi. Bracteæ latæ, membranaceæ.—*Fl. Bras.* 154.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

258. *C. TRACHYCARPA*, *Vog.!* *Syn. Cass.* 52. Foliola 4–10-juga, ovato-oblonga, supra pilosula, subtus pallida. Racemi breves, multiflori. Bracteæ parvæ, setaceæ.—*Fl. Bras.* 154.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

259. *C. CATHARTICA*, *Mart.!* *Reis. Bras.* i. 548. Foliola 4–12-juga, oblonga, utrinque viscido-puberula. Racemi foliati, pauciflori, pedicellis nempe plerisque ad axillam folii pinnati solitariis unifloris.—*Fl. Bras.* 155, t. 42.

*C. aprica*, Vell. *Fl. Flum.* 169; *Ic.* iv. t. 76.

*C. hirsuta*, Vell. *Fl. Flum.* 170; *Ic.* iv. t. 80.

*C. pachycalyx*, *Vog.!* *Syn. Cass.* 52.

*Hab.* Tropical America: Brazil, prov. Minas Geraes, S. Paulo, and Rio Janeiro.

#### Sectio 9. CHAMÆCRISTA.

Herbæ fruticesve glabri, pubescentes v. pilosi, nec viscosi. Pedicelli solitarii v. in pedunculo communi vix evoluto 2–4-ni, axillares supraaxillares v. in mediis internodiis oriundi. Antheræ sæpe inæquales, alternis minoribus v. deficientibus.

This section differs from *Absus* chiefly in inflorescence.



Subsect. 1. Xerocalyx. *Sepala rigidula, subscariosa, tenuiter striato-multinervia.*

\* *Foliola 1-juga.*

260. *C. DIPHYLLA*, Linn.! *Spec. Pl.* 537. Glabra, prostrata. Foliola obovata, rigidule membranacea, glandula parva, stipitata v. urceolata.—*Fl. Bras.* 156.

*C. diphylla*, Cav. *Ic.* t. 600.

*Hab.* Tropical America: from Brazil to Central America and Mexico.

Linnæus having given the erroneous habitat "in India" for this plant, its identity has been doubted; but his specimen clearly belongs to this species.

261. *C. CULTRIFOLIA*, H. B. et K.! *Nov. Gen. et Sp.* vi. 363. Glabra v. apice patentim pilosa. Foliola dimidiato-oblonga v. oblongo-lineararia, sæpe falcata, subcoriacea; glandula scutellata v. urceolata.—*Fl. Bras.* 156.

*Hab.* Tropical America: Columbia, Guiana, Central Brazil.

\*\* *Foliola 2-juga (species omnes vix inter se distinctæ).*

262. *C. LATISTIPULA*, Benth.! in *Mart. Fl. Bras. Cæsalp.* 156. Glabra v. superne pubescens. Foliola latiuscula, oblonga v. obovata, rectiuscula. Stipulæ amplæ, obtusæ. Flores magni.

*Hab.* Tropical America: Brazil, prov. Minas Geraes and Goyaz.

263. *C. DESVAUXII*, Collad. *Hist. Cass.* 131. Glabra v. ramulis bifariam pubescentibus. Foliola obovato-oblonga, rectiuscula. Stipulæ acutæ. Flores magni. Pedicelli longiusculi v. rarius abbreviati. Legumen appresse pilosum, 5-6-plo longius quam latum.—*Fl. Bras.* 157.

*C. tetraphylla*, Desv. *Journ. Bot.* iii. (1814) 72, non Collad.

*C. pulchra*, H. B. et K.! *Nov. Gen. et Sp.* vi. 362.

Var. MOLLISSIMA, mollissime pubescens, pedicellis longiusculis.

Var. ? BREVIPES, pubescens v. glabrescens, pedicellis ut in *C. brevipedis* brevissimis, legumine *C. Desvauxii*.

*Hab.* Tropical America: Brazil, Guiana, and Columbia; the var. *mollissima* in S. Brazil, the var. *brevipes* in Brazil and Guiana.

264. *C. BREVIPES*, DC.! in *Collad. Hist. Cass.* 119, t. 9. Pubescens. Folia floresque *C. Desvauxii*. Pedicelli brevissimi. Legumen vix duplo longius quam latum, pilis longis aureis hirsutissimum.

*Hab.* Tropical America: Panama, Seemann; Costarica, Ersted.

265. *C. UNIFLORA*, Spreng. *Neu. Entd.* i. 291. Glabra v. rarius tenuiter pubescens. Foliola obovato-oblonga, recta v. leviter incurva, in forma typica subsemipollicaria, rigidule membranacea. Stipulæ acutæ, longiusculæ. Flores mediocres v. parvi. Legumen glabrum v. appresse pilosum.—*Fl. Bras.* 157, t. 43.

*C. lanceolata*, Pers. *Syn.* i. 456 (ex char.), non Forsk.

*C. Persoonii*, Collad. *Hist. Cass.* 119.

Var. PARVIFOLIA, foliolis 2-6 lin. longis, sæpius quam in forma typica obtusioribus.

*C. ramosa*, Vog.! *Syn. Cass.* 55.

*C. savanensis*, Miq.! in *Linnæa*, xviii. 584.



*Hab.* Tropical America: Brazil and Guiana; both varieties very abundant and running closely into each other, the larger-leaved form at least extending into Columbia, and some forms closely connecting it with *C. Desvauxii*.

266. *C. LANGSDORFFII*, *Kunth in Vog.!* *Syn. Cass.* 55. Glabra v. pubescens. Foliola lineari-oblonga. Stipulæ acutæ, persistentes. Flores mediocres v. majusculi. Legumen glabrum v. appresse pilosum.—*Fl. Bras.* 158.

*C. borbonioides*, *Vog.!* *Syn. Cass.* 55 (forma foliolis paullo majoribus rigidioribus).

*Hab.* Tropical America: Brazil from S. Paolo to the Rio Negro and on the Orinoco.

Several forms of this species are noted in the 'Flora Brasiliensis;' and to these many others might be added as more or less distinct varieties.

267. *C. GRACILIS*, *Kunth!*, *Mim.* 120, t. 36. Glabra, gracilis, ramulis subfiliformibus. Foliola oblonga, sæpe parva. Stipulæ parvæ, acutæ, sæpe deciduæ.—*Fl. Bras.* 159.

*Hab.* Tropical America: Columbia and Central Brazil.

Some specimens of Burchell's from San Paolo, n. 4280, appear to connect this with *C. Langsdorffii*.

268. *C. TECTA*, *Vog.!* *Syn. Cass.* 56. Undique molliter pubescens. Foliola oblonga, semipollice longiora. Stipulæ cordatæ, acutæ, foliolis subæquilongæ, ramulos obtegentes.—*Fl. Bras.* 159.

*Hab.* Tropical America: Brazil, prov. Minas Geraes and S. Paolo.

269. *C. MALACOPHYLLA*, *Vog.!* *Syn. Cass.* 55. Undique molliter pubescens. Foliola oblonga, semipollice breviora. Stipulæ cordatæ, acutæ, foliolis subæquilongæ, ramulos obtegentes.—*Fl. Bras.* 159.

*Hab.* Tropical America: Central Brazil.

270. *C. CURVIFOLIA*, *Vog.!* *Syn. Cass.* 55. Glabra v. pubescens. Foliola falcato-oblonga v. falcato-obovata, sæpius parva. Stipulæ cordatæ, acutæ, appressæ. Legumen glabrum v. appresse puberulum.—*Fl. Bras.* 160.

*Hab.* Tropical America: Brazil, prov. Goyaz, Minas Geraes, Bahia, Ceara, Para, and Rio Negro.

The foliage varies from perfectly glabrous and shining to densely and softly pubescent.

\*\*\* *Foliola plurijuga.*

271. *C. CALYCIOIDES*, *DC.!* *Prod.* ii. 503. Prostrata, patentim pilosa. Foliola 6–12-juga, dimidiato-lineararia; glandula stipitata. Flores parvuli, pedicellis abbreviatis.—*Fl. Bras.* 160, t. 43.

*Hab.* Tropical America: Brazil, prov. Goyaz, Piauhy, and Para, also Mexico, *Berlandier*, n. 2036.

Subsect. 2. *Leiocalyx. Sepala membranacea, haud striata.*

Series 1. *Subaphyllæ. Stipula cordatæ, cauli bifariam appressæ, foliolis nisi ad basin caulis nullis.*

272. *C. BASIFOLIA*, *Vog.!* *Syn. Cass.* 56. Folia ad basin caulis interdum perpauca bifoliolata, cætera omnia ad setulam minutam inter stipulas reducta. Stipulæ 4–8 lin. longæ. Flores mediocres v. parvuli, pedicellis stipulis subæquilongis.—*Fl. Bras.* 161, t. 44.

*Hab.* Tropical America: Brazil, prov. Minas Geraes and Goyaz.



Series 2. Prostratæ. *Herbæ prostratæ, annuæ v. basi perennes sæpe patentim pilosæ. Foliola uni- plurijuga, membranacea. Glandulæ tenuiter stipitatae v. nullæ. Flores parvi v. mediocres, pedicellis filiformibus.*

273. *C. ROTUNDIFOLIA*, *Pers. Syn.* i. 456. Foliola 1-juga, obovata, petiolo eglanduloso. Stipulæ cordatæ, cauli arcte appressæ.—*Fl. Bras.* 161.

*C. bifoliolata*, DC. ! in Collad. Hist. Cass. 120, t. 9.

*C. pentandra*, Raddi, Quar. Piant. Nuov. 20 (in Mem. Acad. Moden. xviii.).

*C. monophylla*, Vell. Fl. Flum. 166; Ic. iv. t. 61.

Var. *BAUHINIÆFOLIA*. Stipulæ semipollicares longioresque, foliola usque ad  $1\frac{1}{2}$  poll. longa, flores quam in forma typica majores, sepalis 3 lin. longis.

*C. bauhiniæfolia*, Kunth !, Mim. 123, t. 37.

*C. fabaginæfolia*, H. B. et K. ! Nov. Gen. et Sp. vi. 363.

*C. filipes*, Benth. ! in Hook. Journ. Bot. ii. 81.

Var. *GRANDIFLORA*. Stipulæ vix 3 lin. longi. Flores magni, sepalis 6 lin. longis.

*Hab.* Tropical America: Brazil, Guiana, Columbia, Central America, and Mexico; the var. *bauhiniæfolia* in Guiana and Columbia, the var. *grandiflora* in Brazil.

274. *C. TAGERA*, *Linn. ! Spec. Pl.* 538, *excl. syn.* Foliola 3- rarius 2-juga, parva, obovata; glandula stipitata. Stipulæ cordato-lanceolatæ, cauli appressæ, demum subhyalinæ. Legumen breve, 1-4-spermum.—*Fl. Bras.* 162.

*C. ciliaris*, Collad. ! Hist. Cass. 98.

*C. Kunthiana*, Cham. et Schlecht. ! in Linnæa, v. 598.

*Hab.* Tropical America: Brazil, Guiana, Columbia, Central America, Mexico.

The specimen in the Linnæan herbarium (answering to the character given) is certainly this species, although the habitat "in India" and the synonyms are erroneous.

275. *C. PILOSA*, *Linn. Spec. Pl.* 540. Annua. Foliola 3-5-juga, latiuscule oblonga, membranacea,  $\frac{1}{2}$ -1-pollicaria, petiolo eglanduloso. Stipulæ lanceolatæ, basi obliquæ.

*C. emarginata*, Mill. ! Dict. n. 13, non Linn.

*C. Milleri*, Collad. Hist. Cass. 132.

*Hab.* Tropical America: Jamaica, Columbia, sea coast, *Fendler*.

There is no specimen of this in Linnæus's herbarium.

276. *C. SERPENS*, *Linn. ! Spec. Pl.* 541, *non Vog.* Foliola 5-7-juga, lineari-oblonga, membranacea, semipollice breviora; glandula tenuiter stipitata v. rarius nulla. Stipulæ lanceolato-subulatæ. Leguminis acumen rectiusculum.—*Fl. Bras.* 162.

*C. prostrata*, Humb. et Bonpl. ! in Willd. Enum. 441.

*C. flexuosa*, Mill. ! Dict. n. 16, non Linn.

*Hab.* Tropical America: Brazil, Guiana, Columbia, West Indies, Central America, Mexico.

277. *C. TRICHOPODA*, *Benth. ! in Mart. Fl. Bras. Cæsalp.* 163. Herbacea, prostrata, patentim pilosa. Foliola 8-25-juga, dimidiato-lineararia, rigidule membranacea; glandula tenuiter stipitata. Pedicelli calyce multo longiores. Stigma parvum.

*Hab.* Tropical America: Brazil, prov. S. Paulo, Minas Geraes, and Goyaz; Caraccas, *Birschell*.

278. *C. PUMILA*, *Lam. Dict.* i. 651. Herbacea, prostrata, pubescens. Foliola 8-15-



juga, dimidiato-lineararia; glandula tenuiter stipitata. Pedicelli calyce vix longiores brevioresve. Stigma stylo abbreviato peltatum.—*Benth. Fl. Austr.* ii. 290.

*C. prostrata*, Roxb. ! Hort. Beng. 32.

*Senna prostrata*, Roxb. ! Fl. Ind. ii. 352.

*Hab.* Tropical Asia and Australia.

279. *C. SUPPLEX*, *Mart. ! Fl. Bras. Cæsalp.* 163. Annua, prostrata, patentim pilosa. Foliola 4–6-juga, parva, anguste oblonga; glandula parva, tenuiter stipitata. Stipulæ oblique cordatæ. Legumen brevi acumine inflexo uncinatum.

*Hab.* Tropical America: Brazil, prov. Bahia, Pernambuco, Piauhy, and Goyaz.

(*C. zambesica* has also the long-stipitate gland of this group.)

Series 3. Paucijugæ. *Perennes v. fruticosæ, erectæ v. diffusæ. Foliola 3–7-juga, membranacea v. subcoriacea, costa excentrica pennivenia; glandulæ parvæ, breviter stipitatæ.*

280. *C. CORDISTIPULA*, *Mart. ! Herb. Fl. Bras.* 139. Suffrutex procumbens, pilosopubescens. Foliola 5–7-juga, parva, lineari-oblonga, paucivenia. Stipulæ cordatæ, aristatæ. Flores mediocres v. majusculi. Leguminis acumen rectiusculum.—*Fl. Bras.* 164.

*C. psammophila*, Benth. in herb. Acad. Petrop. olim.

*Hab.* Tropical America: Brazil, prov. Mattogrosso, *Riedel, Manso.*

281. *C. SCHLIMII*, *Benth.*, sp. n. Diffusa, pubescens v. hirsuta. Foliola 2–4-juga, obovato-cuneata, semipollice breviora, venis a costa divergentibus furcatis dichotomisve cum 2–3 uno latere a basi oriundis; glandula urceolata, sessilis v. substipitata. Stipulæ e basi latiuscule cordata subulato-acuminatæ. Flores mediocres, pedicellis brevibus.

*Hab.* Tropical America: Columbia, near Ocaña, *Schlim*, n. 281.

This has much the aspect of *C. cordistipula*; but the leaflets are shorter and broader, and the venation is peculiar.

282. *C. TENELLA*, *H. B. et K. ! Nov. Gen. et Sp. Pl.* vi. 365. Caules e rhizomate lignoso, breves, tenelli foliaque glabra. Foliola 3–4-juga, obovato-cuneata, semipollice breviora, venis a costa divergentibus, paucis subreticulatis v. hinc inde furcatis; glandula breviter stipitata. Stipulæ parvæ. Flores mediocres, pedicellis longiusculis.

*Hab.* Tropical America: near San Borja on the Orinoco, *Humboldt and Bonpland.*

Allied to *C. Schlimii*, but quite glabrous, the veins of the leaflets less prominent and the stipules very small.

*C. foliosa*, G. Don, Gen. Syst. ii. 446, from Peru, *Pavon*, which I have not seen, may be the same as *C. tenella*, but is insufficiently described for identification.

283. *C. GRANTII*, *Oliv. ! Fl. Trop. Afr.* ii. 279. Glaberrima. Caules e rhizomate perenni, breves, diffusi v. ascendentes. Foliola 4–6-juga, latiuscule oblonga, obtusissima, membranacea. Flores mediocres, pedicellis subpollicaribus.

*Hab.* Tropical Africa.

284. *C. WRIGHTII*, *A. Gray !, Pl. Wright.* ii. 50 (*Smiths. Contr.* v.). Glaberrima. Caules e rhizomate perenni, breves, erectiusculi. Foliola 4–6-juga, anguste oblonga, obtusa, membranacea. Flores mediocres, pedicellis subpollicaribus.

*Hab.* Subtropical North America: New Mexico.

285. *C. TENUISEPALA*, *Benth. ! in Mart. Fl. Bras. Cæsalp.* 164. Fruticosa. Foliola



3-4-juga, cuneato-oblonga, obtusa, glabra, rigidule membranacea. Flores majusculi, sepalis pallidis latis tenuibus.

*Hab.* Tropical America: Brazil, prov. Para, Piauhy, and Minas Geraes; Paraguay.

286. *C. PASCUORUM*, *Mart.!* *Fl. Bras. Cæsalp.* 165. Herbacea, erecta. Foliola 4-8-juga, membranacea, utrinque molliter pubescentia. Flores magni.

*Hab.* Tropical America: Brazil, prov. Bahia.

287. *C. GRAMMICA*, *Spreng.!* *Neue Entd.* iii. 55. Suffruticulosa? Foliola 4-7-juga, parva, oblonga subcuneatave, subcoriacea, utrinque molliter pubescentia. Flores majusculi.

*C. lineata*, var. *brachyloba*, Griseb. *!* *Pl. Wright. Cub. in Mem. Amer. Acad.* viii. 179.

*Hab.* Tropical America: Cuba, also Central America, *Ersted.*

Foliola 3-6 lin. longa, fere *C. lineatæ* costa parum excentrica, venis tamen multo tenuioribus ad utrumque latus costæ sat crebris, inferioribus lateris exterioris approximatis.

Series 4. Coriaceæ. *Frutices suffruticesve, rarius herbæ perennes. Foliola coriacea, rigida v. crassiuscula, basi bi-plurinervia, costa subcentrali v. excentrica, utrinque pennivenia. Glandula depressa, scutellata v. urceolata, sessilis v. vix stipitata.*

\* *Foliola 1-4- rarius hinc inde 5-6-juga. Stipulæ parvæ, angustæ.*

288. *C. CHORIOPHYLLA*, *Vog.!* *Syn. Cass.* 56. Glaberrima. Foliola 1-juga, falcato-oblonga v. obovata, 1-2-pollicaria; glandula depressa. Flores majusculi.—*Fl. Bras.* 165.

*C. gonoclada*, Benth. in herb. Acad. Petrop. olim.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

289. *C. BURCHELLII*, *Benth.!* in *Mart. Fl. Bras. Cæsalp.* 165. Glaberrima. Foliola 2-3-juga v. floralia 1-2-juga, late oblonga, obtusa, 1-2-pollicaria; glandula depressa. Flores majusculi.

*Hab.* Tropical America: Brazil, prov. Goyaz.

290. *C. MULTINERVIA*, *Mart.!* *Fl. Bras. Cæsalp.* 166. Glaberrima. Foliola 2-3-juga v. floralia 1-juga, oblonga, mucronata,  $\frac{3}{4}$ -1-pollicaria; glandula urceolata. Flores majusculi.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

291. *C. LINEATA*, *Swartz, Fl. Ind. Occid.* 726. Diffusa?, puberula. Foliola 2-4-juga, obovato-cuneata, venis a costa divergentibus simplicibus, semipollice breviora; glandula urceolata v. nulla. Flores mediocres.

*C. obcordata*, Swartz ex Wikstr. *!* in *K. Vetensk. Akad. Handl. Stockh.* 1825, 429.

*C. cuneata*, Griseb. *!* *Cat. Pl. Cub.* 80, non DC.

*Hab.* Tropical America: Cuba, Jamaica, and other West-Indian islands.

*C. obcordata* is referred by Grisebach to *C. biflora*, but whether or not on any other authority than Wikström's expression "*C. bifloræ affinis*" does not appear. The description given is totally at variance with that species, and suggested an affinity to *C. lineata*, differing in the rather more numerous leaflets and the stipitate gland; and subsequently I met with an original specimen from Wikström in herb. DC., which appeared to me to be only a slight variety of that species, which requires, however, further comparison with allied species, through a better series of specimens than we possess.

*C. tenella* and *C. Schlimii* come near to some of the smaller forms of *C. lineata*; but the veins of the leaflets are more or less branched, and their habit is that of *C. cordistipula*. *C. polyadena*, DC., to which Grisebach referred Wright's Cuban specimens, n. 2376, is also nearly allied, differing in the larger, more numerous leaflets, more erect habit, &c.



292. *C. PACHYPHYLLA*, *Mart. ! Fl. Bras. Cæsalp.* 166. Fruticulus ramosissimus. Foliola 3–4-juga, lineari-oblonga v. anguste cuneata, semipollicem raro excedentia, glabra v. puberula; glandula urceolata. Flores mediocres v. majusculi.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

293. *C. TRAGACANTHOIDES*, *Mart. ! Fl. Bras. Cæsalp.* 166, t. 45. Fruticulus ramosissimus, foliis confertis. Foliola 2–4-juga, lineari-oblonga v. subcuneata, semipollice breviora, utrinque cano-sericea. Flores majusculi.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

\*\* *Foliola* 4–10-juga, rarius 3-juga. *Stipulae* latae, foliaceae, striato-multinerves. *Folia* saepe disticha.

294. *C. ANCEPS*, *Benth. ! in Mart. Fl. Bras. Cæsalp.* 166. Frutex glaber, ramulis ancipitibus. Foliola 3-juga, ovali-oblonga,  $\frac{1}{2}$ – $\frac{3}{4}$ -pollicaria. *Stipulae* oblique cordato-ovatae. Flores majusculi.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

295. *C. ROTUNDATA*, *Vog. ! Syn. Cass.* 58. Frutex. Foliola 4–10-juga, late oblonga v. ovalia, obtusissima, in forma typica semipollicem haud excedentia. *Stipulae* ovatae v. orbiculatae, obtusissimae. Flores majusculi.—*Fl. Bras.* 167.

Var. *GRANDISTIPULA*. Omnibus partibus major; *stipulae* rotundatae, 9–12 lin. diametro.

*C. grandistipula*, *Vog. ! Syn. Cass.* 58.

Var. *ANGUSTIFOLIA*. Foliola angustius oblonga, *stipulae* ovatae.

*Hab.* Tropical America: Brazil, prov. Minas Geraes, the three varieties.

296. *C. SWAINSONI*, *Benth. ! in Mart. Fl. Bras. Cæsalp.* 167. Frutex pubescens, forte glutinosus. Foliola 4–6-juga, oblonga, aristato-mucronata,  $\frac{3}{4}$ –1-pollicaria. *Stipulae* latae, semicordatae, aristato-acuminatae. Flores majusculi.

*Hab.* Tropical America: Brazil.

297. *C. CINERASCENS*, *Vog. ! Syn. Cass.* 60. Fruticulus ramulis puberulis. Foliola 6–10-juga, oblonga, subsemipollicaria, glabra. *Stipulae* latae, oblique cordatae, acutae v. mucronatae. Flores majusculi. Legumen junius pubescens, demum glabratum.—*Fl. Bras.* 167.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

298. *C. DISTICHOCLADA*, *Mart. ! Fl. Bras. Cæsalp.* 168. Frutex ramulis dense pubescenti-hirtis. Foliola 3–5-juga, oblonga, mucronato-acuta, 2–3 lin. longa, punctata, ciliolata. *Stipulae* oblique cordatae, acutae. Flores majusculi. Legumen tenuiter pubescens.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

\*\*\* *Foliola* 10–50-juga. *Stipulae* late v. anguste lanceolatae.

299. *C. POTENTILLA*, *Mart. ! Fl. Bras. Cæsalp.* 168. Frutex ramulis molliter pubescentibus. Foliola 10–20-juga, oblonga, mucronato-acuta, parva, decrescentia, puberula v. demum glabrata, tenuiter nervosa. *Stipulae* lato-lanceolatae, persistentes. Flores majusculi. Legumen pubescens.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

It is possible that this and *C. distichoclada* may prove to be varieties of *C. cinerascens*, differing chiefly in the number of leaflets, pubescence, and other minor characters.



300. *C. GONOCCLADA*, *Benth.!* in *Mart. Fl. Bras. Cæsalp.* 169. Suffrutex erectus, subglaber. Foliola 10–20-juga, falcato-oblonga, majora  $\frac{3}{4}$ -pollicaria, decrescentia. Stipulæ semicordatæ, lato-lanceolatæ, acutæ. Flores majusculi.

*Hab.* Tropical America: Brazil.

301. *C. FLEXUOSA*, *Linn. Spec. Pl.* 543. Suffruticosa v. perennis caule erecto rigido flexuoso, glabro v. pubescenti. Foliola 20–50-juga, dimidiato-linearia, parva, decrescentia, subglabra. Stipulæ semicordatæ, late lanceolatæ, acutæ. Flores majusculi.—*Fl. Bras.* 169; *Breyn. Cent.* t. 23 (opt.).

*C. arenaria*, H. B. et K. ! *Nov. Gen. et Sp. Pl.* vi. 370.

*Hab.* Tropical America: Brazil, Guiana, Columbia, and southward to the Uruguay.

302. *C. RORAIMÆ*, *Benth.*, sp. n. Fruticosa. Foliola 15–25-juga, lineari-falcata, acutissima, subsemipollicaria, decrescentia, nitida, subglabra. Stipulæ semilanceolatæ, caducæ. Flores magni.

*Hab.* British Guiana: Roraima, *Appun*, n. 1231; and probably in the same mountains, *Rob. Schomburgk*, 2nd coll. n. 582; *Rich. Schomburgk*, n. 840.

Frutex rigide ramosus, ramulis petiolisque pubescentibus. Foliola 15–25-juga, lineari-falcata, acutissima, rigida, basi obliqua, sub-5-nervia, glabra v. margine ciliata, supra nitida, subtus pallida, inferiora cujusve folii 4–6 lin. longa, superiora sæpius valde decrescentia. Petiolus communis 2–3-pollicaris. Glandula sessilis, scutellata v. urceolata. Stipulæ semilanceolatæ, striatæ, caducæ. Pedicelli semipollicares. Sepala acuminata, semipollicaria v. longiora, extus minute puberula. Petala pollicaria. Antheræ parum inæquales. Ovarium dense hirsutum. Legumen perfectum 2-pollicare v. longius, 3–3 $\frac{1}{2}$  lin. latum, hirtellum.

303. *C. OLESIPHYLLA*, *Vog.!* *Syn. Cass.* 68. Frutex ramulis sordide pubescentibus. Foliola 15–30-juga, linearia, parva, decrescentia, rigida, puberula v. glabrata. Stipulæ semilanceolatæ, rigidæ, persistentes. Flores majusculi.—*Fl. Bras.* 169.

*C. rupicola*, *Benth.* in herb. Acad. Petrop. olim.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

\*\*\*\* Foliola 4–20-juga. Stipulæ parvæ v. angustæ.

304. *C. ARISTATA*, *Benth.!* in *Mart. Fl. Bras. Cæsalp.* 170. Frutex ramulis pubescentibus. Foliola 4–7-juga, late ovata, aristato-mucronata, subsemipollicaria, glabra v. puberula. Stipulæ lanceolato-subulatæ. Flores majusculi.

*Hab.* Tropical America: Brazil.

305. *C. VENULOSA*, *Benth.!* in *Mart. Fl. Bras. Cæsalp.* 170. Frutex ramulis pubescenti-hirtis. Foliola 6–8-juga, falcato-oblonga, acuta, subsemipollicaria, pubescentia. Stipulæ sublanceolato-lineares. Legumen longe pilosum.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

306. *C. DREPANOPHYLLA*, *Benth.!* in *Mart. Fl. Bras. Cæsalp.* 170. Suffrutex? caule molliter pubescente. Foliola 15–20-juga, falcato-oblonga, acuta,  $\frac{1}{2}$ – $\frac{3}{4}$ -pollicaria, sæpe decrescentia, puberula. Flores majusculi.

*Hab.* Tropical America: Brazil, prov. Ceara and Bahia.

307. *C. PARVISTIPULA*, *Benth.!* in *Mart. Fl. Bras. Cæsalp.* 170. Suffrutex? glaberrimus. Foliola 8–12-juga, lineari-oblonga, obtusa, 4–8 lin. longa. Stipulæ parvæ. Flores mediocres.

*Hab.* Tropical America: Brazil, prov. Minas Geraes and Goyaz.



Series 5. Subcoriaceæ. *Perennes v. fruticosæ, erectæ. Foliola 3–10-juga, obtusa, costa subcentrali pennivenia, sæpius subcoriacea. Glandula sessilis v. rarius stipitata. Stipulæ angustæ v. parvæ.*

308. *C. GREGGII*, *A. Gray!*, *Pl. Wright.* i. 61 (*Smiths. Contrib.* iii.). Frutex subglaber. Foliola 3–5-juga, parva, oblonga, obtusa, coriacea, 3–5 lin. longa, costa subcentrali, venis reticulatis; glandula parva, breviter stipitata. Flores majusculi.

*Hab.* Subtropical North America: South Texas.

This species would be almost as well placed amongst the *Coriaceæ* near *C. lineata*, connecting the two series.

309. *C. MUCRONATA*, *Spreng. Syst.* ii. 341. Frutex ramulis pubescentibus. Foliola 3–4-juga, latiuscule oblonga, obtusa, glabra v. puberula,  $\frac{1}{2}$ –1-pollicaria, costa subcentrali tenuiter pennivenia; glandula urceolata. Flores majusculi.—*Fl. Bras.* 171.

*Hab.* Tropical America: Brazil, prov. Minas Geraes and Maranham.

310. *C. POLYADENA*, *DC.!* *Pl. Rar. Jard. Gen.* 2<sup>e</sup> *Rapp.* 12. Frutex ramulis puberulis. Folia 5–10-juga, oblonga, obtusa, subglabra, semipollicaria v. longiora, costa subcentrali pennivenia; glandula depressa v. rarius substipitata, interjugales etiam sæpe adsunt. Legumina patentia.

*Hab.* Tropical America: Jamaica, Guadeloupe, Bahamas.

Nearly allied to *C. virgata*, but with much larger, fewer, and more coriaceous leaflets, which, however, are much more numerous than in *C. lineata*, which this species otherwise resembles. There are three West-Indian forms in our herbaria—one with pubescent leaves and rather large sessile glands, another with glabrous leaves and small almost sessile and few glands, a third with similar glabrous leaves but the glands remarkably stipitate and rather numerous.

311. ? *C. REPENS*, *Vog. Syn. Cass.* 60. Suffrutex humilis, molliter pubescens v. glabratus. Foliola 4–10-juga, oblonga, obtusa, sæpius mucronata, subsemipollicaria, costa subcentrali pennivenia; glandula sessilis v. subsessilis. Legumina patentia.—*Fl. Bras.* 171.

*Hab.* Tropical America: Brazil, prov. Minas Geraes.

A specimen from the Andes of Popayan in herb. Hook. appears to be a variety of this species, which may possibly not be distinct from the following *C. cuneata*; but the specimens are as yet insufficient to determine the point.

312. *C. CUNEATA*, *DC.!* in *Collad. Hist. Cass.* 121. Habitus et stipulæ *C. repentis*. Foliola 4–6-juga, oblongo-cuneata, semipollicaria, supra glabra, subtus pubescentia, costa subcentrali lineato-pennivenia, basi tamen a latere exteriori sæpius 1–2-nervia; glandula subsessilis. Pedicelli 1–3-ni, semipollicares, pubescentes. Sepala acuminatissima.

*Hab.* Tropical America? A single specimen of uncertain origin in herb. DC.

313. *C. BRACHYPODA*, *Benth.!* in *Mart. Fl. Bras. Cæsalp.* 172. Herbacea v. suffruticosa, erecta, molliter pubescens v. hirsuta. Foliola 6–10-juga, oblonga, obtusa,  $\frac{1}{2}$ –1-pollicaria, costa subcentrali crebre pennivenia; glandula sessilis, depressa. Flores mediocres. Pedicelli brevissimi et legumina erecta, stricta, more *C. patellarie* et *C. nigricantis*.

*Hab.* Tropical America: Brazil, prov. Minas Geraes and Goyaz; Bolivia, prov. Chiquitos, *Weddell*; Lamas, Peru, *Spruce*.

This may possibly be reducible to *C. vestita*, *Vog. Syn. Cass.* 60, *Linnaea* xi. 711, a species I have not seen, and accidentally omitted in *Fl. Bras.* It agrees with *C. brachypoda* in every respect except that the gland is said to be urceolate and shortly stipitate.



Series 6. *Chamæcristæ veræ*. *Herbæ v. suffrutices*. *Foliola 8–20-juga* (in *C. mimosoide sæpe ultra 30-juga*), *membranacea, costa subcentrali v. excentrica utrinque pennivenia v. rarius venulis latere angustiore subevanidis*. *Glandula sessilis vel stipitata*. *Stipulæ parvæ v. angustæ*.

\* *Foliola obtusa v. acutiuscula, costa subcentrali v. parum excentrica*.

314. *C. CHAMÆCRISTA*, *Linn. ! Spec. Pl. 542*. Herbacea. *Glandula sessilis, depressa*. Flores majusculi.

*C. triflora*, Jacq. Hort. Schönbr. t. 480, fide specim. in herb. DC.

*C. venosa*, Castigl. ex DC. in Collad. Hist. Cass. 130.

*C. castiglionea*, Collad. *l. c.* lapsu calami pro *C. trifolia*, Jacq.

*C. Hornemanni*, DC. Prod. ii. 507 (*C. venosa*, Hornem. Hort. Hafn. Suppl. 46), ex char. nimis brevi.

*C. pulchella*, Salisb. Prod. 326.

*C. fasciculata*, Mich. Fl. Bor.-Amer. i. 262.

Var. *BRASILIENSIS*, *Vog. ! Mart. Fl. Bras. Cæsalp. 172, t. 45*. Caule robustiore, 1–3-pedali.

*C. hypnotica*, Vell. Fl. Flum. 169; Ic. iv. t. 75, ex icone.

*C. gemina*, Vell. *l. c.*; Ic. t. 74 est forte forma floribus minoribus.

*Hab.* Subtropical and extratropical N. America, where it varies exceedingly in stature, indumentum, &c., as well as in the proportion of large and small anthers. The Brazilian variety appears common in South and Central Brazil and Eastern Bolivia.

The original typical form appears to be annual; but some varieties are described by collectors as shrubby, at least at the base, and it is possible that characters might be found generally to separate as species the Brazilian from the North-American forms; but then it would be necessary to split up the North-American ones into several species. The specimens, for instance, from Texas, *Lindheimer*, 2nd coll. n. 232, have a very distinct habit. On the other hand, the whole of the group of the *Chamæcristæ veræ* seem to pass so gradually one into the other, that the delimitation of species here given must be admitted to be very unsatisfactory.

*C. felipensis*, H. B. et K. ! Nov. Gen. et Sp. vi. 368, with quite sessile glands, appears to be referable rather to *C. Chamæcrista* than to *C. glandulosa*.

315. *C. FLAVICOMA*, *H. B. et K. ! Nov. Gen. et Sp. vi. 366*. Fruticosa, molliter aureo-pubescent. *Glandula urceolata v. stipitata*. Flores majusculi. Legumen villosum.—*Fl. Bras. 173*.

*C. stipulata*, G. Don !, Gen. Syst. ii. 44.

*Hab.* Tropical America: Columbia and Peru.

316. *C. VIRGATA*, *Swartz !, Fl. Ind. Occid. ii. 728*. Fruticosa, glabra v. adpresse pubescens. *Glandula stipitata*. Legumen glabrum.

*C. Chamæcrista*, Mill. ! herb., at non Dict. n. 17.

*C. glandulosa*, Hook. Bot. Mag. t. 3435; Benth. Pl. Hartw. 263, and others.

*C. Swartzii*, Wikstr. in Stockh. Vetensk. Akad. Handl. 1825, 430, ex Griseb.

*Hab.* Tropical America: West-Indian Islands.

317. *C. GLANDULOSA*, *Linn. ! Spec. Pl. 542*. Herbacea v. suffruticosa, pubescens v. glabrescens nec patentim pilosa. *Glandula stipitata*. Flores majusculi, longiuscule pedicellati. Legumen glabrum v. pube brevi conspersum.—*Fl. Bras. 173*.



*C. propinqua*, H. B. et K. ! Nov. Gen. et Sp. vi. 369.

*C. erecta*, Willd. herb. ex Steud. Nom. Bot. ed. 2.

*C. Otterbeinii*, G. F. W. Mey. Prim. Fl. Esseq. 169, ex descr.

*C. parvifolia*, Wender. in Syll. Flor. Ratisb. i. 65, ex descr.

*C. Pavoniana*, G. Don !, Gen. Syst. ii. 447.

*C. disadena*, Steud. ! in Flora, 1843, 760.

*C. ramosissima*, H. B. et K. ! Nov. Gen. et Sp. vi. 367, videtur hujus potius quam *C. flavicomæ* var.

*Hab.* Tropical America : Brazil, Guiana, Columbia, Peru.

318. *C. STENOCARPA*, Vog. ! *Syn. Cass.* 68. Herbacea v. suffruticosa, patentim pilosa. Glandula stipitata. Flores mediocres, breviter pedicellati. Legumen glabrum v. pube brevi conspersum.—*Fl. Bras.* 173.

*Hab.* Tropical America : Brazil, Guiana, Columbia.

319. *C. RIPARIA*, H. B. et K. ! *Nov. Gen. et Sp.* vi. 369. Herbacea v. suffruticosa, glabra v. tenuiter pubescens. Glandula stipitata. Flores mediocres, breviter pedicellati. Legumen pilis longiusculis conspersum.—*Fl. Bras.* 174.

*C. Parkeriana*, DC. ! *Prod.* ii. 504.

*Hab.* Tropical America : Brazil, Guiana, Peru, Central America, West-Indian Islands.

The three preceding species ought probably to be united into one; but if *C. stenocarpa* be retained as distinct, *C. riparia* cannot well be referred to *C. glandulosa*.

320. *C. NIGRICANS*, Vahl, *Symb.* i. 30. Herbacea, molliter hirsuta. Glandula sessilis, depressa. Flores parvi, brevissime pedicellati. Legumina erecta, stricta, pilosa.—*Oliv. ! Fl. Trop. Afr.* ii. 280.

*C. micrantha*, Guill. ! et Perr. *Fl. Seneg.* 262.

*C. Arnottiana*, Wight !, herb. propr. n. 2410.

*Hab.* Tropical Africa and Asia.

*C. pilidens*, Steud. *Nom. Bot.* ed. 2, is founded on the Abyssinian specimens, Schimper, n. 66, at first referred to the N. American *C. nictitans*, of which it has the aspect and small flowers, with only 4 or 5 stamens; but the gland is broad and sessile, and it may very possibly prove to be a reduced variety of *C. nigricans*, differing in being less hairy, with rather longer more slender pedicels, and only 4 or 5 stamens. The specimens are few, much smaller and more slender than *C. nigricans* usually is. We have also two very similar specimens from Simla in herb. Hook., and one very near to them from N. China.

321. *C. BREVIFOLIA*, Lam. *Dict.* i. 651, *fide herb. DC. !* Pumila, diffusa, pilis paucis brevibus conspersa. Folia parva, foliolis confertis. Glandula parva, depressa. Flores mediocres, longiuscule pedicellati. Sepala obtusa.

*Hab.* Madagascar.

Fruticulosa videtur. Folia vix semipollicaria, foliolis 8–12-jugis approximatis 1–2 lin. longis oblongis obtusis coriaceis, costa subcentrali nunc duplicata, venis utrinque perpaucis prominulis. Stipulæ e basi lanceolata v. cordata setaceo-acuminatæ. Pedicelli solitarii. Sepala glabra.

Var. *MINUTULA*, Boj. !, longius pilosa, foliis tenuioribus, venis vix conspicuis.

*Hab.* Madagascar, in the lofty mountains of the province of Emirna, Bojer in *herb. DC.*



\*\* *Foliola angustiora, sæpius acutiuscula v. mucronato-acuta, costa magis excentrica, margini superiori plus minus approximata, venis tamen sæpius nonnullis obliquis interjectis.*

322. *C. NICTITANS*, Linn. ! *Spec. Pl.* 543. Annua, erecta v. diffusa, ramosa, glabra v. pilosa. Glandula urceolata, sessilis v. breviter stipitata. Flores parvi, breviter pedicellati. Stamina 4–6, sæpius 5, filamentis longiusculis (in sequentibus stamina sæpius 7–10 filamentis, abbreviatis).

*C. procumbens*, Linn. *Spec. Pl.* 543, quoad plantam boreali-Americanam non Linn. herb.

*C. diffusa*, DC. ! in *Mém. Soc. Hist. Nat. Genève*, ii. 130.

*Grimaldia assurgens* et *G. decumbens*, Schrank, in *Denkschr. Münch. Akad.* 1808, 110, 111, t. 4, 5.

*Cassia smaragdina*, Macfad. *Fl. Jam.* i. 347, ex Griseb.

*C. aspera*, Muhlenb. in *Ell. Bot. S. Car. and Georg.* i. 474, ex Torr. et Gr.

*Hab.* Subtropical N. America: Southern United States, Mexico, and perhaps also tropical America, W. Indies, Guiana, and Columbia.

Although Linnæus gives "in Indiis" as well as Virginia for the habitat of his *C. procumbens*, both his references belong to the N. American species, which is certainly not distinct from *C. nictitans*.

323. *C. ZAMBESICA*, Oliv. ! *Fl. Trop. Afr.* ii. 280. Herbacea (erecta ?), patentim pilosa. Glandula tenuiter stipitata. Flores parvi, breviter pedicellati. Stamina 7–10. Legumen hirsutum.

*Hab.* Tropical Africa.

This has the gland of the *Prostratæ*; but the habit appears to be more that of the *Chamæcristæ veræ*.

324. *C. PROCUMBENS*, Linn. ! *herb. et Spec. Pl.* 543, *ex parte*. Suffruticosa, procumbens, pubescens. Glandula parva, sessilis v. breviter stipitata. Flores parvuli v. mediocres, breviter v. longiuscule pedicellati. Stamina 7–10. Legumen sparse pilosulum.

*C. pygmæa*, DC. ! *Prod.* ii. 502.

*C. Chamæcrista*, Mill. ! *Dict.* n. 17.

*C. chamæcristoides*, Collad. *Hist. Cass.* 134.

*Hab.* Tropical America: Vera Cruz, *Houston*; Costarica, *Ærsted*; St. Domingo (*DC., Vogel*).

Caules e basi plus minus lignosa prostrataque, apice adscendentes, semipedales ad pedales, uti folia pilis subappressis substrigosis pubescentes interdum cinerascens. Foliola 8–20-juga, jugis confertis, dimidiato-oblonga, sublinearia, costa valde excentrica, venis uno latere 1–2 basilaribus paucisque a costa divergentibus, inter costam et marginem superiorem perpaucis obscurisve, in forma normali  $1\frac{1}{2}$ –3 lin. longa (folio toto sæpe vix semipollicaria), rigidula, oblique acutiuscula. Stipulæ anguste v. latiuscule lanceolatae.

Berlandier's n. 2427, from Texas, seems to be a rather larger variety, with larger stipules and flowers, and longer pedicels; Wright's n. 2380, from Cuba, has smaller leaflets, bordered by long cilia; but all belong probably to one species. The larger specimens sometimes resemble *C. cinerea*, but the venation of the leaflets is quite different.

325. *C. PATELLARIA*, DC. ! in *Collad. Hist. Cass.* 125, t. 16. Herbacea (v. suffruticosa ?), erecta, molliter hirsuta. Glandula sessilis, depressa. Flores parvi, aggregati, brevissime pedicellati. Stamina 7–10. Legumina erecta, stricta, hirsuta.—*Fl. Bras.* 174.

*Hab.* Tropical America: Brazil, Guiana, and Columbia.

In its habit, indumentum, small flowers, and erect pods clustered in the axils, this species closely resembles the African *C. nigricans*: but the venation of the leaflets will be found quite different; it is



almost that of *C. mimosoides* in *C. patellaria*, whilst in *C. nigricans* the midrib is nearly central as in *C. Chamæcrista*.

Var. ? LONGIFOLIA, foliis 4–5-pollicaribus, foliolis  $\frac{1}{2}$ – $\frac{3}{4}$ -pollicaribus iis *C. subtrifloræ* subsimilibus. Glandula depressa *C. patellariæ*.

*Hab.* Tropical America: Brazil, Bolivia, Peru, Columbia, Guiana, W. Indies, Mexico; the long-leaved variety in N. Brazil, *Spruce*.

326. *C. PRÆTEXTA*, *Vog. Syn. Cass.* 67. Herbacea, subglabra. Glandula sessilis, turbinato-cupulata. Flores parvi, brevissime pedicellati. Antheræ 7–10. Legumen glabrum, crassum, incurvum, suturis late marginatis fere alatis.—*Fl. Bras.* 173.

*Hab.* Tropical America: North Brazil, *Spruce*; Cayenne, *Aublet*; Guiana, *Schomburgk*, 1st coll. n. 683; Trinidad, *Crueger*.

This species, very remarkable for its fruit, appears to be scarce, although rather widely diffused; for the few collectors who have gathered it have generally sent few or even single specimens, perhaps because, when in flower, it is readily confounded with other *Chamæcrista*.

327. *C. MIMOSOIDES*, *Linn. Spec. Pl.* 543. Herbacea v. suffruticosa, pubescens v. glabra, erecta v. basi decumbens. Foliola numerosa, lineari-falcata v. lineari-oblonga. Glandula sessilis, depressa v. parum elevata. Flores parvi, mediocres v. rarius majusculi, breviter nunc brevissime pedicellati. Antheræ 7–10 (v. rarius in floribus parvis 5–6). Legumina glabra v. pubescentia, sæpius patentia.—*Fl. Bras.* 175; *Oliv. Fl. Trop. Afr.* ii. 280; *Benth. Fl. Austral.* ii. 291.

*a. Forma typica.* Foliola parva, numerosa, angustissima, petiolo sæpe inter juga marginato. Flores parvi, nunc minimi.

*C. angustissima*, Lam. Dict. i. 650.

*Senna dimidiata*, *S. sensitiva*, et *S. tenella*, Roxb. ! *Fl. Ind.* ii. 352, 353, 354.

*Cassia dimidiata*, *C. sensitiva*, et *C. tenella*, Roxb. ! *Hort. Beng.* 32.

*C. amaena*, Ham. ! in Wall. Cat. Herb. Ind. n. 5321.

*C. Roxburghiana*, Grah. ! in Wall. Cat. Herb. Ind. n. 5323 (floribus inter *a* et *β* mediis).

*Chamæcrista stricta*, E. Mey. ! *Comm. Pl. Afr. Austr.* 159.

*Cassia filipendula*, Boj. in Nov. Act. Nat. Cur. xxii. 399, t. 42, ex ic. et descr. (radicibus hinc inde nodoso-tuberosis).

*β. MYRIOPHYLLA.* Foliola parva, numerosa, angustissima, petiolo marginato v. immarginato. Flores mediocres, sæpius paullo longius pedicellati.

*C. microphylla*, Willd. *Spec. Pl.* ii. 529, fide Vogelii.

*C. hecatophylla*, DC. in Collad. *Hist. Cass.* 124, t. 18.

*C. myriophylla*, Wall. ! *Cat. Herb. Ind.* n. 5326.

*Chamæcrista plumosa*, E. Mey. ! *Comm. Pl. Afr. Austr.* 159.

*Cassia plumosa*, *Vog. Syn. Cass.* 64.

*C. Telfairiana*, Wall. ! *Cat. Herb. Ind.* n. 5324; *Bot. Mag.* t. 5874 (floribus adhuc majoribus).

*C. guineensis*, G. Don, *Gen. Syst.* ii. 499 (foliolis mendo 4-jugis pro 40-jugis), ex *Vog.* in *Linnæa*, xi.

714.

*γ. ÆSCHYNOMENE.* Foliola linearia, latiora tamen et minus rigida quam in forma typica. Planta glabra v. laxè pubescens. Flores mediocres v. parvuli, breviter pedicellati.

*C. æschynomene*, DC. ! in Collad. *Hist. Cass.* 127, t. 17.



*C. Wallichiana*, DC. ! in Wall. Cat. Herb. Ind. n. 5320.

*C. Leschenaultiana*, DC. ! in Mém. Soc. Hist. Nat. Genève, ii. 132.

δ. AURICOMA. Caulis superne pube densa sæpius aurea hirsutus. Cætera formæ præcedentis.

*C. auricoma*, Grah. ! in Wall. Cat. Herb. Ind. n. 5322.

*Hab.* Tropical Asia, Africa, and Australia, very abundantly, more rare in America.

The typical form, with small narrow compact leaflets and very small flowers, is exceedingly abundant and variable all over the tropical regions of the Old World, where it passes into the larger-flowered var. β, of which a rather exaggerated form occurs rarely in tropical America, with as many as fifty pairs of leaflets, and is that figured by Colladon as *C. hecatophylla*, and of which I have seen specimens from British Guiana, *Appun*, n. 796. The var. *æschynomene*, with rather broader and less crowded leaflets, of which we have several specimens from the West Indies, Guiana, and North Brazil, distinguished from *C. glandulosa* and its allies by the glands and venation of the leaves, seems to vary but little in that country; but a precisely corresponding East-Indian form, included in *C. Wallichiana*, passes there very gradually into the small-flowered typical *C. mimosoides* on the one hand, and on the other into the larger-flowered and more hairy varieties *C. Telfairiana* and *C. auricoma*.

Some specimens of *C. Kleinii*, with the midrib less marginal, much resemble some varieties of *C. mimosoides*, but are readily known by the small stipitate gland.

328. *C. COMOSA*, *Vog. Syn. Cass.* 65. Herbacea?, glabriuscula, erecta v. basi decumbens. Foliola oblique v. subfalcato-oblonga, 2–3 lin. lata. Glandula magna, depressa. Cætera *C. mimosoidis*.

*Chamæcrista comosa*, E. Mey. Comm. Pl. Afr. 160.

*Hab.* Extratropical South Africa: eastern districts towards Port Natal.

I have only seen two or three detached specimens which appear referable to this species, of which I have not met with the type. The leaflets are very much broader than in any form known of *C. mimosoides*, of which they have the venation.

329. *C. SUBTRIFLORA*, *Mart. ! Fl. Bras. Cæsalp.* 176. Suffruticosa, undique laxè molliorè pubescens. Foliola valde obliqua, lineari-oblonga. Glandula urceolata. Flores majusculi, breviter pedicellati. Legumina patentia, laxè hirsuta.

*Hab.* Tropical America: Brazil, prov. Minas Geraes, Ceara, Piauhy, and Rio Negro.

Very near some of the larger forms of *C. mimosoides*, but also with something of the habit of *C. patellaris*, but with much larger flowers.

330. *C. KIRKII*, *Oliv. ! Fl. Trop. Afr.* ii. 281. Molliter villosa, grandifolia, grandiflora. Cætera fere *C. mimosoidis* var. *auricomæ*.

*Hab.* Tropical Africa.

I have some doubts whether this should be regarded as more than an extreme form of *C. mimosoides*. Welwitsch's fine specimens, with broad black sepals, appear as distinct as any *Chamæcrista*; but there are also two specimens from the more eastern districts of tropical Africa which are about intermediate between Welwitsch's and some Mauritius specimens of the large-flowered *C. mimosoides* named by Wallich *C. Telfairiana*.



Series 7. Dimidiatæ. *Suffrutices v. herbæ procumbentes v. rarius frutices erecti. Foliola 8–20- rarius 20–30-juga, angusta, sæpius acuta rigidulaque, costa margini superiori arcte approximata v. cum eo confluenta, venis exterioribus valde obliquis.*

331. *C. CAPENSIS*, *Thunb. Fl. Cap.* 318. Suffrutex humilis, pubescens v. glabriusculus. Foliola linearia, obtusiuscula. Glandula minima. Stipulæ angustæ, striatæ. Flores majusculi, longiuscule pedicellati. Stamina 10.

*Chamæcrista capensis*, E. Mey. ! in *Linnæa*, vii. 172.

*Hab.* South Africa, Madagascar, and Mauritius.

*C. Burmanni*, DC. *Prod.* ii. 502, very imperfectly described, is probably a form of this species.

332. *C. FALCINELLA*, *Oliv. ! Fl. Trop. Afr.* ii. 281. Suffrutex? patentim pilosus. Foliola linearia, falcata, mucronato-acuta. Glandula parva. Stipulæ latæ, semicordatæ, falcatae, striatæ. Flores mediocres, longe pedicellati. Stamina 10.

*Hab.* Tropical Africa.

333. *C. CONCINNA*, *Benth. ! Fl. Austral.* ii. 291. Perennis v. suffruticosa, diffusa, pubescens. Foliola linearia, falcata, mucronato-acuta. Glandula parva, stipitata. Stipulæ minimæ, patentæ. Flores mediocres, longe pedicellati. Stamina 5.

*Hab.* Tropical and Eastern subtropical Australia.

334. *C. KLEINII*, *W. et Arn. ! Prod. Fl. Penins. Ind. Or.* 293. Perennis v. suffruticosa, diffusa, pubescens. Foliola oblongo-linearia, subfalcata, mucronata. Glandula stipitata. Stipulæ semilanceolatæ, erectæ. Flores breviter v. rarius longiuscule pedicellati. Stamina 10.

*C. dimidiata*, Klein, in Wall. ! *Cat.* n. 5328.

*Hab.* Tropical Asia.

This species seems to vary with the midrib either close to the margin or at some distance from it, but very rarely with any lateral veins on the upper narrow side.

335. *C. STRIGILLOSA*, *Benth.* Suffruticosa, prostrata, pilis rigidulis subappressis pubens. Foliola 8–12-juga, lineari-falcata, acuta v. oblongo-linearia, venis pluribus a costa marginali divergentibus prominentibus. Glandula parva, subsessilis. Stipulæ angustæ, striatæ. Flores mediocres v. majusculi, longe pedicellati. Legumen vix 2 lin. latum.

*C. serpens*, Griseb. ! *Cat. Pl. Cub.* 80, non Linn.

*Hab.* Tropical<sup>12</sup> America: Cuba, *Linden*, n. 1708, *Wright*, n. 147; St. Domingo, *herb. Mus. Petrop.*

Possibly a variety of *C. cinerea*, but a strongly marked one.

336. *C. CINEREA*, *Cham. et Schlecht. ! in Linnæa*, v. 599. Suffruticosa, prostrata, pubes strigosa cinerascens. Foliola 12–20-juga, lineari-falcata, acuta, costa marginali venisque paucis plerisque basilaribus elongatis. Glandula parva, subsessilis. Stipulæ angustæ, striatæ. Flores magni, breviter pedicellati. Legumen 2½–3 lin. latum.

*Hab.* Tropical America: Mexican sea-coast, *Schiede and Deppe*, *Galeotti*, n. 3408, *Liebmann*, *Berlandier*, n. 2479.

337. *C. TRISTICULA*, *H. B. et K. Nov. Gen. et Sp.* vi. 367. Suffrutex v. frutex erectus, ramulis villosopubescentibus. Foliola 15–25-juga, oblique v. subfalcato-linearia, acuta, costa marginali. Flores majusculi, longiuscule pedicellati.



*C. flavicoma*, Benth. Pl. Hartw. 171, non H. B. et K.

*C. rusa*, Mart. et Gal. ! in Bull. Acad. Brux. x. 2. 306.

*Hab.* Tropical America: Columbia, Central America, and Mexico.

338. *C. PEDICELLARIS*, DC. ! *Prod.* ii. 504. Frutex?, ramulis strigoso-pubescentibus. Foliola 15–20-juga, subfalcato-lineararia, incurvo-mucronata, costa marginali, 3–4 lin. longa, superiora decrescentia. Glandula longiuscule stipitata. Flores mediocres, longiuscule pedicellati.

*Hab.* Tropical America: St. Domingo, *herb.* DC.

This may prove to be a variety of *C. tristicula*; but it appears distinct.

The following supposed species have been named only, or so imperfectly described as to make it impossible now to identify them, although there is very little doubt that they are all included under other names in the foregoing enumeration:—

*C. aurita*, Collad. Hist. Cass. 131; *C. macradena*, Collad. *l. c.* 132; and *C. tuberculata*, Collad. *l. c.* 133, all from Brazil, probably common Rio Janeiro species, all named by Colladon on the sole authority of the very meagre diagnoses given in Vandelli, Fl. Lus. et Bras. specim. 26 (also in Rœm. Script. 104).

*C. dispar*, Willd. Enum. Hort. Berol. 441; *C. hirta*, Willd. *l. c.* Suppl. 23; *C. elegans*, Voigt, in Syll. Fl. Ratisb. ii. 55; *C. eglandulosa*, Dum. Cours, ex DC. *Prod.* ii. 506; *C. homophylla*, Hoffmans. Verz. ex DC. *Prod.* ii. 506; *C. glaucescens* and *C. papulosa*, Hoffmans. *l. c.* ex Steud. Nom. Bot.; *C. acisperma*, Colla, Hort. Rip. App. ii. 343, are all garden plants very imperfectly described, mostly without having seen flowers or fruit, and now not to be recognized.

*C. ornata*, Klotzsch in Schomb. Reis. Gui. iii. (Vers. Faun. u. Fl. Brit. Gui.) 1104; *C. Arowana*, Schomb. *l. c.* 1206; *C. Schomburgkii*, *C. leucoxyton*, and *C. annulata*, Klotzsch, *l. c.* 1207, are names only, without quotation of numbers or any other means of identification, and, without doubt, included among the species above enumerated, as I had received from Sir Robert Schomburgk what he considered a complete set of his own and his brother's Guiana collections.

*C. australis*, Reinw.; *C. biglandulosa*, Bertol., referred by Sprengel to *C. patellaria*; *C. bonariensis*, Hortul., referred by Colladon to *C. corymbosa*; *C. purgans*, Steud., named from Bertero's Chilian specimens, n. 148, are names only entered in Steudel's 'Nomenclator Botanicus.'

The following supposed species do not belong to the genus:—

*C. biflora*, Mill. ! Dict. n. 14, non Linn., altered to *C. Houstoniana*, Collad. Hist. Cass. 132, was founded on a small imperfect specimen of an *Æschynomene*.

*C. paramariboensis*, Miq. in Ann. Nat. Hist. ser. 1, xi. 15, from Surinam, described from fruiting specimens without having seen the flowers (Miq. in Linnæa, xviii. 584), is evidently *Æschynomene sensitiva*, L.

*C. disperma*, Vell. Fl. Flum. 167, Ic. iv. t. 69, = *Peltophorum Vogelianum*, Benth.

*C. fluminensis*, Vell. *l. c.* 168, t. 72, = *Dimorphandra exaltata*, Schott.

*C. parahyba*, Vell. *l. c.* t. 71 = *Schizolobium excelsum*, Vog.

*C. paratyensis*, Vell. *l. c.* t. 70, is no *Cassia*; but the genus is uncertain.



The following determinations of a few numbered collections more or less generally distributed may be found useful:—

## ASIATIC COLLECTIONS.

## Cuming's Philippine-Island Plants.

666	<i>C. occidentalis</i> , Linn.	1028	<i>C. nodosa</i> , Ham.	1450	<i>C. occidentalis</i> , Linn.
747	<i>C. Tora</i> , Linn.	1369	<i>C. mimosoides</i> , Linn.	1805	<i>C. fistula</i> , Linn.
968	<i>C. timorensis</i> , DC.				

## Wallich's Distribution of Indian Plants.

5301	<i>C. alata</i> , Linn.	5312	<i>C. glauca</i> , Lam.	5322	<i>C. mimosoides</i> , Linn.
5302	<i>C. Fistula</i> , Linn.	5313	<i>C. bicapsularis</i> , Linn.	5323	<i>C. mimosoides</i> , Linn.
5303	<i>C. auriculata</i> , Linn.	5314	<i>C. Absus</i> , Linn.	5324	<i>C. mimosoides</i> , Linn.
5304	<i>C. hirsuta</i> , Linn.	5315	<i>C. Absus</i> , Linn.	5325	<i>C. mimosoides</i> , Linn.
5305	<i>C. siamea</i> , Lam.	5316	<i>C. Tora</i> , Linn.	5326	<i>C. mimosoides</i> , Linn.
5306	<i>C. timorensis</i> , DC.	5317	<i>C. Sophera</i> , Linn., et <i>C. occi-</i>	5327	<i>C. pumila</i> , Lam.
5307	<i>C. renigera</i> , Wall.		<i>dentalis</i> , Linn.	5328	<i>C. Kleinii</i> , W. et Arn.
5308	<i>C. marginata</i> , Roxb.	5318	<i>C. angustifolia</i> , Vahl.	5329	<i>C. tomentosa</i> , Linn.
5309	<i>C. javanica</i> , Linn.	5319	<i>C. obovata</i> , Collad.	5330	<i>C. montana</i> , Heyne.
5310	<i>C. multijuga</i> , Rich.	5320	<i>C. mimosoides</i> , Linn.	5331	<i>C. nodosa</i> , Hamilt.
5311	<i>C. glauca</i> , Lam.	5321	<i>C. mimosoides</i> , Linn.		

## SOUTH-AMERICAN COLLECTIONS.

## Appun: British Guiana.

363	<i>C. multijuga</i> , Rich.	1231	<i>C. Roraimæ</i> , Benth.	1804	<i>C. grandis</i> , Linn.
796	<i>C. minosoides</i> , Linn., var.	1535	<i>C. glandulosa</i> , Linn.	1904	<i>C. latifolia</i> , Mey.

## Blanchet: Brazil.

43	<i>C. quinquangulata</i> , Rich.	1836	<i>C. brachystachya</i> , Benth.	2895	<i>C. cana</i> , Nees.
181	<i>C. rotundifolia</i> , Pers.	1879	<i>C. hispidula</i> , Vahl.	3012	<i>C. Tora</i> , Linn.
251	<i>C. flexuosa</i> , Linn.	1986	<i>C. Tora</i> , Linn.	3093	<i>C. viscosa</i> , H. B. et K.
253	<i>C. patellaria</i> , DC.	2167	<i>C. uniflora</i> , Spr., var.	3128	<i>C. curvifolia</i> , Vog.
371	<i>C. drepanophylla</i> , Benth.	2168	<i>C. uniflora</i> , Spr.	3486	<i>C. splendida</i> , Vog.
653	<i>C. uniflora</i> , Spr., var.	2536	<i>C. Langsdorffii</i> , Kunth, var.	3553	<i>C. excelsa</i> , Schrad.
1038	<i>C. uniflora</i> , Spr., var.	2549	<i>C. Blancheti</i> , Benth.	3666	<i>C. barbata</i> , Nees et Mart.
1207	<i>C. stenocarpa</i> , Vog.	2553	<i>C. excelsa</i> , Schrad.	3667	<i>C. speciosa</i> , Schrad.
1397	<i>C. uniflora</i> , Spr., var.	2747	<i>C. supplex</i> , Mart.	3668	<i>C. macranthera</i> , Collad.
1504	<i>C. Apoucouita</i> , Aubl.	2845	<i>C. cana</i> , Nees.	3676	<i>C. jacobinea</i> , Benth.
1559	<i>C. biflora</i> , Linn., var.	2851	<i>C. acuruensis</i> , Benth.	3710	<i>C. Apoucouita</i> , Aubl.
1597	<i>C. verrucosa</i> , Vog.	2890	<i>C. Gardneri</i> , Benth.	3955	<i>C. multijuga</i> , Rich.

## Burchell: Brazil.

899	<i>C. Tora</i> , Linn.	1610	<i>C. rotundifolia</i> , Pers.	3964	<i>C. speciosa</i> , Schrad.
1013	<i>C. Tora</i> , Linn.	2790	<i>C. multijuga</i> , Rich.	4154	<i>C. sulcata</i> , DC.
1092	<i>C. uniflora</i> , Spr., var.	2827	<i>C. viminea</i> , Linn.	4249	<i>C. flexuosa</i> , Linn.
1177	<i>C. patellaria</i> , DC.	2914	<i>C. affinis</i> , Benth.	4276	<i>C. rotundifolia</i> , Pers.
1198	<i>C. Tora</i> , Linn.	2920	<i>C. bicapsularis</i> , Linn.	4280	<i>C. Langsdorffii</i> , Kunth, var.?
1205	<i>C. rotundifolia</i> , Pers.	2976, 2	<i>C. alata</i> , Linn.	4288	<i>C. flexuosa</i> , Linn.
1306	<i>C. patellaria</i> , DC.	3125	<i>C. uniflora</i> , Spr.	4349	<i>C. patellaria</i> , DC.
1326	<i>C. rotundifolia</i> , Pers.	3813	<i>C. multijuga</i> , Rich.	4362	<i>C. multijuga</i> , Rich.
1373	<i>C. oblongifolia</i> , Vog.	3884	<i>C. lævigata</i> , Linn.	4487, 2	<i>C. trichopoda</i> , Benth.



Burchell: Brazil (*continued*).

- 4490 *C. sulcata*, DC.  
 4532, 2 *C. multijuga*, Rich.  
 4627 *C. splendida*, Vog.  
 4714 *C. bicapsularis*, Linn.  
 4729 *C. occidentalis*, Linn.  
 4857 *C. bicapsularis*, Linn.  
 4869 *C. rugosa*, Don.  
 4947 *C. hirsuta*, Linn.  
 4980 *C. rugosa*, Don.  
 5036 *C. cathartica*, Mart.  
 5100 *C. cathartica*, Mart.  
 5173 *C. sylvestris*, Vell.  
 5289, 2 *C. cathartica*, Mart.  
 5306 *C. pilifera*, Vog.  
 5369 *C. setosa*, Vog.  
 5394 *C. Langsdorfii*, Kunth, var.  
 5429 *C. debilis*, Vog.  
 5466 *C. rotundifolia*, Pers.  
 5472 *C. Langsdorfii*, Kunth, var.  
 5574 *C. Langsdorfii*, Kunth, var.  
 5595 *C. Desvauxii*, Collad.  
 5635 *C. cathartica*, Mart.  
 5707 *C. basifolia*, Vog.  
 5755 *C. cotinifolia*, Don.  
 5756 *C. cinerascens*, Vog.  
 5828 *C. lomatomoda*, Benth.  
 5848 *C. viscosa*, H. B. et K.  
 5872 *C. filicifolia*, Mart., var.?  
 5875, 2 *C. cathartica*, Mart.  
 5889 *C. Neesiana*, Mart., var.  
 5891 *C. lomatomoda*, Benth.  
 5967 *C. Claussenii*, Benth.  
 5970, 2 *C. viscosa*, H. B. et K.  
 6019, 2 *C. Claussenii*, Benth.  
 6035 *C. cathartica*, Mart.  
 6045 *C. dysophylla*, Benth.  
 6074 *C. conferta*, Benth.  
 6090 *C. Pohliana*, Benth.  
 6160 *C. elata*, Linn.  
 6176 *C. densifolia*, Benth.  
 6237 *C. multijuga*, Rich., var.  
 6512 *C. sylvestris*, Vell.  
 6618 *C. trichopoda*, Benth.  
 6679 *C. bicapsularis*, Linn.  
 6686 *C. brachypoda*, Benth.  
 6696, 2 *C. trichopoda*, Benth.  
 6755, 3 *C. bicapsularis*, Linn.  
 6774 *C. trichopoda*, Benth.  
 6840 *C. rotundifolia*, Pers.  
 6867 *C. Chamaecrista*, Linn., var.?  
 6868 *C. bicapsularis*, Linn.  
 6909 *C. setosa*, Vog., var.  
 6929 *C. pentagonia*, Mill.  
 6930, 2 *C. bicapsularis*, Linn.  
 6931 *C. Tora*, Linn.  
 6939 *C. mimosoides*, Linn., var.  
 6943 *C. setosa*, Vog., var.  
 6949 *C. Claussenii*, Benth.  
 6995 *C. hispidula*, Vahl, var.  
 7024 *C. Isidorea*, Benth.  
 7062, 2 *C. pentagonia*, Mill.  
 7076, 2 *C. Claussenii*, Benth.  
 7084 *C. multijuga*, Rich., var.  
 7122 *C. setosa*, Vog., var.  
 7195 *C. multijuga*, Rich.  
 7200, 2 *C. flexuosa*, Linn.  
 7286 *C. Hoffmanseggii*, Mart.  
 7400 *C. biflora*, Linn., var. *rostrata*.  
 7432 *C. bacillaris*, Linn.  
 7469 *C. nummulariaefolia*, Benth.  
 7470 *C. conferta*, Benth.  
 7529 *C. orbiculata*, Benth.  
 7556 *C. oligosperma*, Mart.  
 7582 *C. Burchellii*, Benth.  
 7588 *C. setosa*, Vog., var.  
 7690 *C. curvifolia*, Vog., var.  
 7692 *C. gracillima*, Benth.  
 7868 *C. Neesiana*, Mart., var.  
 7913 *C. curvifolia*, Vog., var.  
 7933 *C. hypoleuca*, Mart.  
 8052 *C. uniflora*, Spr.  
 8055 *C. basifolia*, Vog.  
 8070 *C. hispidula*, Vahl.  
 8235 *C. parvistipula*, Benth.  
 8256 *C. curvifolia*, Vog., var.  
 8303 *C. Tagera*, Linn.  
 8414 *C. rotundifolia*, Pers.  
 8483, 2 *C. supplex*, Mart.  
 8489 *C. cultrifolia*, H. B. et K.  
 8490 *C. uniflora*, Spr.  
 8523 *C. trichopoda*, Benth.  
 8527, 2 *C. uniflora* Spr.  
 8548 *C. Tagera*, Linn.  
 8548, 2 *C. supplex*, Mart.  
 8549 *C. trichopoda*, Benth.  
 8551 *C. flexuosa*, Linn.  
 8552 *C. trichopoda*, Benth.  
 8554, 2 *C. supplex*, Mart.  
 8554, 3 *C. uniflora*, Spr.  
 8554, 4 *C. rotundifolia*, Pers.  
 8598, 2 *C. cultrifolia*, H. B. et K.  
 8624 *C. sylvestris*, Vell.  
 8626, 2 *C. trichopoda*, Benth.  
 8635, 2 *C. cultrifolia*, H. B. et K.  
 8645 *C. diphylla*, Lam.  
 8648 *C. Tora*, Linn.  
 8654, 2 *C. supplex*, Mart.  
 8660, 2 *C. trichopoda*, Benth.  
 8664 *C. trichopoda*, Benth.  
 8679, 2 *C. rotundifolia*, Pers.  
 8679, 3 *C. Tagera*, Linn.  
 8679, 11 *C. trichopoda*, Benth.  
 8679, 14 *C. supplex*, Mart.  
 8679, 16 *C. trichopoda*, Benth.  
 8679, 17 *C. cultrifolia*, H. B. et K.  
 8679, 18 *C. flexuosa*, Linn.  
 8679, 19 *C. uniflora*, Spr.  
 8686, 2 *C. diphylla*, Lam.  
 8722, 2 *C. trichopoda*, Benth.  
 8740 *C. sylvestris*, Vell.  
 8744, 2 *C. cultrifolia*, H. B. et K.  
 8744, 4 *C. flexuosa*, Linn.  
 8747, 2 *C. trichopoda*, Benth.  
 8749, 4 *C. Tora*, Linn.  
 8768 *C. dysophylla*, Benth.  
 8774 *C. brachypoda*, Benth.  
 8925 *C. mimosoides*, Linn., var.  
 8943 *C. Desvauxii*, Collad.  
 8973 *C. hispidula*, Vahl, var.  
 8986 *C. Desvauxii*, Collad.  
 9001 *C. calycioides*, DC.  
 9002 *C. supplex*, Mart.  
 9038 *C. Desvauxii*, Collad.  
 9046 *C. Hoffmanseggii*, Mart.  
 9079 *C. Tora*, Linn.  
 9218 *C. multijuga*, Rich.  
 9290 *C. Hoffmanseggii*, Mart.  
 9342, 2 *C. Hoffmanseggii*, Mart.  
 9422 *C. flexuosa*, Linn.  
 9484, 2 *C. reticulata*, Willd.  
 9506, 2 *C. flexuosa*, Linn.  
 9554 *C. reticulata*, Willd.  
 9572 *C. chrysocarpa*, Desv.  
 9605 *C. mimosoides*, Linn., var.  
 9616 *C. Hoffmanseggii*, Mart., var.  
 9649 *C. fastuosa*, Willd.  
 9661 *C. diphylla*, Lam.  
 9729 *C. chrysocarpa*, Desv.  
 9928 *C. Hoffmanseggii*, Mart.  
 9932 *C. chrysocarpa*, Desv.  
 9996, 2 *C. quinquangularis*, Rich.  
 10011, 3 *C. mimosoides*, Linn., var.  
 10019, 3 *C. diphylla*, Lam.  
 10022 *C. flexuosa*, Linn.  
 10063 *C. Tora*, Linn.



## Fendler : Venezuela.

- |             |  |      |   |      |  |
|-------------|--|------|---|------|--|
| 319         | <i>C. nictitans</i> , <i>Linn.</i> ?   | 330  | <i>C. bicapsularis</i> , <i>Linn.</i>   | 2229 | <i>C. pilosa</i> , <i>Linn.</i>              |
| 320         | <i>C. virgata</i> , <i>H. B. et K.</i>   | 331  | <i>C. spectabilis</i> , <i>DC.</i>      | 2230 | <i>C. viciaefolia</i> , <i>Benth.</i>        |
| 321         | <i>C. glandulosa</i> , <i>Linn.</i>  | 1850 | <i>C. inæquilatera</i> , <i>Balb.</i> ? | 2231 | <i>C. viciaefolia</i> , <i>Benth.</i>        |
| 321 $\beta$ | <i>C. Chamæcrista</i> , <i>Linn.</i> , var.                                    | 1851 | <i>C. patellaria</i> , <i>DC.</i>       | 2233 | <i>C. moschata</i> , <i>H. B. et K.</i>      |
| 322         | <i>C. biflora</i> , <i>Linn.</i>   | 1852 | <i>C. biflora</i> , <i>Linn.</i>        | 2234 | <i>C. emarginata</i> , <i>Linn.</i>          |
| 324         | <i>C. occidentalis</i> , <i>Linn.</i> , var.                                   | 1853 | <i>C. patellaria</i> , <i>DC.</i>       | 2236 | <i>C. hirsuta</i> , <i>Linn.</i>             |
| 325         | <i>C. pilifera</i> , <i>Vog.</i>   | 1854 | <i>C. serpens</i> , <i>Linn.</i>        | 2239 | <i>C. bacillaris</i> , <i>Linn.</i>          |
| 326         | <i>C. oxyphylla</i> , <i>H. B. et K.</i> (cum<br>leg. <i>C. spectabilis</i> ). | 1855 | <i>C. rotundifolia</i> , <i>Pers.</i>   | 2240 | <i>C. bicapsularis</i> , <i>Linn.</i> , var. |
| 327         | <i>C. oxyphylla</i> , <i>H. B. et K.</i>                                       | 1856 | <i>C. Tora</i> , <i>Linn.</i>           | 2241 | <i>C. Fistula</i> , <i>Linn.</i>             |
| 328         | <i>C. bicapsularis</i> , <i>Linn.</i> , var.                                   | 1857 | <i>C. viminea</i> , <i>Linn.</i>        | 2596 | <i>C. macrophylla</i> , <i>H. B. et K.</i>   |
|             |  | 1858 | <i>C. reticulata</i> , <i>Willd.</i>    |      |  |

## Fendler : Panama.

- |    |                                       |    |  |    |                                      |
|----|---------------------------------------|----|--|----|--------------------------------------|
| 82 | <i>C. bacillaris</i> , <i>Linn.</i>   | 87 | <i>C. bacillaris</i> , <i>Linn.</i>      | 92 | <i>C. Tora</i> , <i>Linn.</i>        |
| 85 | <i>C. occidentalis</i> , <i>Linn.</i> | 88 | <i>C. oxyphylla</i> , <i>H. B. et K.</i> | 95 | <i>C. reticulata</i> , <i>Willd.</i> |
| 86 | <i>C. undulata</i> , <i>Benth.</i>    | 90 | <i>C. bacillaris</i> , <i>Linn.</i>      |    |                                      |

## Gardner : Brazil.

- |      |   |      |  |      |   |
|------|---|------|--|------|---|
| 26   | <i>C. rotundifolia</i> , <i>Pers.</i>         | 2121 | <i>C. hispidula</i> , <i>Vahl.</i>           | 3686 | <i>C. brachypoda</i> , <i>Benth.</i>        |
| 149  | <i>C. Chamæcrista</i> , <i>Linn.</i> , var.   | 2122 | <i>C. brevicalyx</i> , <i>Benth.</i>         | 3687 | <i>C. diphylla</i> , <i>Lam.</i>            |
| 366  | <i>C. multijuga</i> , <i>Rich.</i>            | 2123 | <i>C. Gardneri</i> , <i>Benth.</i>           | 3688 | <i>C. dalbergiæfolia</i> , <i>Benth.</i>    |
| 367  | <i>C. multijuga</i> , <i>Rich.</i> , var.     | 2124 | <i>C. velutina</i> , <i>Vog.</i>             | 3689 | <i>C. parvistipula</i> , <i>Benth.</i>      |
| 368  | <i>C. macranthera</i> , <i>Collad.</i>        | 2125 | <i>C. tenuisepala</i> , <i>Benth.</i>        | 3690 | <i>C. speciosa</i> , <i>Schrad.</i>         |
| 749  | <i>C. Chamæcrista</i> , <i>Linn.</i> , var.   | 2126 | <i>C. hispidula</i> , <i>Vahl.</i>           | 3691 | <i>C. pilifera</i> , <i>Vog.</i>            |
| 888  | <i>C. uniflora</i> , <i>Spr.</i> , var.       | 2127 | <i>C. subtriflora</i> , <i>Mart.</i>         | 3692 | <i>C. sylvestris</i> , <i>Vell.</i>         |
| 967  | <i>C. rotundifolia</i> , <i>Pers.</i>         | 2128 | <i>C. serpens</i> , <i>Linn.</i>             | 3693 | <i>C. bicapsularis</i> , <i>Linn.</i>       |
| 988  | <i>C. uniflora</i> , <i>Spr.</i> , var.       | 2129 | <i>C. supplex</i> , <i>Mart.</i>             | 3694 | <i>C. dysophylla</i> , <i>Benth.</i>        |
| 989  | <i>C. flexuosa</i> , <i>Linn.</i>             | 2130 | <i>C. calycioides</i> , <i>DC.</i>           | 4120 | <i>C. curvifolia</i> , <i>Vog.</i> , var.   |
| 990  | <i>C. Hoffmanseggii</i> , <i>Mart.</i> , var. | 2131 | <i>C. flexuosa</i> , <i>Linn.</i> , var.     | 4121 | <i>C. densifolia</i> , <i>Benth.</i>        |
| 1282 | <i>C. brachystachya</i> , <i>Benth.</i>       | 2412 | <i>C. uniflora</i> , <i>Spr.</i>             | 4122 | <i>C. orbiculata</i> , <i>Benth.</i>        |
| 1283 | <i>C. excelsa</i> , <i>Schrad.</i>            | 2546 | <i>C. desertorum</i> , <i>Mart.</i>          | 4527 | <i>C. Claussenii</i> , <i>Benth.</i>        |
| 1568 | <i>C. chrysocarpa</i> , <i>Desv.</i>          | 2547 | <i>C. desertorum</i> , <i>Mart.</i>          | 4528 | <i>C. rotundata</i> , <i>Vog.</i>           |
| 1569 | <i>C. supplex</i> , <i>Mart.</i>              | 2548 | <i>C. rugosa</i> , <i>Don.</i>               | 4529 | <i>C. potentilla</i> , <i>Mart.</i>         |
| 1570 | <i>C. sericea</i> , <i>Sw.</i>                | 2549 | <i>C. bicapsularis</i> , <i>Linn.</i> , var. | 4530 | <i>C. cathartica</i> , <i>Mart.</i>         |
| 1571 | <i>C. splendida</i> , <i>Vog.</i>             | 2550 | <i>C. curvifolia</i> , <i>Vog.</i>           | 4531 | <i>C. multijuga</i> , <i>Rich.</i>          |
| 1572 | <i>C. drepanophylla</i> , <i>Benth.</i>       | 2551 | <i>C. aculeata</i> , <i>Benth.</i>           | 4532 | <i>C. biflora</i> , <i>Linn.</i> , var.     |
| 1573 | <i>C. subtriflora</i> , <i>Mart.</i>          | 2828 | <i>C. Langsdorffii</i> , <i>Kunth</i> , var. | 4533 | <i>C. cathartica</i> , <i>Mart.</i>         |
| 1574 | <i>C. curvifolia</i> , <i>Vog.</i>            | 2829 | <i>C. orbiculata</i> , <i>Benth.</i>         | 4534 | <i>C. obtecta</i> , <i>Benth.</i>           |
| 1575 | <i>C. trachypus</i> , <i>Mart.</i>            | 3124 | <i>C. conferta</i> , <i>Benth.</i>           | 4535 | <i>C. viscosa</i> , <i>H. B. et K.</i>      |
| 1912 | <i>C. excelsa</i> , <i>Schrad.</i>            | 3126 | <i>C. ciliolata</i> , <i>Benth.</i>          | 5439 | <i>C. ferruginea</i> , <i>Schrad.</i>       |
| 1935 | <i>C. excelsa</i> , <i>Schrad.</i>            | 3127 | <i>C. setosa</i> , <i>Vog.</i> , var.        | 5442 | <i>C. Apoucouita</i> , <i>Aubl.</i>         |
| 1936 | <i>C. ferruginea</i> , <i>Schrad.</i>         | 3683 | <i>C. basifolia</i> , <i>Vog.</i>            | 5701 | <i>C. oblongifolia</i> , <i>Vog.</i> , var. |
| 2027 | <i>C. viscosa</i> , <i>H. B. et B.</i>        | 3684 | <i>C. brachypoda</i> , <i>Benth.</i>         | 6004 | <i>C. diphylla</i> , <i>Lam.</i>            |
| 2119 | <i>C. trachypus</i> , <i>Mart.</i>            | 3685 | <i>C. flexuosa</i> , <i>Linn.</i>            | 6005 | <i>C. rotundifolia</i> , <i>Pers.</i>       |
| 2120 | <i>C. pudibunda</i> , <i>Mart.</i>            |      |  |      |   |

## Hostmann : Surinam.

- |     |   |     |   |      |  |
|-----|---|-----|---|------|--|
| 150 | <i>C. quinquangulata</i> , <i>Rich.</i> | 728 | <i>C. chrysocarpa</i> , <i>Desv.</i>    | 1062 | <i>C. flexuosa</i> , <i>Linn.</i>      |
| 327 | <i>C. chrysocarpa</i> , <i>Desv.</i>    | 808 | <i>C. uniflora</i> , <i>Spr.</i> , var. | 1083 | <i>C. hispidula</i> , <i>Vahl.</i>     |
| 400 | <i>C. occidentalis</i> , <i>Lam.</i>    | 829 | <i>C. multijuga</i> , <i>Rich.</i>      | 1174 | <i>C. hispidula</i> , <i>Vahl.</i>     |
| 436 | <i>C. Tora</i> , <i>Linn.</i>           | 834 | <i>C. grandis</i> , <i>Linn.</i>        | 1179 | <i>C. glandulosa</i> , <i>Linn.</i>    |
| 451 | <i>C. patellaria</i> , <i>DC.</i>       | 950 | <i>C. patellaria</i> , <i>DC.</i>       | 1185 | <i>C. viscosa</i> , <i>H. B. et K.</i> |
| 670 | <i>C. bacillaris</i> , <i>Linn.</i>     |     |   |      |  |



## Mandon : Bolivia.

- |          |                                      |     |                                     |      |  |
|----------|--------------------------------------|-----|-------------------------------------|------|--|
| 750      | <i>C. tomentosa</i> , <i>Linn.</i>   | 752 | <i>C. glandulosa</i> , <i>Linn.</i> | 754  | <i>C. hirsuta</i> , <i>Linn.</i>       |
| 751      | <i>C. versicolor</i> , <i>Meyen.</i> | 753 | <i>C. lævigata</i> , <i>Linn.</i>   | 1506 | <i>C. latopetiolata</i> , <i>Domb.</i> |
| 751 bis. | <i>C. Mandoni</i> , <i>Benth.</i>    |     |                                     |      |  |

## Martius : herb. Floræ Brasiliensis.

- |     |   |      |   |      |  |
|-----|---|------|---|------|--|
| 128 | <i>C. angulata</i> , <i>Vog.</i>        | 715  | <i>C. bicapsularis</i> , <i>Linn.</i> , var., et<br><i>C. Tora</i> , <i>Linn.</i> | 1073 | <i>C. sylvestris</i> , <i>Vell.</i>  |
| 129 | <i>C. bicapsularis</i> , <i>Linn.</i>   | 716  | <i>C. reniformis</i> , <i>Don.</i>  | 1074 | <i>C. rugosa</i> , <i>Don.</i>   |
| 141 | <i>C. multijuga</i> , <i>Rich.</i>      | 718  | <i>C. bicapsularis</i> , <i>Linn.</i>   | 1075 | <i>C. speciosa</i> , <i>Schrad.</i>  |
| 220 | <i>C. velutina</i> , <i>Vog.</i>        | 720  | <i>C. stenocarpa</i> , <i>Vog.</i>  | 1076 | <i>C. uniflora</i> , <i>Spr.</i>   |
| 223 | <i>C. cordistipula</i> , <i>Mart.</i>   | 721  | <i>C. Apoucouita</i> , <i>Aubl.</i>   | 1077 | <i>C. patellaria</i> , <i>DC.</i>  |
| 405 | <i>C. uniflora</i> , <i>Spr.</i> , var. | 722  | <i>C. cathartica</i> , <i>Mart.</i>   | 1078 | <i>C. patellaria</i> , <i>DC.</i> , et<br><i>C. brachypoda</i> , <i>Benth.</i> |
| 431 | <i>C. multijuga</i> , <i>Rich.</i>      | 812  | <i>C. setosa</i> , <i>Vog.</i>  | 1504 | <i>C. Apoucouita</i> , <i>Aubl.</i>  |
| 585 | <i>C. bicapsularis</i> , <i>Linn.</i>   | 1072 | <i>C. trachypus</i> , <i>Mart.</i>  |      |  |
| 586 | <i>C. flexuosa</i> , <i>Linn.</i>       |      |   |      |  |

## Mathews : Peru.

- |     |  |      |  |      |  |
|-----|--|------|--|------|--|
| 739 | <i>C. arequipensis</i> , <i>Meyen.</i> | 1576 | <i>C. patellaria</i> , <i>DC.</i>            | 1921 | <i>C. Ruiziana</i> , <i>Vog.</i>             |
| 876 | <i>C. arequipensis</i> , <i>Meyen.</i> | 1589 | <i>C. Hoffmansseggii</i> , <i>Mart.</i>      | 1925 | <i>C. flavicoma</i> , <i>H. B. et K.</i>     |
| 917 | <i>C. glandulosa</i> , <i>Linn.</i>    | 1590 | <i>C. occidentalis</i> , <i>Linn.</i> , var. | 3276 | <i>C. bicapsularis</i> , <i>Linn.</i> , var. |
| 918 | <i>C. glandulosa</i> , <i>Linn.</i>    | 1591 | <i>C. bacillari</i> , <i>Linn.</i> , aff.    |      |  |

## Regnell : Brazil.

- | COLL. I. |   | COLL. II. |  | COLL. III. |                                       |
|----------|---|-----------|--|------------|---------------------------------------|
| 59       | <i>C. Chamæcrista</i> , <i>Linn.</i> , var. | 74        | <i>C. Langsdorffii</i> , <i>Kunth.</i> | 475        | <i>C. oblongifolia</i> , <i>Vog.</i>  |
| 66       | <i>C. multijuga</i> , <i>Rich.</i> , var.   | 75        | <i>C. rugosa</i> , <i>Don.</i>         | 476        | <i>C. alata</i> , <i>Linn.</i>        |
| 67       | <i>C. multijuga</i> , <i>Rich.</i> , var.   | 76        | <i>C. bicapsularis</i> , <i>Linn.</i>  | 477        | <i>C. mucronifera</i> , <i>Mart.</i>  |
| 68       | <i>C. bicapsularis</i> , <i>Linn.</i>       | 77        | <i>C. ferruginea</i> , <i>Schrad.</i>  | 481        | <i>C. debilis</i> , <i>Vog.</i>       |
| 69       | <i>C. sulcata</i> , <i>DC.</i>              |           |  | 482        | <i>C. setosa</i> , <i>Vog.</i>        |
| 70       | <i>C. splendida</i> , <i>Vog.</i>           |           |  | 483        | <i>C. sylvestris</i> , <i>Vell.</i>   |
| 71       | <i>C. speciosa</i> , <i>Schrad.</i>         |           |  | 484        | <i>C. rotundifolia</i> , <i>Pers.</i> |
| 71 bis.  | <i>C. speciosa</i> , <i>Schrad.</i>         |           |  | 485        | <i>C. basifolia</i> , <i>Vog.</i>     |
| 72       | <i>C. mucronifera</i> , <i>Mart.</i>        |           |  | 486        | <i>C. latistipula</i> , <i>Vog.</i>   |
| 74       | <i>C. cathartica</i> , <i>Mart.</i>         |           |  | 486*       | <i>C. Desvauxii</i> , <i>Collad.</i>  |
| 75       | <i>C. trachysperma</i> , <i>Vog.</i>        |           |  | 487        | <i>C. trichopoda</i> , <i>Benth.</i>  |
|          |   |           |  | 488        | <i>C. flexuosa</i> , <i>Linn.</i>     |

## Sagot : Cayenne.

- |     |                                    |     |   |      |                                   |
|-----|------------------------------------|-----|---|------|-----------------------------------|
| 178 | <i>C. Tora</i> , <i>Linn.</i>      | 181 | <i>C. chrysocarpa</i> , <i>Desv.</i>    | 1006 | <i>C. alata</i> , <i>Linn.</i>    |
| 179 | <i>C. hispidula</i> , <i>Vahl.</i> | 182 | <i>C. quinquangulata</i> , <i>Rich.</i> | 1156 | <i>C. latifolia</i> , <i>Mey.</i> |
| 180 | <i>C. diphylla</i> , <i>Linn.</i>  | 802 | <i>C. Sagotiana</i> , <i>Benth.</i>     |      |                                   |

## Schlim : Columbia (or Funcke and Schlim).

- |     |   |     |  |     |  |
|-----|---|-----|--|-----|--|
| 2   | <i>C. robiniaefolia</i> , <i>Benth.</i>         | 186 | <i>C. Mutisiana</i> , <i>Humb. et Bonpl.</i> | 374 | <i>C. bicapsularis</i> , <i>Linn.</i> , var. |
| 6   | <i>C. oxyphyllæ</i> , <i>H. B. et K.</i> , aff. | 281 | <i>C. Schlimii</i> , <i>Benth.</i>           | 491 | <i>C. flavicoma</i> , <i>H. B. et K.</i>     |
| 106 | <i>C. patellaria</i> , <i>DC.</i>               | 291 | <i>C. bacillaris</i> , <i>Linn.</i>          | 941 | <i>C. emarginata</i> , <i>Linn.</i>          |
| 174 | <i>C. patellaria</i> , <i>DC.</i>               | 369 | <i>C. oxyphylla</i> , <i>H. B. et K.</i>     |     |  |

## Rob. Schomburgk : Guiana, 1st collection.

- |     |  |     |   |     |  |
|-----|--|-----|---|-----|--|
| 21  | <i>C. diphylla</i> , <i>Linn.</i>        | 190 | <i>C. uniflora</i> , <i>Spr.</i> , var., et <i>C.</i><br><i>Desvauxii</i> , <i>Collad.</i> , var. | 787 | <i>C. rotundifolia</i> , <i>Pers.</i> , var.<br><i>baubiniæfolia</i> .         |
| 59  | <i>C. flexuosa</i> , <i>Linn.</i>        | 401 | <i>C. cultrifolia</i> , <i>H. B. et K.</i>  | 840 | <i>C. serpens</i> , <i>Linn.</i>   |
| 64  | <i>C. hispidula</i> , <i>Vahl</i> , var. | 522 | <i>C. multijuga</i> , <i>Rich.</i>  | 843 | <i>C. Tora</i> , <i>Linn.</i>  |
| 84  | <i>C. latifolia</i> , <i>Mey.</i>        | 614 | <i>C. bacillaris</i> , <i>Linn.</i>   | 894 | <i>C. leiandra</i> , <i>Benth.</i> , cum fol.<br><i>Macrolobii plurijugi</i> . |
| 86  | <i>C. undulata</i> , <i>Benth.</i>       | 621 | <i>C. polystachya</i> , <i>Benth.</i>   | 895 | <i>C. racemosa</i> , <i>Mill.</i>  |
| 94  | <i>C. bacillaris</i> , <i>Linn.</i>      | 683 | <i>C. prætexta</i> , <i>Vog.</i>  |     |  |
| 176 | <i>C. stenocarpa</i> , <i>Vog.</i>       | 720 | <i>C. glandulosa</i> , <i>Linn.</i>   |     |  |
| 186 | <i>C. viscosa</i> , <i>H. B. et K.</i>   |     |   |     |  |



## Robert and Richard Schomburgk : Guiana, 2nd collection.

Rob. S.	Rich. S.		Rob. S.	Rich. S.		Rob. S.	Rich. S.	
49		<i>C. multijuga</i> , Rich.	471 = 776		<i>C. dysophylla</i> , Benth.	528 = 839		<i>C. uniflora</i> , Spr.
398 = 607		<i>C. glandulosa</i> , Linn.	473 = 775		<i>C. serpens</i> , Linn.	531 = 836		<i>C. serpens</i> , Linn.
441 = 689		<i>C. patellaria</i> , DC.	489 = 754		<i>C. Tora</i> , Linn.	553 = 890		<i>C. uniflora</i> , Spr.
446		<i>C. parvistipula</i> , Benth.	498 = 771		<i>C. rotundifolia</i> , Pers.,	582 = 840		<i>C. Roraimæ</i> , Benth.
447		<i>C. Desvauxii</i> , Collad.,			var. <i>bauhiniæfolia</i> .	683 = 1053		<i>C. multijuga</i> , Rich.
		var.	514 = 811		<i>C. polystachya</i> , Benth.	881 = 1523		<i>C. bacillari</i> , Linn., aff.
454 = 725		<i>C. hispidula</i> , Vahl.						

## Spruce : Brazil, Peru, and Ecuador.

234	<i>C. fastuosa</i> , Willd.	1110	<i>C. Hoffmanseggii</i> , Mart.	3249	<i>C. orinocensis</i> , Benth.
238	<i>C. chrysocharpa</i> , Desv.	1272	<i>C. viminea</i> , Linn.	3300	<i>C. moschata</i> , H. B. et K.
241	<i>C. diphylla</i> , Linn.	1292	<i>C. riparia</i> , H. B. et K.	3589	<i>C. serpens</i> , Linn.
255	<i>C. quinquangulata</i> , Rich.	1557*	<i>C. leiandra</i> , Benth.	3646	<i>C. Langsdorffii</i> , Kunth, var.
262	<i>C. flexuosa</i> , Linn.	1558	<i>C. Hoffmanseggii</i> , Mart.	3701	<i>C. Desvauxii</i> , Collad.
292	<i>C. curvifolia</i> , Vog.	1775	<i>C. angulata</i> , Vog.	3807	<i>C. gracilis</i> , H. B. et K.
439	<i>C. leiandra</i> , Benth.	1781	<i>C. bicapsularis</i> , Linn., var.	3925	<i>C. lævigata</i> , Linn., var.
721	<i>C. Desvauxii</i> , Collad.	2125	<i>C. multijuga</i> , Rich.	4147	<i>C. multijuga</i> , Rich.
747	<i>C. viscosa</i> , H. B. et K.	2145	<i>C. Apoucouita</i> , Aubl.	4170	<i>C. hirsuta</i> , Linn.
788	<i>C. flexuosa</i> , Linn.	2539	<i>C. bacillaris</i> , Linn.	4299	<i>C. leiophylla</i> , Vog., var.
851	<i>C. calycioides</i> , DC.	2558	<i>C. Spruceana</i> , Benth.	5222	<i>C. tomentosa</i> , Linn.
908	<i>C. racemosa</i> , Mill.	2787	<i>C. hymeneæfolia</i> , Benth.	6346	<i>C. bicapsularis</i> , Linn.
916	<i>C. chrysocharpa</i> , Desv.	3003	<i>C. Tagera</i> , Linn.		

## Vauthier : Brazil.

96	<i>C. ericifolia</i> , Benth.	144	<i>C. mucronata</i> , Spr.	150	<i>C. oblongifolia</i> , Vog.
135	<i>C. reniformis</i> , Don.	145	<i>C. hedysaroides</i> , Vog.	153	<i>C. rotundata</i> , Vog.
136	<i>C. rugosa</i> , Don.	146	<i>C. Tora</i> , Linn.	154	<i>C. Potentilla</i> , Mart.
139	<i>C. exsudans</i> , Benth.	147	<i>C. cotinifolia</i> , Don.	155	<i>C. anceps</i> , Benth.
140	<i>C. cathartica</i> , Mart.	148	<i>C. Vauthieri</i> , Benth.	159	<i>C. conferta</i> , Benth.
143	<i>C. multijuga</i> , Rich.				

## Weir : South Brazil.

104	<i>C. lævigata</i> , Linn.	206	<i>C. Langsdorffii</i> , Kunth.	371	<i>C. cathartica</i> , Mart.
161	<i>C. sylvestris</i> , Vell.	221	<i>C. multijuga</i> , Rich.	402	<i>C. incana</i> , Vog.
205	<i>C. Desvauxii</i> , Collad.				

## MEXICAN AND WEST-INDIAN COLLECTIONS.

## Andrieux : Mexico.

414	<i>C. Andrieuxii</i> , Benth.	418	<i>C. villosa</i> , Mill.	420	<i>C. polyantha</i> , Moç. et Sess.
416	<i>C. multiflora</i> , Mart. et Gal.	419	<i>C. polyantha</i> , Moç. et Sess.	421	<i>C. Galeottiana</i> , Martens.
417	<i>C. occidentalis</i> , Linn.				

## Berlandier : Mexico and West Texas.

258	<i>C. crotalarioides</i> , H. B. et K.	1498	<i>C. Lindheimeriana</i> , Scheele.	2293	<i>C. emarginata</i> , Linn.
626	<i>C. calycioides</i> , DC.	2036	<i>C. calycioides</i> , DC.	2294	<i>C. Berlandieri</i> , Benth.
786	<i>C. bauhinioides</i> , A. Gr.	2206	<i>C. bauhinioides</i> , A. Gr.	2327	<i>C. sericea</i> , Sw.
840	<i>C. bauhinioides</i> , A. Gr.	2260	<i>C. bauhinioides</i> , A. Gr.	2427	<i>C. procumbens</i> , Linn., var.
897	<i>C. sericea</i> , Sw.	2270	<i>C. Greggii</i> , A. Gr.	2479	<i>C. procumbens</i> , Linn., var.
997	<i>C. procumbens</i> , Linn., var.				

## Botteri : Orizaba.

445	<i>C. tristicula</i> , H. B. et K.	668	<i>C. patellaria</i> , DC.	783	<i>C. hirsuta</i> , Linn.
574	<i>C. Tagera</i> , Linn.	691	<i>C. Tagera</i> , Linn.	784	<i>C. Botteriana</i> , Benth., cum
667	<i>C. tristicula</i> , H. B. et K.	713	<i>C. lævigata</i> , Linn.		<i>C. leiophylla</i> , Vog.

## Jurgensen : Mexico.

18	<i>C. emarginata</i> , Linn.	505	<i>C. patellaria</i> , DC.	724	<i>C. oxyphylla</i> , H. B. et K.
51	<i>C. densiflora</i> , Mart. et Gal.	522	<i>C. hirsuta</i> , Linn.	759	<i>C. tristicula</i> , H. B. et K.
162	<i>C. atomaria</i> , Linn.	705	<i>C. polyantha</i> , Moç. et Sess.		



## Wright: Cuba.

146	<i>C. grammica</i> , Spr.	1601	<i>C. stenophylla</i> , Benth.	2374	<i>C. rotundifolia</i> , Pers.
147	<i>C. strigillosa</i> , Benth.	1602	<i>C. chrysocarpa</i> , Desv.	2375	<i>C. serpens</i> , Linn.
148	<i>C. sericea</i> , Sw. (Griseb.).	2368	<i>C. emarginata</i> , Linn.	2376	<i>C. lineata</i> , Sw.
149	<i>C. ligustrina</i> , Linn.	2369	<i>C. glauca</i> , Lam.	2377	<i>C. lineata</i> , Sw.
150	<i>C. domingensis</i> , Spr.	2370	<i>C. robiniaefolia</i> , Benth.	2378	<i>C. flexuosa</i> , Linn.
1190	<i>C. ligustrina</i> , Linn.	2371	<i>C. alata</i> , Linn. (Griseb.).	2379	<i>C. procumbens</i> , Linn.
1599	<i>C. nictitans</i> , Linn. (Griseb.).	2372	<i>C. hispidula</i> , Vahl.	2380	<i>C. procumbens</i> , Linn.
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W.H. Fitch. del. et. lith.

*Cassia Sprucei*, Benth

J.N. Fitch. imp.







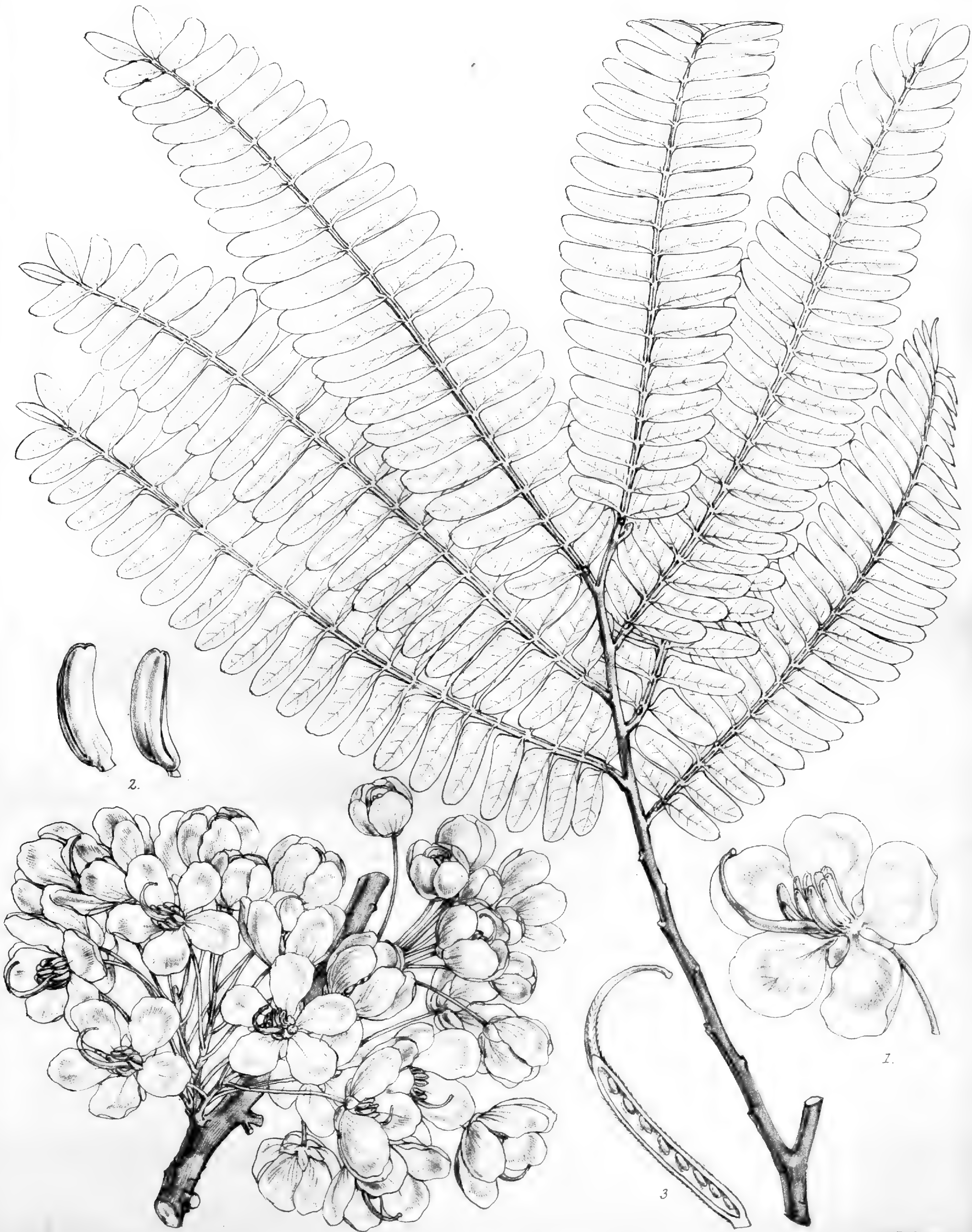


W.H. Fitch del. et lith.

*Cassia bacillaris*, Linn

J.N. Fitch imp







XIX. *Contributions to the Natural History of the Passifloraceæ.* By M. T. MASTERS,  
Esq., M.D., F.R.S., L.S., &c.

Read November 17th, 1870.

(Plates LXIV. & LXV.)

CONTENTS.

<p>Organography. Germination. Development of the leaf, tendril, bracts, flower, &amp;c. Teratology. General remarks on the Morphology of the flower in <i>Passiflora</i>. Minute Anatomy of the several organs. Fertilization of the flower.</p>	<p>Movements of the reproductive organs &amp;c. Affinities of the group, and mode of estimating the value of characters in general. Remarks on the genera of <i>Passifloraceæ</i>. Enumeration of the genera and species of the tribe <i>Passifloreæ</i>, Benth. et Hook. Geographical Distribution. Select Bibliography.</p>
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IN studying the species of the order *Passifloraceæ* with the view of describing those members of the group which are natives either of tropical America or of tropical Africa, I have necessarily passed in review the great majority of the hitherto described forms. The technical descriptions of these species will be found in a future part of the 'Flora Brasiliensis' (inaugurated by the late Von Martius, and continued under the superintendence of Dr. Eichler), and in the second volume of the 'Flora of Tropical Africa' (drawn up by my friend Professor Oliver)\*.

In this place I propose, with the permission of the Society, to place on record some remarks of a general character, which may serve to illustrate the natural history of the group. In order the better to illustrate the morphology and affinities of the group, I take the order *Passifloraceæ* as it stands in Bentham and Hooker's 'Genera Plantarum'†, though, for reasons hereafter to be assigned, I should prefer to remove the tribes *Modeceæ*, *Achariæ*, and *Papayacæ* from *Passifloraceæ* proper.

My remarks have reference to the outward conformation, the internal structure, the mode of development, and the physiological history of certain selected representatives of the order in question. In commenting on the affinities of the group, I shall introduce some general considerations on the nature and value of the evidence upon which species, genera, orders, &c. are founded and arranged. I also subjoin a list of the species of *Passifloraceæ* proper, together with some remarks on their geographical distribution. Owing to the kindness of my friends and fellow workers I have been enabled to examine all the specimens of the order *Passifloraceæ* belonging to the collections at Kew, the British Museum, to the herbaria of Munich, Berlin, and Paris, those contained in the herbaria of the late Von Martius, as well as in many collections of less magnitude. Moreover

\* Both these works are passing through the press (May 1871).

† Vol. i. p. 808.



I have availed myself of every opportunity of examining fresh specimens that has presented itself; and for this privilege I have specially to thank the Director and Curator of the Royal Gardens at Kew, as well as a large number of friends and correspondents who have from time to time furnished me with specimens for examination.

#### ORGANOGRAPHY.

*Root.*—The root offers few characters worthy of special comment, and, moreover, it is rarely or never seen in herbarium-specimens. It is probably very uniformly fibrous throughout the group, though in some cases, as in *Passiflora quadrangularis* and *Machadoa*, it is said to be tuberous\*. Whether these tubers are truly root-formations or subterranean forms of stem I have had no means of ascertaining.

*Stem.*—We are so apt to consider a climbing-habit a necessary feature in all Passion-flowers, that it seems strange at first to find that at least half the genera of the order consist of erect herbs or shrubs destitute of tendrils. Even in the genus *Passiflora* itself certain of the species are trees with no indication of a climbing-habit. The minor characters afforded by the form and superficial peculiarities of the stem and branches afford, in some instances, useful marks whereby to discriminate species.

*Leaves.*—The leaves in this order are arranged alternately, and in  $\frac{2}{5}$  order; they present great variations in form and size. Almost every conceivable form of simple, lobed, and divided leaves may be met with; but true compound leaves are confined to the genus *Deidamia*, of which I have seen no representative. Some of the species of *Passiflora* are distinguished by the presence of leaves of very unusual form such as:—the transversely elliptical leaf of *P. coriacea*, Juss.; the lunate leaves of *P. lunata*, Sm.; the wedge-shaped or semicircular leaves of *P. Vespertilio* L.; and the singular two-lobed leaf of *P. perfoliata*, resembling in some degree the head of a slug—the two diverging lobes representing the tentacles, the small intermediate process corresponding to the head of the creature, whence Bory de St. Vincent's name of *Cephaleima*.

Most of these peculiar forms are consequent upon the arrested growth of the central lobe, or on the disproportionate development of the two lateral ones.

*P. Berteriana* has a much divided leaf, not unlike that of a *Thalictrum*; other species have pedate leaves, like those of *Helleborus* or *Arum Dracunculus*. Some of the species of *Passiflora* exhibit leaves of various forms on the same plant at the same time—a circumstance that has given rise to the establishment of several untenable species.

The absence or presence of glands is a character of some importance in distinguishing species of *Passiflora*. When present they are almost always sessile, orbicular, and situated on the under surface, often in the angle between the divergent nerves; very frequently they are scattered irregularly over the lamina, as in the species "*foliis ocellatis*."

The nervation of the leaf is unicostate or palmicostate; in the latter case the number and size of the diverging costæ correspond to that of the lobes; if the latter are of about equal size, the nerves are equal likewise; if the central lobe is the largest, the corresponding nerve has the preeminence over the lateral ones, while in the bilobed leaves, where the central lobe is rudimentary or altogether wanting, the two lateral nerves are

\* Young plants of *P. quadrangularis* do not show this form of root.



larger than the central one. Frequently the nerves project beyond the margin of the leaf in the form of a small mucro.

The variations in the colour of the leaf afford useful characters as well as add considerably to the beauty of the plant in special instances. The diversities in amount and quality of pubescence are of little value for specific purposes, though it may be incidentally remarked that stellate pubescence is very rare in the order, nor is it at all customary to meet with the very shaggy investment we sometimes find in other plants, though a covering of glandular hairs is characteristic of certain species, *e. g.* *Passiflora fetida*.

*Petiole*.—The leaves of this order are usually stalked, the stalk itself generally presenting one feature which, though not absolutely peculiar to the order, is nevertheless very characteristic of it—the presence of glands. These glands present sundry diversities: in some species they are sessile, in others they are stipitate, disposed with tolerable regularity or, in other instances, irregularly scattered; small in some species, in others they attain to considerable dimensions. That they are true glandular organs in some species is evident from their secretion and from their internal structure, while their morphological nature is elucidated by a study of their development, and by various species of *Tacsonia*, in which the glands appear as so many miniature leaf-lobes emerging from either side of the petiole towards the upper surface.

In some species the glands are represented by small thread-like processes, as in *P. ligularis*. The petiolar glands in their typical state are therefore laminar processes, structurally adapted for the purpose of secretion. In other instances they do not appear to secrete and are then present in the form of small leaf-lobes or of thread-like processes. The study of their development shows not only that they are relatively larger in the juvenile stage, but that their functions are more actively carried on at that time than subsequently. Too much stress must not be laid on their number or their position. Thus in *P. edulis* and other species the petiolar glands are at the very apex of the stalk in young leaves, while in adult ones they are nearly  $\frac{1}{4}$  of an inch below it. The number, too, is confessedly variable, even on the same plant.

*Stipules*.—The existence of these organs is universal in the order. Varying much in size and external configuration, and to a less degree in internal structure, they often afford useful means of discrimination between one species and another. In some cases they are small linear threads, as insignificant in appearance as purposeless in action. In other cases they are large, and by their size and structure are enabled to fulfil the double purpose of protection to the young leaf and of respiration. In form they vary considerably in different species, and thus afford useful means of discrimination. Whatever form they assume, they are very generally more or less inequilateral, the obliquity resulting from the impeded development of that side of the stipule nearest to the stem, the larger portion of the stipule being always furthest away from the supporting axis. The venation of the stipules is either multicostate or uncostate; in the former case the nerves always converge to the apex, in the latter instance the midrib frequently extends beyond the margin in the form of a mucro. In both the smaller veins break up into an intricate network. The difference in the venation points to a different morphological



nature; the multicostate stipules represent probably the sheath of the leaf, the unicostate stipules correspond to the laminar portions.

*Shoots.*—In those instances where a leaf-bud and an inflorescence or tendril emerge from the same axil, will be found that the leaf-shoot arises from the axis in a line with, but above the tendril and flower-stalk.

*Inflorescence. Tendrils.*—Speaking in general terms, the inflorescence may be called mixed. It pertains to the indefinite type as far as the axillary position of the main flower-stalk is concerned; but as regards the disposition and arrangement of the secondary flower-stalks the inflorescence is cymose or definite, as is obvious in the species with many-flowered inflorescence. The peculiarities of form, relative size, &c. of the flower-stalk afford occasionally useful points of distinction between one species and another\*.

The inflorescence of a new species of *Barteria* (*B. fistulosa*, Mast.) is so peculiar that it is necessary to allude to it in this place. In this plant the flowers are sessile, or on very short, scaly stalks, and densely packed in a single somewhat semilunar series in the axil of the leaf.

The tendrils are classed with the inflorescence because it is obvious from their axillary position, structure, and specially their mode of development, that they are to be regarded as flowerless subdivisions of the peduncle. They are simple or branched; and in some cases, as in *Modecca*, they bear flowers. In *Passiflora holosericea* the main peduncle sometimes terminates in a flowerless tendril, while the lower branches of the cyme bear flowers.

*Bracts.*—The existence of three bracts on the flower-stalk below the flower, is almost constant throughout the order. They may be very small, or so large as entirely to conceal the flower. They may be entire or excessively divided, as in *Passiflora*, § *Dysosmia*. Usually sessile, in *P. picturata* they are stalked. In most points they correspond to the stipules; but there are certain points with reference to them which call for notice, such as, for instance, their number (almost invariably three), their position (usually approximate to each other, and not far removed from the base of the flower, so close, indeed, as to constitute an involucre or epicalyx); but in some species, especially when the bracts are minute, they are comparatively widely separate from each other and from the base of the flower.

In *Passiflora silvestris*, and also in *P. tetraden*, the bracts are remarkable for their irregularity of size and their remoteness one from the other. In some cases the bracts remain 'coherent' to a greater or less extent, the apparent cohesion being the result of imperfect separation. Of the three bracts the lowest is placed somewhat laterally as regards the main axis, but anteriorly as regards the tendril, and the remaining two antero-laterally. The inferences to be derived from this arrangement will be stated hereafter.

*Flower-tube.*—This term is here used as one to the employment of which no morphological objection can be raised. By most writers it is described as the calyx-tube; but this term, I believe, conveys a wrong impression as to the real nature of the organ in

\* Cf. Wydler, Berner naturwiss. Mittheil. June 1852.



question. Others might possibly object to the term "receptacular tube," a denomination which appears to the writer to be correct, from the conformation, structure, and mode of development, as well as from the consideration of the nature and number of the parts that are attached to, or rather which emerge from it. These are points which will receive further comment under other headings. Looked at as a means of discriminating species, the flower-tube presents valuable 'characters.' Its form, consistence, and size are all subject to variation in different species: thus it is flat and saucer-shaped, or bell-shaped, or tubular, or funnel-shaped, and so on; thin and membranous, or thick and fleshy; sometimes rounded at the base, in other species umbilicate, from the excessive growth of some portions as contrasted with others. The phrase so often made use of in describing these plants (*tubus basi intrusus*) must be taken conventionally, and not literally.

*Calyx-lobes. Sepals.*—These are usually five in number, quincuncially imbricated in the bud, and so placed that two are anterior or nearly so in relation to the axis that bears them, two lateral, and one posterior. They are almost invariably vaginal in their venation (multicostate, convergent); but not unfrequently they present a trace of a petiole, in the shape of a small horn-like projection from the upper end of the dorsal surface, just below the apex. They are often thick in substance, except at the margins, which frequently retain the traces of the overlapping that occurs in the bud in their thinner texture and petaloid coloration; thus the two sepals that are overlapped on both sides by the edges of the adjoining sepals have their margins thin and petaloid, while those sepals which are only overlapped on one edge have one thin margin only.

*Corolla.*—The petals are occasionally wanting, but more generally they are present, and originate, with the sepals, from the upper edge of the flower-tube, within and alternately with the calyx-lobes. In the bud they are quincuncially imbricated, one of the petals being completely external, one completely internal, and the remainder partly external, partly internal. They are usually multicostate; but in *Paropsia* each petal has a single costa.

The petals are usually equal in size and regular in form; but in a genus (*Atheranthera*) of which a description and illustrations will be found further on, and of which only male flowers exist in Dr. Welwitsch's collection of Angola plants, the five petals are unequal in size, quincuncially imbricated, the two innermost much larger and more concave than the rest. This inequality of size is probably not congenital, but manifests itself during development. As a consequence, some of the sepals are more widely separated one from another than the rest.

The calyx and corolla of *Ceratiosicyos* and *Acharia* require passing notice, as they have been differently described by different authors. In *Ceratiosicyos* the five sepals are spreading, linear, much shorter than the corolla, to the base of which they are adherent. The corolla is somewhat bell-shaped, and consists of five united petals. In *Acharia* there are four distinct, ovate, leafy sepals, free from adhesion to the corolla, which latter is bell-shaped and gamopetalous. If the female flower of *Acharia* be examined first, or to the exclusion of the male, which is rarer in herbaria, the presence of four small glands, opposite to the lobes of the inner bell-shaped part of the flower, is liable to lead the



observer to conclude that the bell-shaped organ is a calyx, the outer segments being in that case referable to bracts; but in the male flower, where the perianthial whorls have the same form as in the female flower, the fertile stamens are alternate with the lobes of the corolla, and the glands are opposite to them, showing that the glands are to be regarded as the representatives of a second row of stamens.

In *Ceratiosicyos* there are five awl-shaped staminodes in the situation of the tubercles of *Acharia*, the five fertile stamens being alternate with the petals. On the whole, then, the evidence is in favour of considering the outer envelope in these two genera a calyx, the inner a corolla, though the latter is gamopetalous, an exceptional feature in the order, but one shared by the male flowers of the *Papayaceæ*.

A. L. de Jussieu, who was the first to propose the establishment of *Passifloreæ* as a separate order, held the opinion that true Passion-flowers (*Passiflora*) had no true petals, but rather a double calycine whorl, the inner segments of which are petaloid. He based his opinion on the circumstance that the sepals and petals are confounded at the base, that they wither together, and are not separated one from the other\*. But this opinion is quite opposed to the analogy with other genera described since the time of Jussieu, and is also not in accordance with organogeny, which shows that the sepals are developed successively, while all five petals appear simultaneously after the production of the sepals. Nevertheless there are some species of *Passiflora* (tribe *Cieca*), in which the petals are constantly suppressed, as also in the genus *Tryphostemma*.

*Corona*.—Under this general head is included all that series of rings, scales, or threads intervening between the petals and the stamens. From their almost universal presence in the species of the order, their variety of form, and the part they play in the physiological functions of the flower, considerable interest attaches to them. Sometimes there is but one ring; at other times there are a great number, lining the whole of the interior of the flower-tube. The corona is met with in greatest complexity in some species of Passion-flower, and in the greatest simplicity in *Malesherbiæ*. It may therefore be of interest to trace the gradual advances in complexity in the various genera, beginning with those in which the structure is simplest, and passing on to those in which it is most complex.

In *Malesherbiæ* the corona exists as a thickened rim or, at most, as a series of tubercles projecting from the margin of the tube. In some species of *Gynopleura* there is a similar coronal rim, but of somewhat larger size, and partly deflexed. In *Smeathmannia* the corona is but little more developed than it is in *Malesherbiæ*. In *Paropsia* the corona also consists of a single ring, emerging from the throat of the flower-tube (here very short), and divided into a number of ciliated laciniae. In *Crossostemma* the corona consists of a single row of threads, encircling the base of the staminal tube. In *Tacsonia* the corona is for the most part twofold, consisting of an upper series of tubercles or threads emerging from the mouth of the tube, and of a lower membranous outgrowth projecting from near the base of the tube, and usually bent downwards and inwards. In *Barteria* the corona is also twofold, the two series being near together; the outermost is membranous, the inner one tubercular. In *Tryphostemma* and *Basa-*

\* Juss. Ann. Mus. Hist. Nat. vi. p. 100. Jussieu's views were supported by St.-Hilaire in Mem. Mus. v. p. 304.



*nanthe* the corona is similarly arranged in two rows: the outer one is in the form of a membranous tube or sheath, surmounted by long threads; the inner one is also membranous, but shorter and entire at the top. To the inner surface of this second corona the five stamens are congenitally adherent, or, more correctly speaking, not separate from it.

In the genus *Passiflora* the form and arrangement of the rings of the corona vary in the different subgenera, and may, indeed, sometimes be used to distinguish species from each other. In *Passiflora bilobata*, Juss., the flower is described as destitute of corona, on which account it was made the type of a genus *Astephananthes* by Bory de St.-Vincent. Mr. Sowerby, in the second volume of the 'Transactions of the Linnean Society'\*, has given accurate figures and descriptions of the arrangement of the corona in several species of the genus. In *Passiflora quadrangularis*, in which the coronal filaments are in greatest abundance, he describes the following series, going from above downwards, or from without inwards:—1, perfect rays, consisting of two or three rows of distinct threads; 2, imperfect rays, consisting of a variable number of short and, as it were, imperfect or rudimentary threads; 3, a membranous ring, the "false operculum" found in *P. quadrangularis*, and in one or two other species only; 4, a membranous sheath called the "operculum," which shuts off the nectary proper from the upper part of the flower-tube, and below which is sometimes to be seen, 5, a thickened rim projecting from the side of the nectary, and partially dividing it into two compartments, an upper and a lower; lastly, at the base of the gynophore is often to be seen, 6, a shallow membranous or thickened cup.

Such an arrangement as that just mentioned pertains especially, with certain variations in individual species, to the subgenus *Granadilla*. It may be remarked that the several rows are often closely approximate, so that almost the whole inner surface of the flower-tube is lined with these outgrowths.

In the other subgenera the number and arrangement of the parts of the corona are different. Mr. Sowerby's divisions are strictly accurate in the case of the species mentioned by him, and apply very well to a large number of other species also; but, from the difficulty in some instances of ascertaining the exactly corresponding rows in different species, it is simpler to employ such terms as outer or inner, faucial, median or basilar, according to their position—or filamentous or membranous, according to the nature of the outgrowths in question.

In the subgenus *Astropheia* the corona consists of two or three rows of filaments springing from the upper portion of the tube; of these the uppermost or outermost are considerably the longest, and are usually more or less dilated and sickle-shaped at the extremity. The innermost corona, the "operculum," emerges from near the base of the tube, at some distance from the outer ring, and consists either of a membranous tube or of a row of short filaments; in the former case the membrane is often inflexed.

In the subgenus *Plectostemma*, Mast., including the sections *Cieca*, *Dysosmia*, *Polyanthea*, *Distemma*, and *Decaloba* of other writers, the flower-tube is usually short and saucer-shaped; the rings of the corona emerge from the mouth of the tube; the outer

\* Trans. Linn. Soc. ii. p. 19, t. 3, 4, 5.



series are filamentous and widely spreading, while the inner row consists of a shallow folded membrane, the upper edge of which is often inflexed and crested or fimbriated. Within this is a small projecting rim, surrounding the base of the gynophore, and at some distance from it. In the subgenus *Murucuia* the membranous corona springs from the mouth or from the middle of the tube, and is either bent downwards or erect.

Although considerable differences in the form, position, and number of the coronal series exist in the genus *Passiflora*, it will be seen, from what has been before stated, that these characters are readily grouped under a few heads, such as:—the nature of the corona—filamentous, membranous, tubular, or annular; its position—faucial, median, and basilar, with regard to the flower-tube and its form. The form and position of the membranous corona or operculum is particularly worthy of notice. In one division of the genus it is flat, in another crumpled and folded; in the latter case it invariably arises from the throat of the flower-tube, while in those cases where it is flat it may proceed from the middle or from either extremity of the tube. It is important also to observe whether the membranous corona (the operculum of Sowerby) be erect or slightly inflexed, or whether it be decidedly deflexed. These points have been made by some writers the bases of distinct genera. I cannot, however, consider them of more than subgeneric importance; but, as will be seen in the remarks on the classification of the species of *Passiflora*, I attribute considerable importance to the short, crumpled, and often fringed corona, which characterizes a large proportion of the species\*.

The most complicated arrangement of the corona is that which occurs in some species of *Modecca* ♀ e. g. *M. tamnifolia* (Pl. LXV. figs. 1–3). In this plant there are two sets of staminodes—an outer series, of five distinct liguliform capitate segments placed opposite to the sepals (figs. 2, 3c), and an inner series, of five subulate antherless filaments connected together at the base and also placed in front of the sepals (figs. 2, 3b). The corona is membranous, and springs from the tube of the flower at the same point as the petals. As seen in the mature flower, the corona is attached on either side of each petal, thus connecting these organs together, and sending processes inwards to each side of the inner staminodes, so as to form a series of closed pouches, enclosing the outer staminodes (figs. 2, 3f). The true nature of this extraordinary arrangement cannot be understood till fresh flowers have been examined in all stages of development. The illustrations on Plate LXV. show the arrangement of the corona and staminodes. The subulate inner staminodes are clearly the representatives of the perfect stamens in the male flowers; but the nature of the outer staminodes is not so clear. They may be seen also in the male flowers of some species in the same situation (superposed to the sepals), and are sometimes spoken of as “glands of the disk,” a convenient expression, as involving no definite assertion as to their real morphological nature. Something like the curious pouches of this *Modecca* may be seen in some species of *Eutoca*; but these are simpler.

*Andræcium*.—In the tribe *Passifloreæ*, as also in *Malesherbiæ*, the flowers are usually hermaphrodite. *Passiflora tetrandra*, however, a New-Zealand species, by some referred to a separate genus *Tetrapathæa*, has unisexual flowers; and the same separation of the

\* Illustrations of most of the forms of the corona will be found in my monograph of the American *Passifloraceæ* in Von Martius and Eichler's ‘Flora Brasiliensis’.



sexes characterizes the tribes *Modeceæ*, *Achariæ*, and *Papayacæ*. When, by exception, in these last-named groups the flowers are bisexual, the stamens are perigynous, and not hypogynous as in true Passion-flowers.

The staminal whorl presents considerable diversities in different genera of the order. In the genus *Passiflora* itself the andrœcium becomes complicated by apparent adhesion to, *i. e.* imperfect separation from, the gynophore.

Taking the simplest case first, we have merely five stamens opposite to the sepals, inseparate to a slight extent at the base, and springing directly from the receptacle (hypogynous). Such a condition of things exists in the male flowers of *Ophiocaulon* and in the male flowers of *Passiflora tetrandra*, as well as in the hermaphrodite flowers of *P. multiflora*.

Usually the stamens, like the pistil, are, after a time, raised above their original level by the formation of a stalk or gynophore. In *Tryphostemma* the stamens spring from the inner surface of the inner corona, and are not raised upon a gynophore. The stamens in this case are rather perigynous than hypogynous. In *Crossostemma* the stamens are apparently ten in number, five fertile and five sterile. The filaments form at the base a cup, from the edge of which proceed the five anther-bearing filaments and five teeth (representing the sterile stamens). *Machadoa* has a similar arrangement. In *Barteria* there are very numerous stamens arising from the edge of a membranous tube also disconnected from the gynophore. *Smeathmannia* is chiefly remarkable, so far as its andrœcium is concerned, for the great number of its stamens. Probably these are true "compound stamens;" but this cannot be stated with certainty till their mode of development is known. The filaments are generally flat and ribbon-like; but in *Physena*, *Smeathmannia*, *Barteria*, *Basananthe*, and some others they are thread-like.

Throughout the order the anthers are bilocular: in most cases the filament is attached to the back of the anther; but in some of the genera, and especially in the tribe *Modecca*, the anthers are basifixed. The anthers of *Modecca* are remarkable for their linear form, and for their prolonged connective, which forms a long, slender mucro above the antherlobes. In *Atheranthera*, already referred to, the filaments are flat and ribbon-like, twisted on themselves at the top, so that the dorsifixed anthers, which were originally introrse, become extrorse by the curvature of the filaments. The anthers appear to be one-celled, and provided with a mucro continuous with the filament, and which may either represent an abortive half anther or stand in the place of the connective. In *Passiflora* and *Tacsonia* the anthers are versatile, and completely change their position as the flower is matured. Originally pressed up against the ovary, against which their face is applied, they ultimately turn in the reverse direction, so as to open extrorsely by two longitudinal clefts. This change in position is facilitated by the peculiar mode in which the filament is attached to the anther. The filament is flat, and traversed by a central nerve, which is prolonged beyond the rounded apex of the filament in such a way that the anther is attached by a fine thread only.

*Gynœcium*.—The most constant feature of the whole group is the possession of a superior or non-adherent one-celled ovary, with three or four parietal placentas, to which are attached in two or four longitudinal rows a number of horizontal anatropal



ovules. In the beginning the ovary is sessile; but in most of the genera of the order it becomes, after a time, stalked by the gradual elongation of the central portion of the receptacle, which pushes up not only the pistil, but also the stamens, and has hence received the name of gynandrophore, or gynophore. In *Passiflora multiflora* the ovary is sessile. The minor peculiarities of the ovary do not call for special comment.

The processes often met with in the lower part of the gynandrophore demand passing notice, inasmuch as they, in conjunction with one of the innermost rings of the corona (the operculum), frequently separate, as by a diaphragm, the true nectary, or honey-secreting surface of the flower-tube, from the upper portion.

The species included in the section *Granadilla* of the genus *Passiflora* are the most remarkable for these processes of the gynandrophore, which there form a kind of pulley-like projection, into the groove of which fits the lowest ring of the corona. In other species, as in *P. elliptica*, the same purpose seems fulfilled by a spindle-shaped dilatation in, or below, the centre of the stalk of the pistil, and which is covered with fine hairs.

The styles, usually three in number, project from the apex of the ovary; but in some of the *Passifloræ* (sect. *Astrophea*) the ovary is somewhat cuboidal in outline, flattened at the top, and the styles project from the angles at the top of the ovary.

In *Malesherbiæ* the styles project from the dorsal surface of the ovary at some distance from the summit, and thus recall the corniculus or horn-like projection from the backs of the sepals.

The genus *Barteria* is remarkable for the connation of its styles, which thus form an undivided column surrounded by a large mushroom-shaped stigma. The stigmatic ends of the styles are usually large, more or less reniform or three-lobed.

The *fruit* is usually more or less baccate, but is in some genera capsular and dehiscent by three valves. No special comment appears necessary, except to point attention to the curious manner in which the capsule opens in the *Malesherbiæ*. In this suborder the seed-vessel splits septicidally into three valves, each valve bearing a style or a remnant of that organ at some distance below the summit of the dorsal surface. Ultimately the valves split at the top along the dorsal sutures, the separation extending as far as the base of the style. The result is that in the mature fruit there are three valves, each valve cleft at the summit, and bearing the persistent style in the central notch. At the base of the fruit or of its stipes are the persistent, withered remnants of the flower.

*Ovules*.—These are generally indefinite in number, horizontal, anatropal, and funiculate, with two coats and a central nucleus. The funicle is transversely articulated above the middle; and from the joint proceeds, subsequently to fertilization, an arillus, which forms a pulpy investment growing from below upwards till it covers the seed. The ovules are generally arranged in four, rarely in two or six, vertical ranks along the placentas.

*Seeds*.—The seeds are usually ovoid, obcordate, or heart-shaped, enclosed within the pulpy aril just mentioned. The testa is hard and bony, often more or less pitted. In the centre is a horny albumen surrounding a straight embryo, with flat leafy cotyledons, and whose radicle points towards the hilum.



## GERMINATION.

A germinating embryo of *Passiflora* shows a conical radicle, a long cylindrical caulicle, a pair of opposite-stalked leafy cotyledons of oblong or suborbicular outline with three convergent primary ribs. The succeeding leaves are alternate, provided with stipules, and, in the species with lobed leaves, generally show indications of lobing from the first.

## ORGANOGENY.

*Development of the leaf and tendril &c.*—In a very early stage of the development of the leaf in *Passiflora quadrangularis* may be seen on the side of the axis two small tubercles, one next the axis, slightly depressed at the summit—and close to it on the distal side another, similar prominence, which speedily becomes marked out into two lateral and an intermediate central tubercle: the two lateral projections are the nascent stipules; the central one is the beginning of the leaf; while the depression in the centre of the tubercle next to the axis indicates the subsequent separation of the tendril and the flower-stalk (Plate LXIV. fig. 1). The tendril, therefore, is unquestionably, in the beginning, a portion of the flower-stalk, as, indeed, is evident in many cases in the adult condition. The blade of the leaf, immediately subsequent to its initial stage, consists of a linear-oblong, blunt tubercle protruding from the axis by the side of the tendril (fig. 2); it speedily manifests a central groove on the side next to the tendril; this groove gradually extends (fig. 3) till the leaf assumes a conduplicate appearance. It is thus clear that the conduplicate arrangement is not, as the term would imply, the result of a folding process, but of a disproportionately rapid development of the margins or side portions of the leaf as contrasted with the central parts. It would appear as if the depression in this early stage of development had some reference to the tendril, which is partially concealed in the groove thus formed.

In the palmately divided leaves of *P. cærulea* the central leaflet is the first to appear, followed by the stipules, which latter, however, speedily overtake the leaf. The side-lobes of the leaf follow next in order from above downwards, and then the glands on the petiole. The glands on the leaf-stalk in this species are late in their development, while in *P. quadrangularis* they are early, the lower pair appearing first (fig. 6). The notches on the margin of the leaf precede the formation of the veins. Vascular tissue in the form of spiral vessels first shows itself in the midrib, and, as Griffith long since remarked, is not extended from the vessels of the stem. Indeed this independent formation of vascular tissue seems to be the general rule in all cases.

*Development of the bracts.*—The bracts in *P. quadrangularis* are three in number, and developed successively (fig. 7, a, b, c). The one first developed (fig. 7, a) is placed anteriorly as regards the tendril (fig. 7, d)—that is to say, somewhat laterally as regards the main axis; the two others are lateral in relation to the tendril. The relative position of the several parts of the flower will be more fully spoken of under another section.

*Development of the flower.*—In the earliest stage of development in a garden-variety of *P. quadrangularis* the flower consisted merely of a small subglobose tubercle (Plate LXIV. fig. 7, e) already encircled by the bracts. In the next stage examined by me



three of the five sepals were already marked out (fig. 8). In a bud still further advanced all five sepals were observed surrounding a pentagonal disk (fig. 9); and it was further noticeable that the sheath or lower portion of the sepal was the part first protruded, and that the little corniculus on its dorsal surface near the apex was not formed till subsequently. The corniculus appears to be the analogue of the petiole. Payer states that two sepals are anterior or superposed to the primary bract (*i. e.* sepals 1 and 3, numbered in the order of their development), two lateral (4 and 5), while sepal no 2 is posterior; but I have reason for doubting if this is the exact order in all cases, as will be subsequently explained.

In a flower-bud still more fully developed the sepals were larger, but retained their inequality of size. At the angles of the central pentagon were now to be seen five small tubercles, all of the same size and simultaneously developed; these correspond to the five petals (fig. 10). These tubercles gradually exchange their globular form for an oblong flattened shape. In a bud in a more advanced state of development the sepals and petals had increased in size; and five staminal tubercles opposite to the sepals were visible, the central disk remaining as before, flat and pentagonal (fig. 11). Next in succession appear three small tubercles on the central disk; these represent the three styles or the upper portion of the carpels. They are at first perfectly separate one from the other, and leave between them in the centre a slight depression (fig. 12). As growth goes on, the three tubercles lengthen from below upwards; originally separate at the apex, disunion ceases after a little while, so that the carpels are congenitally inseparable below; while the upper edges, at first free, become confluent one with the other, so as ultimately to form a closed ovary, the styles remaining separate (fig. 13). Previously to the complete closure of the ovary, however, the ovules begin to make their appearance, as will be explained further on (fig. 16).

At this stage the anthers are fully sketched out, and even the filaments have made their appearance (fig. 14). Shortly after this the formation of the flower-tube, from the dilatation and gradual excavation of the thalamus below the sepals, becomes perceptible, and about the same time the corona also makes its appearance in the shape of a series of small tubercles protruding from the flower-tube immediately beneath the petals (fig. 15). The order of development of the succeeding rows of the corona seems, so far as I have ascertained, to be different in different species; thus, after the formation of the uppermost row of the corona in *P. quadrangularis* the median series or operculum is developed, and the intermediate rows subsequently. The urceolus or basilar corona at the base of the stamens is developed before the column or gynandrophore begins to lengthen. This latter organ, the stalk of the stamens and of the pistil, is the last of the floral organs to appear (fig. 18).

*Ovules.*—The ovules present themselves in the first instance as small conical papillæ projecting from the placenta (fig. 19); these speedily become invested, from below upwards, by a cellular tube, the secundine. As this tube grows, the primary nucleus becomes curved. After a little time a second envelope, the primine, is formed, so that the fully formed ovule is anatropal and invested by two coatings (figs. 20, 21). The arillus which surrounds the ripe seeds is not fully developed till after the fertilization of the ovule; but



even before that process occurs a small projection from the funicle at the joint may be seen near the inverted apex of the ovule (fig. 22). This gradually enlarges after the fertilization of the ovule, so as to enclose the seed in a membranous sheath, at first open at the top (figs. 23, 24), but ultimately closed (fig. 26). The pulpy matter intervening between the aril and the seed consists of large cells formed apparently from the inner surface of the aril.

It will thus be seen that my observations, so far as they go, are in accordance in all material points with those of Griffith\* and Payer † as regards the development of the parts of the flower, and with those of Planchon on the arillus‡. With Schleiden's account of the development of the flower my observations agree in all points save the formation of the ovary. Schleiden§ describes and figures the commencement of the ovary in the form of a central depression or cavity in the axis, from the sides of which afterwards proceed the three tubercles which form the carpels. "In the centre," says Schleiden, "the axis is conspicuous as the germen (*cauligenum*), with a cavity, but as yet no trace of a style (carpellary leaf);" and again, "Three carpellary leaves are seen at the edges of the germen;" and at p. 370, "In *Passiflora* the superior germen arises from a cup-shaped axis, at whose edges the carpels arise, which form styles and stigmas." From this it will be seen that Schleiden evidently considered that the axis itself entered directly into the composition of the ovary. But, in all the buds of various species that I have examined with reference to this special point (and these have not been few), I have not been able to satisfy myself that any depression in the central disk of the flower takes place prior to the appearance of the three carpellary tubercles. In by far the great majority of cases the central disk remains in the form of a flattened or raised cushion-like mass until after the development of the three carpellary tubercles; and as these grow comparatively rapidly, while the central axis no longer develops, a central depression is very speedily produced.

But here arises a nice point. It has been previously stated that the carpels, originally separate, are afterwards seen to be united together at the base; and what we have now to determine is, whether this tubular portion at the base of the carpels is to be regarded as truly consisting of the inseparate bases of the carpels, or whether it is a process of the axis like the flower-tube. I do not think that organogeny *per se* is sufficient to decide this question; but, as a matter of opinion, I should, if it be considered necessary to adhere uncompromisingly to the alleged distinctions between axis and leaf-organ, regard the tubular structure just alluded to as foliar rather than axial; while, if foliar, it is the sheath of the leaf to which it must be compared; and between the sheath of the leaf and an axial structure the difference is very small. As in so many similar instances, this question seems to be very much a question of words; for who shall tell where axis ends and foliar organ begins? Holding, as I do, that there is no absolute fundamental difference between axial and foliar organs, and that those divergences which ultimately present themselves between the two sets of organs are secondary modifications or adap-

\* Griffith, *Notulæ*, Part i. 1847, tab. 2.

† Payer, *Organogénie*, p. 396, t. 86, 87.

‡ Planchon, *Ann. Sc. Nat.* 3 ser. vol. iii. 1845, p. 275.

§ 'Principles of Scientific Botany,' Lankester's Translation, p. 597, tab. 4 et 5. figs. 6-8.



tations for the fulfilment of particular purposes, it seems to me a matter of very little consequence to determine in these transitional stages precisely where the line should be drawn between leaf-organ and axial organ.

*Summary.*—Recapitulating the main facts which the study of development brings to light, and noting the inferences that may be drawn from these facts, I may state briefly that the development of the leaves in *Passiflora* is basipetal, while that of the sepals, petals, and stamens is basifugal. The carpels, on the other hand, are basipetal in their mode of development.

In the mature flower the sepals and petals are imbricate in æstivation, although in the first instance both are valvate. It might be surmised that the imbrication of the sepals would result from the successive development of those organs; but the petals, which are equally imbricate in the bud, are developed simultaneously. The imbrication, then, of these organs is a secondary operation in point of time, and, however important as a means of discrimination for classificatory purposes, does not seem to have any special morphological significance beyond ensuring economy of space.

It has already been shown that the so-called 'conduplicate' arrangement of the leaf is due to increased development at the margins as contrasted with the central portions of the leaf.

The tube of the flower is an expansion of the receptacle formed after the foundations of the flower are laid. The corona also is a late formation, its constituent filaments or membranes emerging from the inner side of the flower-tube at a late period of the formation of the flower, and being referable neither to the petals nor to the stamens. The corona, then, is an organ *sui generis*, developed, as it would seem, for the fulfilment of a special purpose, as will be hereafter shown. As to the nature of the corona, it is important to quote here Griffith's significant words\*. Alluding to the conflicting opinions as to the morphological nature of this series of organs, and to the notions held by Lindley†, who considered the coronal filaments to be rather of petaloid than of staminal nature, because the normal metamorphosis of the flower is centripetal, Griffith remarks, "Observation, which does not rely on making lucky conjectures, and which argues from things seen by the eye, not from things imagined (seen by the mind), proves that they are neither the one nor the other."

The gynophore, as before stated, is a secondary production, formed by the elongation of the thalamus subsequent to the formation of the other portions of the flower.

The only other point in the development that it seems worth while again to allude to is the dichotomy of that axillary tubercle which ultimately forms on the one side a tendril, on the other a peduncle. The branching here, as might have been anticipated, is not due to the formation of a new growing point or bud, but to a dichotomy or subdivision of the primary tubercle.

#### TERATOLOGY.

Several cases of deviation from the ordinary structure have come under my observation in certain species of *Tacsonia* and *Passiflora*. To some of these it may be interesting to refer. In a flower of the garden hybrid  $\times P. Belottii$  there were six sepals, six petals, six

\* *L. c.*

† *Veg. Kingdom*, p. 333.



stamens, and a one-celled ovary with three styles. To what cause this augmentation was due, whether to an absolute development of six tubercles instead of five, or to a subdivision of one into two, I had no opportunity of ascertaining.

A transition from the verticillate to the spiral arrangement was seen in a flower of *P. alata*; or, rather, it may be said that the distance between the sepals was greater than it usually is. Thus, of the five sepals two were smaller, and on a lower level than the remaining three. The petals of this flower were six in number, four free, two united the one to the other. Considering the successive manner in which the sepals are developed under ordinary circumstances, it may be held that the unusual interspace between them was occasioned by an excess of development in the receptacle of the flower, which lengthened more than usual during the development of the sepals. On the other hand, the sepals themselves, from their smaller size, seem to have experienced an arrest of development. The sixth petal, from its position between two other petals, and in front of a sepal, may be considered the sole member of a second row of petals.

In *Passiflora Raddiana* (*kermesina* of gardens) I have now frequently seen all the flowers on the plant presenting adventitious growths between the stamens and the ovary. The growths in question were like the filaments of the ordinary corona, and apparently emerged from the stalk of the ovary immediately above the spot whence the filaments separate from it, and as it were in the axils of the filaments, superposed to them in fact.

In the Kew Museum is preserved a similar specimen from the same plant; but in this instance some of the adventitious filaments bear an anther. Have we here a tendency to manifest the same polyandrous condition that is found in *Smeathmania* &c? Karsten founded a new genus (*Poggendorffia*) upon a similar adventitious production of thread-like growths above the ordinary stamens\*.

In a garden-variety of Passion-flower,  $\times$  *P. hybrida floribunda*, I have met with the same malformation; and in other flowers of the same variety I have observed the connective of the anther to be prolonged into a crest as in *Violaceæ*. We can hardly lay much stress on an accidental case like this as an evidence of affinity between the two orders; nevertheless it at least adds to the acknowledged marks of relationship between the two.

To Mr. Miers I am indebted for a drawing of the fruit of *Passiflora quadrangularis*, wherein small flower-buds were found springing from the placentas intermixed with the seeds. These flowers were monstrous in character. A similar production of flowers within the fruit occurs occasionally in Crucifers†, and has been also previously recorded in *Passiflora*.

But the most remarkable deviation is that described in the Transactions of this Society by Mr. S. J. A. Salter, in which the ovules of a species of *Passiflora* were found to contain pollen‡.

\* Karsten, Flor. Columb. Spec. Select. i. t. 15. f. 29.

† Masters, Vegetable Teratology, p. 137; Bernouilli, Bot. Zeit. 1869, p. 19, durchwachsene Frucht von *Passiflora*.

‡ Trans. Linn. Soc. xxiv. 143, t. 24. See also 'Vegetable Teratology,' p. 185, f. 99; and Seemann's Journ. Bot. 1867, t. 72, for a similar instance in *Rosa*.



## MORPHOLOGY OF PASSIFLORA.

Having briefly adverted to the conformation of the flower in the several genera of the order and traced its mode of evolution in *Passiflora*, I am now in a position to offer some remarks on the morphology of *Passiflora* itself, taking that genus as the most complex one of the order. In a flower of the section *Granadilla*, where the bracts are well developed and approximate to the flower, there are three bracts formed successively, five sepals also formed successively, five petals formed simultaneously, alternating with the sepals and with them raised upwards on the edge of a tube, which is not developed until the other parts of the flower are well developed, and which is therefore to be considered a tubular prolongation of the thalamus or receptacle. Alternating with the petals are five stamens, formed simultaneously and strictly hypogynous. Three carpels constitute the pistil, which is at first sessile, but which afterwards becomes raised by the elongation of the central portion of the receptacle; the latter in its upward course bears not only the pistil but the stamens also. The various rings of the corona are not developed till after the formation of the other parts of the flower; and the date of their evolution corresponds with that of the receptacular tube, thus preceding that of the gynophore.

The three bracts in the unopened flower-bud are imbricated, one bract overlapping the other two. The sepals and petals are quincuncially imbricate, the stamens valvate and appressed against the pistil. The three carpels are also valvate, so that they form a one-celled pistil with three parietal placentas.

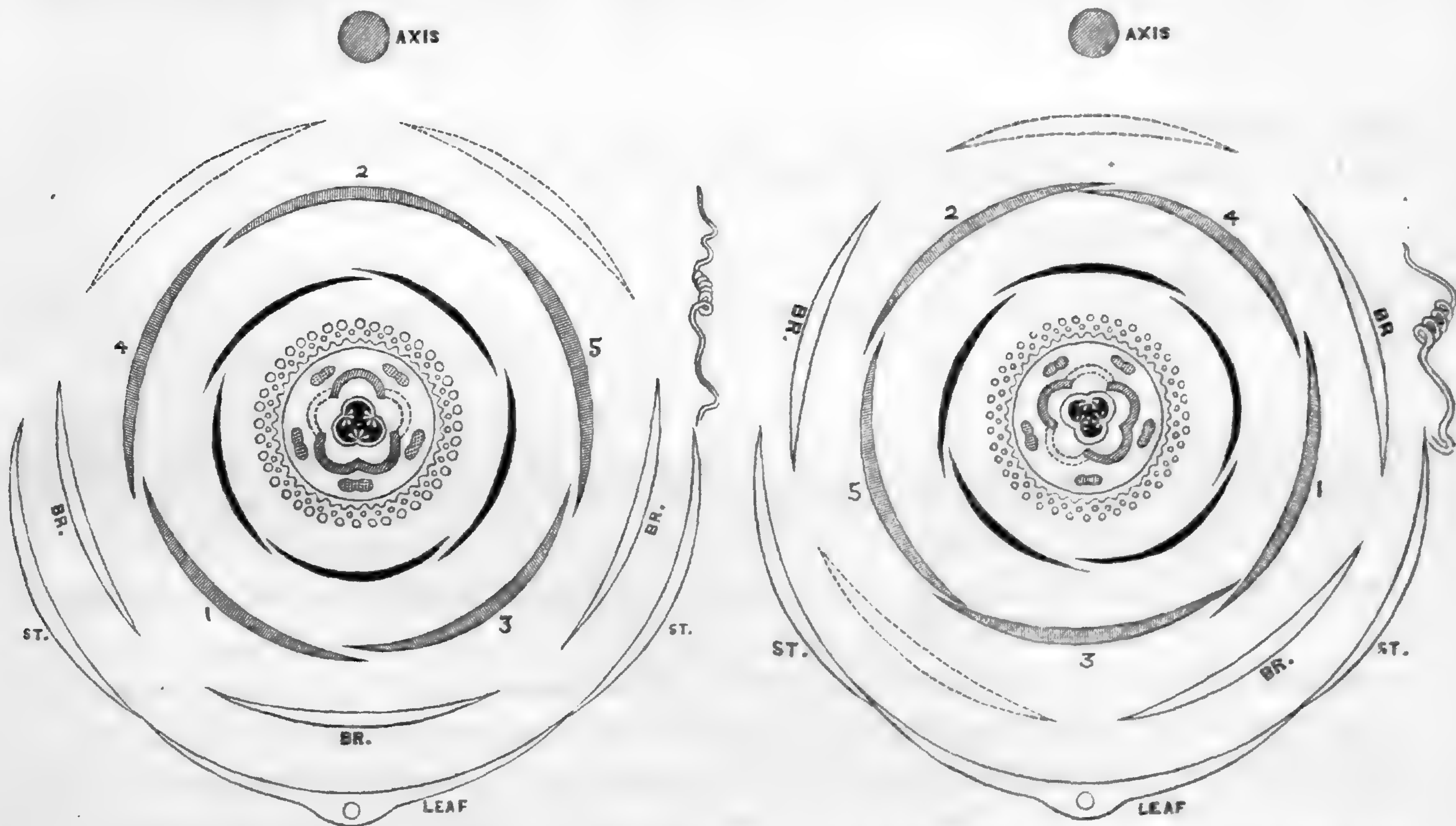
The position of the parts of the flower, in relation to the axis and to the floral leaf, in the axil of which the flower originates, remains to be considered; and as I have been led from my observations to form slightly different conclusions on this matter from those of Payer and others, it becomes necessary to explain in what way my interpretation differs from that of other botanists, and to suggest the probable cause of the slight divergence of opinion. The flower-stalk of a Passion-flower is formed in the axil of a leaf; and it has already been seen that the tendril is merely a flowerless branch originating from the same growing point as the peduncle. Between the leaf, then, anteriorly and the main axis posteriorly is the flower-bud, enveloped in its three bracts; and by the side of the bud is the tendril. In the early stages of the flower-bud the two stipules belonging to the leaf are relatively very large. In point of time of development they are far in advance of the leaf; and they are placed, not anteriorly like the leaf or leaf-stalk of which they are integral portions, but laterally; they are thus placed with their edges fore and aft, as regards the axis, and shut in the flower-bud and the tendril on the sides. In this early stage, then, the flower-bud and tendril are completely enclosed in a kind of case formed anteriorly by the leaf, laterally by the stipules, and posteriorly by the axis. Bearing in mind this arrangement of the parts in the axil of the leaf, the position of the bracts, sepals, &c. with regard to the anterior or posterior part of the flower may be readily understood.

Payer and most authors state that the odd bract is anterior, the two others lateral, as regards the main axis. I believe this to be an error, and consider the bracts to be placed laterally, as regards the axis—two on the side adjacent to the tendril (which fits into the



interspace between them), and one on the other side. One of the bracts might more correctly be described as antero-lateral rather than as strictly lateral; and its fellow on the same side is also slightly posterior as well as lateral.

The sepals are, as above stated, formed successively and in quincuncial order. The relative position of the sepals may be understood by numbering them and arranging the numbers in the order in which the sepals are placed, thus:—1, 3, 5, 2, 4. From this it may be seen that the sepal (3) which is third in the order of development, is placed in the cycle between that which is first developed (1) and that which is last formed (5), and so on. Payer and most authors state that sepals 1 and 3 are placed in front of the bract, which they consider anterior—in other words, that there are two anterior or antero-lateral sepals (1 and 3), one posterior (2), while sepals 4 and 5 are lateral or postero-lateral. According to my observations, sepal No. 1 is placed a little to the side of one of the bracts, sepal 3 is nearly anterior, sepals 4 and 2 postero-lateral, and sepal 5 lateral and nearly opposite to 1. The position of the several parts of the flower is shown in the accompanying illustrations.



Diagrams showing the arrangement of the parts of the flower: that to the left hand of the reader is after Payer; that to the right shows the arrangement as understood by the author: *st* are stipules, *br* bracts; the sepals are numbered 1–5, according to the order in which they are developed. The petals alternate with the sepals; then come the rows of the corona, and within them the stamens, erroneously represented in the left-hand figure as opposite to the petals instead of to the sepals. The double series in the pistilline whorl indicates the theoretical and the actual arrangement of the carpels; the theoretical arrangement is shown in the outer circle, the actual disposition is indicated by the central figure. The dotted outlines in the case of two bracts and two carpels indicate the position of the bracts and carpels assumed to be suppressed. The position of the tendril is shown at the side of each diagram.

The five petals are formed simultaneously; they alternate with the sepals, and are im-



bricate in æstivation, as has already been stated; hence, although the imbrication of the sepals may well be attributed to their successive formation one after the other, the oldest outermost, the most recent innermost, the others intermediate, yet the imbrication of the petals cannot be attributed to a like cause, but to a process of accommodation by which one part grows over the edge of its neighbour, and thus occupies less room. The five stamens are formed simultaneously opposite to the sepals (though, by oversight, they are represented as opposite to the petals in the left-hand diagram). The three carpels are, in my opinion, placed opposite to the three bracts, alternating, or nearly so, with sepals 1 and 4, 2 and 5, and 5 and 3 respectively. This, however, is not the position assigned to them by Payer, according to whom the three carpels alternate with the three bracts, and are placed opposite to the sepals 1, 3, 2. If Payer's version be true, the sepals, stamens, and carpels would all be superposed, as may be thus represented:—

3(5) Bracts.  
                   5 Sepals.  
                   5 Petals.  
                   5 Stamens.  
                   3(5) Carpels.

and we should have an exception to the usual rule of alternation, only to be explained on an assumption not supported by any evidence, viz. that a second or inner row of stamens is entirely suppressed. If the explanation here given be correct, we have no violation of the law of alternation, thus:

3(5) Bracts.  
                   5 Sepals.  
                   5 Petals.  
                   5 Stamens.  
                   3(5) Carpels.

The only deviation from the ordinary symmetry of a pentamerous flower would here consist in the absence of two bracts and of two carpels.

According to Payer's usual nomenclature the first-formed bract would be the "bractée mère;" the other two, lateral bracts. Wydler, also, in a passage pointed out to me by Prof. Eichler, of Grätz, adopts this view, but calls the first-developed bract the *bractea generatrix*, and says it belongs to the tendril. The lateral bracts are regarded by Wydler as *prophylla*. In the opinion, then, of these writers, the first bract belongs to an axis of a different and prior generation to that supporting the lateral ones. It appears to me, however, that there is no warranty for such an opinion. The course of development, as well as the position of the bracts in the adult flower, is sufficient to show that in *Passiflora* the three bracts are formed in succession from the same axis. In those species in which the bracts are more numerous than three and scattered, they are disposed in one continuous spiral series, and there seems no valid reason in this instance for dissociating the anterior or inferior one from the others.

Theoretically, then, we are justified in assuming that the flower of *Passiflora* is pen-



tamerous, with five bracts, five sepals, five petals, five stamens, and five carpels. The sepals and petals, at first hypogynous, become perigynous by the formation of the receptacular tube. The stamens are hypogynous in *Passiflora* and most of the genera of the order; the ovary, originally sessile, becomes, with the stamens, lifted up on a stalk by the elongation of the receptacle. The corona is an outgrowth from the sides of the receptacular tube, formed at a late period of the development of the flower, as already explained.

This view of the construction of the flower is theoretical only so far as regards the assumption of the potential existence and the relative position of two bracts and of two carpels, the growth of which is, moreover, assumed to be suppressed. According to Payer's explanation of the structure of the flower, it is the two posterior bracts, those nearest to the axis, that are wanting, and two lateral, or rather postero-lateral carpels opposite sepals 4 and 5. In my view, however, the defective bracts are one posterior corresponding to the interval between sepals 2 and 4, and one antero-lateral corresponding to the interval between sepals 3 and 5. The missing carpels would occupy a corresponding position.

I believe the discrepancy between the account given by Payer as to the relative position of the several floral organs and that which I am disposed to think, though not without some hesitation, is the more correct, arises from the circumstance that Payer considered the outer, larger bract to be at the *anterior* side of the flower, or opposite to the floral leaf. In reality, as has been before explained, the odd bract is *lateral* with regard to the *main* axis, though it is anterior as regards the *peduncle* on which it is placed, and therefore anterior to the tendril. This error, if error it be, of Payer's involves a dislocation from the real position amounting to two-fifths of the circumference of a circle. This displacement, taken in conjunction with the well-known faculty that organs have of occupying the spaces that would be filled by the now missing organs if no suppression had ensued, and thus of "closing up" the gaps, is amply sufficient to account for any discrepancy of opinion between myself and other observers.

It would be mere speculation to discuss the question whether the original type of *Passiflora* had five bracts and five carpels. Indeed I should be disposed to refer the existing deficiency not so much to any inherited tendency to suppression as to an accommodation process, if I so may term it, designed to obviate undue pressure and give more space. In this way the suppression of the posterior bract and the posterior carpel becomes specially significant, inasmuch as, from the comparatively unyielding nature of the axis opposite to which they would be placed, growth would be liable to be checked by the obstacle so afforded.

#### MINUTE ANATOMY.

The following observations are by no means complete; but they are perhaps sufficient to draw attention to the main features of the internal structure.

*Tuber*.—The fusiform tuberous root or root-stock of *Machadoa* consists of a mass of cells filled with large ovoid starch-grains, very unequal in size. Through the mass are irregularly distributed large barred ducts.



*Stem.*—In *Passiflora quadrangularis* and also in *Barteria nigriflora*, sections of the stem show the following tissues:—On the exterior is an epidermis of squarish cells destitute of chlorophyll, and thickened on the outer wall. Within the epidermis is a quantity of small-celled parenchyma filled with chlorophyll. The constituent cells of this cellular envelope vary in size according to the age of the stem. The liber-bundles consist of large fusiform, thick-walled, pitted wood-cells, arranged in masses which, when seen in section, have a kidney-shaped outline, the concavity being directed inwards towards the centre of the stem. Within these liber-bundles is more parenchyma investing the wood, which consists of ordinary wood-cells closely packed, and surrounding large pitted ducts and, towards the centre of the stem, spiral vessels. The middle of the branch is occupied with an abundance of pith, whose cells contain, at some seasons, starch-grains, and at all times conglomerate raphides. (See Plate LXV. fig. 6.)

*Tendrils.*—These are in structure similar to the branches, consisting of an epidermis surrounding a cellular envelope, in which are imbedded liber-cells arranged as in the branches. Within these is parenchyma with conglomerate raphides, and surrounding wood-cells, in which there are but few vessels. In the centre is the pith.

*Leaf.*—The structure of the leaf in Passion-flowers presents, so far as I have seen, no features of special interest; and hence the subject may be passed over with a brief reference to the epidermis and to the arrangement of the vascular bundles. The epidermis consists of flat cells with sinuous outline, between which are a great number of small oval stomata, bordered on each side by a semilunar guard-cell.

In some of those species, the lower surface of whose leaves is studded over with ocellate glands, the structure is as follows:—The ordinary epidermal cells are, in the species examined, less sinuous in their outline, and arranged concentrically around the circular gland. This latter is composed of a large number of very small hexagonal cells densely packed together, each cell being two or three times less in magnitude than the adjacent epidermal cells (Plate LXV. fig. 7).

*Petiole.*—In transverse section the petiole of *Passiflora quadrangularis* is boat-shaped. In structure it consists of the usual epidermis surrounding parenchyma in which are plunged eight large vascular bundles, and sometimes others of smaller size interposed. The usual arrangement is as follows:—Six large bundles disposed in a ring around the central parenchyma, the largest bundle being uppermost. Each of the bundles has in transverse section a deltoidal outline, the apex of the triangle being directed inwards towards the centre, while the broad base, consisting of cellular tissue and cambium-cells, is directed towards the circumference. The remaining bundles occupy each one of the upper corners of the leaf-stalk, and have their cambium-cells also directed towards the periphery, so that these wedge-like (in section) masses of woody tissue form a broken circle as in a branch, but are more interrupted (Plate LXV. fig. 8).

*Midrib.*—A transverse section of the midrib, in the centre of its course, shows a similar structure to that just described, but with only four woody bundles, placed one on either side, one at the top, and one at the bottom. The cambium-cells are external as in the petiole (Plate LXV. fig. 9).

*Petiolar glands.*—In *Passiflora alata* these glands are cup-shaped, the concavity being



directed upwards. When a section is made through such a gland, the following appearances are presented from above downwards. Two layers of cubical, thick-walled epidermal cells, ordinary parenchyma, spiral vessels, more parenchyma, and below a single layer of epidermal cells.

*Peduncle.*—The structure of the peduncle is precisely similar to that of the tendril. At the upper part the woody bundles, which below form an incomplete ring, are approximated so as to form a continuous vascular circle. As the vessels pass upwards into the flower-tube, the bundles are so arranged as to form on transverse section a pentagonal outline, a disposition maintained throughout the whole length of the gynophore, as far as the point where the stamens are given off. Coupling this fact with the manner in which the stamens and gynophore are respectively developed, as before explained, the inaccuracy of the statement made in some descriptive works, to the effect that the stamens are adherent to the gynophore, becomes obvious. Above the point of emergence of the stamens the vessels are arranged in such a manner as to form, in transverse section, a triangular outline—a circumstance which, as it appears to me, militates against Schleiden's notion that the axis in *Passiflora* has direct concern in the formation of the ovary.

*Flower-tube.*—A longitudinal section of the receptacular tube of *Passiflora alata* shows, going from without inwards, an epidermis of thick-walled cubical cells, enclosing parenchyma of large oblong cells containing a little chlorophyll. This parenchyma is traversed by bundles of spiral vessels, slender wood-cells, and *vasa propria*. The epidermis in the interior of the tube presents a different character according to its position; thus in the upper portion, above the median or membranous corona (operculum), it has the ordinary characteristics, while below, in the nectary proper, it consists of a number of raised papilliform cells, immediately beneath which run at intervals solitary and very small spiral vessels.

*Sepals.*—The sepals on their lower or outer surface are covered by an epidermis, the cells of which are somewhat cuboidal, but sinuous in outline above, and thickened on their upper wall. They are interrupted here and there by oval stomata, bounded by two sausage-shaped guard-cells containing chlorophyll, a substance not met with in most of the other epidermal cells. The inner or upper epiderm of the sepals is of a similar character, and is likewise perforated by stomata. Some of these stomata are of an imperfect character, in that the separation into two guard-cells does not take place. The form of the aperture remains unaffected; but it is bounded by a single cell instead of by two.

According to Von Mohl, the stomata originate from the subdivision of a single cell, each of the subdivisions becoming a guard-cell. In the imperfect stoma above described there has been an arrest of development, as it were, and the sphincter of the stoma is formed of one cell instead of by a pair. Charles Morren\*, who was the first to notice this condition of the stomata, mentions the existence in *Passiflora quadrangularis* of still more imperfect stomata on the calyx, consisting merely of one semilunar guard-cell, as if the fellow cell were suppressed. Morren states that he saw, in one case, an aperture, as of

\* *Dodonæa*, part ii. p. 18.



an ordinary stoma, between the side of this solitary sphincter-cell and the adjoining epidermal cell. I have not myself seen these half stomata, probably because my observations have not been sufficiently extended.

Beneath the outer epidermis are three or four rows of spheroidal cells containing chlorophyll. Within this (in *P. alata*) there is a quantity of loose spongy cellular tissue, consisting of irregularly branching cells, between whose subdivisions are left large spaces or *lacunæ*. These cells contain little or no chlorophyll. Traversing this tissue are numerous bundles of slender spiral vessels. The inner epidermis consists of flattened polygonal cells with oval stomata.

*Petals.*—The outer or lower epidermis of the petals of *P. alata* consists of one layer of thickened, somewhat polygonal, scarcely sinuous cells, beneath which are numerous globular cells closely packed, except towards the inner surface, where there are a few lacunæ. The spiral vessels are of the same character as in the sepals. The inner epidermis consists, in the basal portion, of flattened cells; but above, where the petal becomes coloured, papular cells make their appearance.

The epidermis of the petals in the hybrid  $\times$  *P. cæruleo-racemosa* consists also of sinuous cells, and this on both surfaces. It is perforated by few or no stomata. The colouring-matter is of a fluid nature, and is contained in the cells subjacent to the epidermis.

*Corona.*—A section through one of the larger rays in *P. alata* showed several bundles of spiral vessels traversing a quantity of cellular tissue, the outermost cells of which were filled with red colouring-matter. The epidermal cells are cuboidal in section, and either flat on the outer surface, or, in other cases, prolonged into conical points. There is probably some relation between the presence of this form of cellular tissue and colouring-matter or other secretion, since it is sometimes present, sometimes absent, both from the surface of the petals and from the rays of the corona\*.

With reference to the spiral vessels by which the rays of the corona are traversed, I may remark that, while in the case of the larger rays there are sometimes several bundles in each, in the smaller rays there is only a single vessel; but not one, however small, seems to be destitute of its vessel. It is worth remembering this, as some stress is laid in certain cases, *e. g.* in Orchids, on the number and disposition of the spiral vessels as indicative of so many distinct, or potentially distinct, organs. It would surely not be correct to assume, from the presence of two or more bundles of vessels in one thread of the corona of a Passion-flower, that such thread is really of composite nature.

The annular rim which projects from the inner surface of the flower-tube below the "operculum" consists of a mass of globular cells, covered by a papular epidermis, and traversed by a solitary bundle of spiral vessels. In some of the cells may be seen conglomerate raphides.

*Stamens.*—The filaments present an epidermis of squarish thick-walled cells, destitute of stomata, enclosing cellular tissue of closely packed, oblong, cylindrical cells, enclosing a central bundle of fine spiral vessels. The disposition of the tissues in the excurrent

\* I may here call attention to Mr. Tuffen West's remark in the *Journal of Microscopical Science*, 1859, p. 1, t. 1, as to the effect of this velvet-pile-like tissue in giving "air" and a transparent effect to coloured surfaces.



thread to which the anther is attached has been briefly but correctly described by Morren. It consists of a mass of densely packed, very slender, elongated and rather thick-walled cells, like those of the filament, but smaller, and through the centre of which passes a compact bundle of fine spiral vessels (Plate LXV. fig. 10). These vessels are directly continuous with those of the filament; and as they enter the connective of the anther they break up into numerous branches, destined for the supply of the antherlobes. The connective, in the first instance, presents itself at the back of the anther, in the shape of two rounded fleshy lobes, with a central depression. These consist of globular, closely packed cells; the pollen-cavities are somewhat lateral, and leave between them in front a portion of untransformed tissue, with a straight edge. The structure of the anther-valves themselves I have not sufficiently examined. The fibrous cells are ovoid, and contain a much reticulated spiral fibre.

*Pollen.*—The pollen-cells of *Passiflora* and *Tacsonia* are beautiful microscopic objects. Their form is globose; and they are covered with a membrane which is raised into projecting ridges disposed in a netted manner. The grains open by four valves. For a full account of their structure, on which I have no observations of my own to relate, I may refer to Schleiden's account\*.

*Gynophore.*—A transverse section of the gynophore below the lowest cup-like ring of the corona shows, going from the centre towards the circumference, an epidermis enclosing a parenchyma of spheroidal cells, then a ring of vascular tissue, within which is more cellular tissue, in which are plunged five bundles of vascular tissue which, on transverse section, show a semilunar arrangement, the concavity being directed inwards. These bundles seem to alternate with the angles of a pentagonal mass of vascular tissue and elongated cells; quite in the centre is more cellular tissue. Above the cup-like corona the gynophore exhibits the same appearances. A transverse section above the stamens reveals an epidermis encircling cellular tissue, in which is a broken ring of vascular bundles and spiral vessels, within these more cellular tissue and another interrupted ring of vascular tissue enclosing the central parenchyma.

*Ovary.*—A transverse section of the ovary shows the usual epidermis and parenchyma, through which latter run spiral vessels and long, thin-walled tubes. The spiral vessels ramify in all directions. Within these there is again parenchyma encircling six vascular bundles, three opposite to the placentas, three alternate with them. Each of the placental bundles divides into a number of smaller fascicles, destined for the supply of the ovules, which, in *Passiflora*, are usually arranged in four rows on the placentas, so that the walls of the ovary contain a network of vascular tissue. In other cases there is only a double row of ovules to each placenta; indeed, as the fruit ripens, it often happens that two rows of ovules on each placenta become obliterated. The styles are traversed by spiral vessels, which do not form a ring.

*Stigma.*—The stigmatic tissue consists of long, loosely packed cells, with conical ends overlying a mass of ordinary cellular tissue.

*Ovules. Seeds.*—But little need be said in addition to what has been before stated respecting the development of the ovule. The arillus is at first a mere sheet of oblong

\* Principles of Scientific Botany (ed. Lankester), tab. 4, pp. 597, 598, and 356.



nucleated cells, from the inner surface of which a quantity of very large thin-walled nucleated cells are formed, constituting the pulp which invests the seed. The primine is also a mere sheet of cellular tissue, consisting of oblong, flattened, nucleated cells. The secundine is the layer which chiefly contributes to the thickness of the hard "testa" of the seed. In the young state it is thick and fleshy, presenting on the outside (in *P. alba*) numerous pits, which form conical elevations on the inner surface. These funnel-like processes appear at first to be pervious at the apex (see Plate LXIV. fig. 28), so that direct communication exists between the outer and inner portions of the ovule; but ultimately the perforation becomes closed at the inner end.

The constituent cells of the secundine ultimately become thickened by the formation of secondary deposits within them, so that, as before said, the mass of the hard testa of the seed, which retains its pitted appearance, is derived from the secundine.

### FERTILIZATION OF THE FLOWER.

My remarks on this subject apply solely to the genus *Passiflora*, and refer chiefly to the functions exercised by the corona. Late in its development, and complicated in its arrangement, the series of parts constituting the corona seem to have some special office to fulfil in connexion with the fertilization of the flower. In the first place I may refer to the comparative rarity with which some of the species ripen their fruit unless assisted by art; and not only this, but it has also been observed that in some cases fruit is not formed unless the flower be impregnated with pollen of some other species! A summary of the evidence on this point is given by Mr. Darwin\*, to whose remarks I would merely add that ripe fruit is often formed when perfect seeds are not. This is particularly observable in certain hybrid forms, such as  $\times P. hybrida floribunda$  or  $\times P. cæruleo-racemosa$ .

That the tendency in Passion-flowers is against self-fertilization and in favour of cross impregnation might, I think, be inferred from the arrangement of the parts of the flower, even if the fact were not known practically.

\* 'Variation of Animals and Plants,' ii. 137; Scott, 'Journ. Linn. Soc.' viii. (1864) p. 197. It is, however, certain that many species will ripen perfect fruit and seeds after fertilization by their own pollen. Some species (e. g. *P. alba*) do this without artificial assistance; and the common *P. cærulea* may be observed, in favourable seasons and localities, bearing ripe fruit and seeds out of doors. Mr. Ridout, a practical gardener of much experience, furnishes me with the following note on this matter:—"The extract from Mr. Darwin's 'Variation of Animals and Plants under Domestication' is not in accordance with my own experience. In one instance I have succeeded in fruiting *P. racemosa*, fertilized by its own pollen; the fruit swelled freely and evenly to the full size attained by that species; while, in the case of *P. quadrangularis*, for several years past I have been in the habit of setting, not a few fruit, but several dozens, entirely by its own pollen, and have at this time a plant of that species covering the roof of a small lean-to house, with upwards of 100 fruit on it, this being the third crop it has produced this year, the two former equalling the present in point of number. I impregnate them when there is a good number of flowers expanded at one time, after which the temperature of the house is allowed to rise from 5° to 10° for the remainder of the day; and it has always proved a rare case for one to fail; in fact, they set with much greater certainty than Melons. I know also that Mr. Mundell, of Hooley Hall, has been even more successful than myself; for he has annually excellent crops of the Granadilla, and fruit of *P. edulis*. Nor has his attention been confined to these alone; for three beautiful varieties, produced between species at that establishment, have already emanated from there."



In the young state the anthers are introrse and pressed up against the sides of the ovary and styles, the large stigmas of which project beyond the anthers. When the anthers become sufficiently matured to allow of the emission of the pollen, they undergo a change of position: the filaments spread more or less horizontally, and the anthers become extrorse; so that if the flower-stalk spread somewhat horizontally, as it does usually, or if it be erect, the pollen is likely to be shed on the corona, the styles at this stage being horizontal, with their stigmas quite out of reach of the pollen. In this manner the corona is often found dusted over with pollen; and in *Passiflora cincinnata*, Mast., and in other species it often happens that the stamens are bent downwards to such an extent as to come into direct contact with the corona (Plate LXV. figs. 4, 5).

The outermost rows of the corona, then, appear to attract insects, the smaller threads proceeding from the throat of the flower-tube catch the pollen, while the membranous or median corona (operculum) shuts off the upper portion of the flower from the nectar-secreting portion at the base. The peculiar pulley-like process of the stalk of the pistil in some Passion-flowers, and the substitutes for it in other species, have already been alluded to. In all cases the object seems to be to detain the insect in its passage to the nectar-secreting portions, and so to enable it the more surely to be dusted over with pollen. Now, when a Bee visits an expanded flower, it is easy to see how the insect favours cross fertilization. The insect alights on the rays of the corona; and if there be pollen on them, some of it must naturally adhere to the hairs on the insect's back. Moreover, if the insect be large, or the stamens, with their now extrorse anthers, be bent downwards, as they usually are at a late stage of the expansion of the flower, it is obvious that the back of the insect is very likely to come into contact (nay, does so, as I have frequently observed) and thus remove some of the pollen from them. In those cases where, from the pendulous position of the flower (*P. quadrangularis*, *P. macrocarpa*, &c.), the pollen cannot fall on the corona, which is now placed above the anthers, the pollen is removed by Bees in the manner just indicated. When the pollen-carrying insects alight on the corona of another flower it may so happen that the stigmas of that flower are so placed as to render them liable to come into contact with the insect, and to remove from its hairy thorax the pollen-grains with which it is bestrewn. The styles, which are erect all the time the anthers are introrse and so placed as to be liable to contaminate the stigmas, gradually assume a horizontal or even a deflexed position when the anthers are extrorse, or bent downwards, so as to render access of the pollen from them an improbable occurrence. All this may readily be seen by any one who watches the operations of a Humble-bee as he flies from flower to flower of any of our cultivated Passion-flowers; but it would seem probable, from the length of the gynophore, that in their native haunts the flowers of *Tacsonias*, for instance, are visited by some larger creatures than Bees. Indeed some travellers state that the honied flowers of the *Tacsonias* are very attractive to Humming-birds; and these elegant little creatures probably act as the carriers of pollen from one flower to another.

In connexion with the uses of the corona, I may here mention that, according to the late Prof. Morren, the corona is the seat of the perfume of the flower in *Passiflora*



*quadrangularis*\*—a fact which he considers proved by the anatomical structure of the coronal threads, as also by the circumstance that if the processes in question be early removed the flowers remain scentless.

In repeating this experiment, however, I have not been able to satisfy myself of the absolute correctness of this statement, though indeed it is one which would seem very likely to be correct. So far as I have observed, the chief seat of the perfume is in the nectary itself. Professor Morren attributes to the conical, pimple-like cells of the epidermis of the coronal filaments the formation of the odoriferous principle. These peculiar cells are found on the surface of the petals and in the nectariferous portion of the tube of the flower. The plant, says the Belgian professor, relieves itself of its excess of carbonaceous material by means of these two secretions, the sugary fluid or nectar and the aromatic principle. That these peculiar papilliform cells, constituting what was called by Prof. Morren *conenchyma*, are often associated with secreting surfaces, there can be no doubt; but as they occur on the surface of petals of flowers destitute of perfume, we must await further evidence before we assume that in the Passion-flowers these cells really secrete the odorant principle.

*Movements of the Stamens, Styles, and Anthers.*—The different positions assumed by the reproductive organs have been already referred to. I am not in a position to throw any light on the cause of these movements, of which, so far as I have seen, the minute anatomy offers no explanation. I can only surmise that the differences in position result, as they are known to do in other similar cases, from changes in the contractility or turgescence and consequent tension of certain cells as contrasted with the flaccidity of others. But this is a matter requiring much additional investigation.

The peculiar movement of the anther from introrse to extrorse has been attributed by some to gravity merely. The broad filament ends above in a fine thread, which is continuous with the anther below the centre of its dorsal surface. It was therefore assumed that on the expansion of the flower the superior weight of the upper portion of the anther, in conjunction with the fineness of the pivot on which it is poised, was sufficient to cause the anther to tilt over†. This explanation was combated by Morren, who adduced several reasons for rejecting this explanation, and considered that the fine point terminating the filament acts as a spring, which, under certain conditions, pulls the anther over. This explanation I believe to be correct, and in harmony with the singular structure of the organ in question and before alluded to.

It would be interesting to compare, in a fresh state, the anatomical structure of the filament at its point of attachment to the anther in those genera, such as *Modecca*, where the anther is basifixed and introrse.

*Movements of the Tendrils, &c.*—Under this head I need only refer to the valuable communication of Mr. Darwin, to whose observations I have nothing to add‡.

\* *Dodonæa*, part ii. p. 21.

† St.-Hilaire, 'Leçons de Botanique, ou Morphologie Végétale,' p. 439; Morren 'Dodonæa,' part ii. p. 23.

‡ Darwin, *Journal of Linnean Society*, vol. ix. p. 89.



## AFFINITIES OF THE GROUP.

The *Passifloraceæ* have been variously allocated by different authors. A. L. de Jussieu placed them near Cucurbits and Loasads—a position also assigned to them by Linnæus, the elder De Candolle, Agardh, Bentham and Hooker, and others. St.-Hilaire grouped them near to Loasads. The balance of opinion, indeed, seems to be in this direction. Du Petit Thouars placed them near *Violaceæ*, in which disposition he was followed by Lindley, who included them in his Violal Alliance. Adanson and Lamarck ranged them near to Capparids, Salisbury to Samyds. Others have pointed out their relation to Bixads and Resedas. Brongniart grouped them between Saxifrages and Hamamelids. Agardh has even suggested a resemblance to Bignoniads (*Cobæa*), but one which seems very remote.

Hence it will be seen that while some authors include the order among Perigynous Exogens, others rank it amongst the Hypogynous group, thereby laying greater stress on the one-celled ovary and parietal placentation, characters possessed for the most part by the orders above named, than on the superior or inferior condition of the ovary, or on the point of emergence of the sepals, petals, and stamens, even though these latter characteristics form the landmarks by which the main subdivisions of Exogens are known.

In estimating the affinities of *Passifloraceæ* (as of other groups), the characters upon which we found our estimate must be regarded from various points of view.

1. *Numerical importance*.—In the first place we have characters derived from the relative frequency of occurrence (in the orders under consideration) of a particular form or of a particular arrangement of organs. Such characters formed the basis of Adanson's system of classification\*. They have the great advantage of being easily estimated; nevertheless it has been well objected that they are of little value unless associated with other points, such as invariability, physiological importance, and the like. To some extent, however, such an association must, from the nature of things, be a necessary coincidence.

In illustration of my meaning, I will take those families which have been considered by various authorities to be more or less nearly related to *Passifloraceæ*, excluding those in which the relationship seems very remote, and taking no heed of the exceptional forms which occur. These families are sixteen in number. In the next place I will enumerate the most striking structural characters of *Passifloraceæ*, and will indicate, by means of numbers, the relative frequency of occurrence of these characters in the orders under consideration. Thus, suppose we take the most prominent characters, and those which are almost universally present in true *Passifloraceæ*, and disregard the few exceptional cases, it will be seen that Turnerads agree with Passion-flowers in the possession of twelve of those characters, and differ from them in the absence of the remaining four. Cucurbits have seven points in common with Passion-flowers, and nine points of difference, and so on. This numerical relation between the several orders may be more fully shown as follows:—

\* Adanson, *Familles des Plantes*. Paris, 1763.



TABLE 1.

Characters.	Number of orders in which present.	Characters.	Number of orders in which present.
One-celled ovary .....	16 (all)	Hypogynous stamens .....	9
Parietal placenta .....	16 „	Perigynous petals.....	6
Alternate leaves .....	14	Stipules .....	5
Straight embryo .....	15	Arillate seeds .....	5
Superior ovary .....	13	Climbing habit.....	5
Albuminous seeds .....	13	Gynophore .....	4
Free petals .....	10	Petiolar glands.....	3
Flower-tube or perigynous calyx-lobes ..	9	Corona .....	3

These characters are arranged from above downward according to the relative frequency of their occurrence in the sixteen following orders:—

TABLE 2.

Names of orders.	Number of characters possessed by allied orders in common with Passifloraceæ.	Names of orders.	Number of characters possessed by allied orders in common with Passifloraceæ.
Passifloraceæ .....	16 (all)	Loasaceæ .....	9
Turneraceæ .....	12	Bixaceæ .....	8
Malesherbiaceæ .....	12	Pangiaceæ .....	8
Sauvagesiaceæ .....	10	Papayaceæ .....	8
Samydaceæ .....	10	Frankeniaceæ .....	8
Violaceæ .....	9	Capparidaceæ .....	7
Droseraceæ .....	9	Cucurbitaceæ .....	7
Homaliaceæ .....	9	Bignoniaceæ .....	4

The orders in the foregoing enumeration are placed from above downwards according to the degree of their affinity with Passion-flowers, as estimated by the occurrence of the characters mentioned in Table 1, without reference to other points—*Turneraceæ* and *Malesherbiaceæ* having the greatest number of points in common with Passiflorads, *Bignoniads* and *Cucurbits* the fewest, and so on.

If, then, we wish to ascertain what orders are most closely allied to *Passifloraceæ*, and to seek the greatest number of points of resemblance, as we should do when a synthetical arrangement is desired, we have merely to ascertain which orders are at the top of the list (Table 2), and which are the characters most frequently present (Table 1). If our object be analytical, or, in other words, if our desire is to discover points of divergence, then the foregoing list (Table 1) must be read from below upwards; for while the uppermost characters are common to the large majority of the members of the series, the lower ones are those which are peculiar, or nearly so, to Passion-flowers.

But although, from a numerical point of view, the alliance between certain orders may seem to be close, yet it must of course be remembered that a merely numerical relation may be outweighed by considerations of greater moment. We have, then, to appraise the value of these characters; and in so doing we avail ourselves of such points as the following:—



2. *Relative invariability*, a point on which deservedly much stress is laid, is to a great extent implied in the Table showing the relative frequency of occurrence of certain characters (Table 1)—but not wholly so; for instance, the number of petiolar glands and of rings of the corona is subject to variation even in the same species. It is a rare thing for them to be entirely absent; but it is common for them to be variable. Constancy of occurrence and invariability of form or arrangement do not necessarily go together. Nevertheless, as a general rule, it may be stated that those characters placed high in the list on account of their frequent occurrence, are also those which are least liable to variation in individual plants, or even species. Thus the one-celled ovary and the parietal placentation are not only characters of general occurrence, but they vary comparatively little in form in the individual members of a species. On the other hand, the corona and the petiolar glands, which are almost peculiar to *Passifloraceæ*, and which are therefore placed at the bottom of the list of characters, from the infrequency of their occurrence in other orders, are very liable to variation in individual plants.

3. *Developmental characters*.—A glance over the characters alluded to in the foregoing lists will suffice to show that some of them are “congenital,” and others “acquired.” Of course there is only a difference of degree between congenital and acquired characters; nevertheless the difference is an important one, and one readily recognized.

The acquired characters are necessarily subsequent to the others in the time of their appearance; they belong, as it were, to another stage of growth. If the illustration may be permitted me, I would compare the congenital characters to the “carcass” of a house, the acquired ones to its fittings.

The one set of characters are peculiar to, and perhaps different in, each individual, according to circumstances; the others (though also susceptible of modification) are common to all, or to a large number. Now, in the illustrations already given, it will be seen that those characters which are the most important in point of frequency of occurrence are precisely those which are congenital.

Again, it may be seen that those characters which are acquired, those which make their appearance later in the course of development, are those upon which stress is laid in distinguishing the lower groups, such as genera, sections, and species, one from another. Their use is in analysis chiefly, as that of the congenital characters is in synthesis. Moreover these acquired characters are taken from organs which, speaking generally, are those concerned in the carrying on the physiological actions peculiar or special to individual plants. But congenital characters are not merely of use synthetically, they may occasionally be used analytically, when they afford the means of discriminating, not only between large groups, but also between the members of the group itself. Thus the presence or absence of stipules affords congenital characters available for distinguishing both large and small aggregates from each other. At the same time the stipules are physiologically important as protectors to the young buds, or, in some cases, as secreting organs\*.

\* From their frequent very large comparative size in the young bud it is fair to infer that their office is one of greater importance in that stage of development than it is subsequently, when the leaves are fully developed.



The petiolar glands offer another instance of a congenital character serving for purposes of analysis—for distinguishing between small, as well as between large aggregates. These glands, too, seem to be more important in the young than in the adult condition of the leaf.

A similar remark may be made concerning the albumen—a congenital character usually common to all the members of large groups, and serving to bind their members together, and to discriminate them from others. This, too, is a character of high physiological importance; and yet it is one which sometimes serves to separate closely allied forms from each other. Thus in the genus *Sterculia*, in *Cassia*, &c. there are some species with, and others without albumen.

Congenital characters not only give us direct indications of existing affinities, but they are suggestive of the manner in which that affinity *may have been* brought about; in other words, they give a clue to the ancestry and parentage of existing forms. For instance, at a certain stage of development the flowers of a Passion-flower are almost precisely identical in the arrangement of their several parts with those of *Turnera*; so that we might either look upon *Turnera* as a Passion-flower arrested in its development, or upon a *Passiflora* as a *Turnera* of an exalted and more complicated type of organization. In so saying, I do not mean to assert dogmatically that existing Passifloras were evolved out of Turneras, or that Turneras are really degenerate Passifloras, I would merely infer that as both, at a certain stage of their existence, have the same arrangement of their floral organs, so they may have sprung, and probably did spring, from a common ancestor having a similar arrangement of parts.

The relative importance of congenital and of acquired characters in the sixteen orders previously mentioned is in a measure shown in the accompanying Table 3, in which

TABLE 3.

	Alternate leaves.	Opposite leaves.	Stipules.	Unisexual flowers.	Hypogynous calyx.	Hypogynous corolla.	Peri- or Epi-gynous calyx.	Perigynous corolla.	Gamopetalous corolla.	Polypetalous corolla.	Hypogynous stamens.	Perigynous stamens.	Corona.	Gynophore.	Superior ovary.	Inferior ovary.	One-celled ovary.	Parietal placenta.	Albumen.	Arillus.	Straight embryo.	Climbing habit.	Petiolar glands.
Passifloraceæ ...	*	•	*	•	•	•	×	×	•	*	*	•	×	×	*	•	*	*	*	×	*	×	*
Turneraceæ.....	*	•	•	•	•	•	×	×	•	*	*	•	×	×	*	•	*	*	*	×	*	×	*
Malesherbiaceæ	*	•	•	•	•	•	×	×	•	*	*	×	•	•	*	•	*	*	*	×	*	•	*
Sauvagesiaceæ...	*	•	*	•	*	*	×	×	•	*	*	•	×	×	*	•	*	*	*	•	*	•	•
Samydaceæ.....	*	•	*	•	*	*	×	×	•	*	*	•	•	•	*	•	*	*	*	•	*	•	•
Violaceæ.....	*	•	*	•	*	*	×	×	•	*	*	×	•	•	*	•	*	*	*	×	*	•	•
Droseraceæ.....	*	•	*	•	*	*	•	•	•	*	*	•	•	•	*	•	*	*	*	•	*	•	•
Homaliaceæ.....	*	•	*	•	*	*	×	×	•	*	*	•	•	•	*	•	*	*	*	•	*	•	•
Loasaceæ.....	*	*	•	•	•	•	×	×	•	*	*	×	•	•	•	×	*	*	*	•	*	•	•
Bixaceæ.....	*	•	•	•	*	*	×	×	•	*	*	×	•	•	•	×	*	*	*	•	*	•	•
Pangiaceæ.....	*	•	•	*	*	*	•	•	•	*	*	•	•	•	*	•	*	*	*	•	*	•	•
Papayaceæ.....	*	•	•	*	*	*	•	•	*	*	?	•	?	•	*	•	*	*	*	•	*	•	•
Frankeniaceæ...	•	*	•	•	*	*	•	•	•	*	*	•	•	•	*	•	*	*	*	•	*	•	•
Capparidaceæ...	*	•	•	•	*	*	•	•	•	*	*	•	•	×	*	•	*	*	*	•	*	•	•
Cucurbitaceæ...	*	•	•	*	•	•	×	×	*	•	•	×	•	•	*	×	*	*	*	•	*	×	•
Bignoniaceæ...	•	*	•	•	*	*	•	•	*	•	•	×	•	•	*	•	*	*	*	•	*	×	•

twenty-three characters, some of which are found in all the orders in question, are



enumerated. The \* indicates congenital or primordial characters; the × those that are acquired or secondary. Of these twenty-three selected points of comparison Passion-flowers possess 16, 10 congenital, 6 acquired; Turnerads have 12 points of agreement with Passion-flowers, 8 congenital, 4 acquired, while they differ in 6, viz. in 2 congenital and 4 secondary characters. Samyds have 11 points (of the 23) in common with Passion-flowers, 7 primordial, 4 secondary; and 8 points of divergence, viz. 4 congenital and 4 acquired. This is more easily seen in the following Table 4†:—

TABLE 4.

	Points of Agreement.			Points of Disagreement.		
	Congenital.	Acquired.	Total agree- ment.	Congenital.	Acquired.	Total diver- gence.
Passifloraceæ .....	10	6	16	•	•	•
Turneraceæ .....	8	4	12	2	4	6
Malesherbiaceæ .....	8	4	12	2	2	4
Sauvagesiaceæ .....	11	•	11	3	6	9
Samydaceæ .....	7	4	11	4	4	8
Violaceæ .....	11	•	11	3	6	9
Droseraceæ .....	9	•	9	5	6	11
Homaliaceæ .....	7	4	11	3	6	9
Loasaceæ .....	7	4	11	5	6	11
Bixaceæ .....	10	•	10	4	6	10
Pangiaceæ .....	10	•	10	6	6	12
Papayaceæ .....	10	1	11	8	7	15
Frankeniaceæ .....	10	•	10	6	6	12
Capparidaceæ .....	8	1	9	6	5	11
Cucurbitaceæ .....	6	5	11	9	5	14
Bignoniaceæ .....	8	2	10	9	6	15

Congenital characters, then, are of cardinal importance in estimating affinity, from their frequency of occurrence, and from their relative invariability. The physiological importance of the organs furnishing congenital characters is also necessarily great, as upon the due fulfilment of their functions depend the life and reproduction of the plant. The manner in which those functions are fulfilled depends, as will be shown in the next paragraph, upon those organs which furnish special physiological characters.

† In a case of doubt we should do well to lay greater stress (for purposes of synthesis) upon the possession of these fundamental characters than on the cumulative force of number without reference to value, or on quality rather than on quantity. At the same time, as has been already stated, congenital characters occasionally furnish good means of discrimination between small groups, though their value in this respect is to some extent diminished by the greater tendency which, under such circumstances, the characters in question have to vary.

4. *Special physiological characters.*—These are attributes usually “acquired,” and not common to all plants, but only to certain genera and species. They are, of course,

† These Tables, like the preceding ones, must be taken as only approximately correct; for it is not certain in all cases what is a congenital, what an acquired character. Moreover the characters assigned to any particular order are by no means absolute: for instance, some Passion-flowers are unisexual, though not entered as such in the Table. Exceptions, indeed, are here disregarded.



inseparably connected with the work done by those particular plants; hence their value is not only physiological, but also analytical, because they furnish good marks whereby to discriminate one species from another. In a purely morphological sense these characters may often appear trivial; but if they are associated with a difference in physiological function, it cannot be said that they are unimportant. It is sufficient to mention, by way of illustration of this class of characters, all those diversified arrangements for favouring or preventing cross fertilization. Thus, in the case of the *Passifloræ*, it has been shown that the arrangement of the series of threads and membranous rings constituting the corona is of great value in separating species, or subsections of the genus, one from another. These organs are "acquired," they are formed late, and they have a special office in favouring cross fertilization, and in impeding or preventing self-impregnation. I call characters derived from such organs as these "special physiological characters," not only because they are peculiar to certain plants, but also because their office is special.

They are not essential organs (fertilization can and does take place without their aid); but they modify the action of the essential organs, and make them perform their office in a peculiar manner. The remarks that have been made on acquired characters apply then to those which are here termed special physiological.

It is not requisite in this case to say any thing concerning characters dependent on teratological phenomena or on those founded on varying geographical distribution of species. It would occupy too much space to treat of these subjects at length in such a communication as this; but, by way of summing up, I may add that, in estimating the value to be attached to certain characters or points of distinction, it is necessary to consider the purpose for which they are required. If the object be synthetical—if we are seeking points of resemblance, so as to group together a large number of forms into one or more large aggregates—we must, in the first instance, lay stress on the congenital characters, as serving to bind together the greatest numbers, and as being the most constant, the least variable, and the most physiologically important; then we must consider those dependent on frequency of occurrence and special physiological office, afterwards such others as may be available or forthcoming. If the purport of our investigation be analytical; if discrimination be our object, the special physiological characters first demand attention, then those which have the merit of frequency and invariability, and lastly those that are congenital.

It stands to reason that if a character be at once numerically important, congenital, and of high physiological value, it will be most valuable for synthetical purposes: for instance, in the large group Parietales, including Exogens with parietal placentation, the presence of albumen is a very constant feature (except in Cucurbits); hence then, as a character, albumen, in such a case, is numerically important, it is congenital, and physiologically of high importance. It is hardly necessary to add that the systematist cannot always act up to his own standard. Even the most experienced and sagacious botanists are not unfrequently inconsistent, often must be so from defective evidence. Individual cases have to be dealt with on their own merits, and consistency often has to give place to convenience or expediency.

From what has been previously said, it would seem as if the proper position of *Passi-*



*floraceæ* were among Hypogynous rather than Perigynous Exogens, that the nearest allies are the *Malesherbiæ* (included in *Passifloraceæ* by Bentham and Hooker), the *Turneraceæ*, as already suggested by Dr. Seemann\*, the *Samydaceæ*, the *Bixaceæ*, and the *Violaceæ*. With other groups the alliance is more remote, and especially in the case of *Cucurbitaceæ*, with which the alliance is more apparent than real; or perhaps, as Agardh has suggested †, the two should be regarded as parallel or analogous series. The tribes *Modeceæ*, *Achariæ*, and *Papayaceæ*, included by Bentham and Hooker in *Passifloraceæ*, should either form a suborder or, preferably, a distinct order, intermediate between *Passifloraceæ* and *Cucurbitaceæ*—a plan followed by Lindley ‡. I am disposed to exclude them from *Passifloraceæ* proper by reason of their unisexual flowers, their perigynous stamens, the different attachment of the anthers, their want of corona, or, if present, its different nature, their usual lack of stipules, &c.

## REMARKS ON THE GENERA OF THE TRIBE PASSIFLOREÆ.

## DILKEA, nov. gen.

Under this name I propose the establishment of a new genus, the characters of which are hereinafter given. It differs from *Passiflora* and *Tacsonia*, to which otherwise it is closely allied, in the stamens being scarcely, if at all, removed from the base of the flower-tube, in the number of stamens and of styles (8 and 4 respectively), in the linear anthers, and the peculiar corona. In some respects it stands intermediate between *Passiflora* and *Smeathmannia*.

## TACSONIA.

This genus was separated from *Passiflora* by Jussieu, and has been generally adopted by botanists, not without a suspicion, however, that it was too closely allied to *Passiflora* to be truly generically distinct. In truth there are a certain number of osculant forms which have been bandied about from one genus to the other to the great confusion of the synonymy. By relegating these intermediate forms (including the species generally referred to the sections *Psilanthus* and *Distephana*) to *Passiflora*, a much more compact genus is formed, one distinct morphologically as well as in point of geographical distribution, at the same time that *Passiflora* is by no means weakened as a genus. The distinctive features of *Tacsonia*, then, reside in the elongated flower-tube (to which *T. manicata* offers an exception), in the faucial corona, consisting of tubercles or very short threads (to which *T. pinnatistipula* constitutes an exception), and in the short reflexed membranous corona nearly at the base of the flower-tube. True *Tacsoniæ*, as thus limited, have a peculiar *facies* not to be described in words, but one which is, in general, recognizable by the eye; and they are peculiar to the western side of the Andes, extending in some cases to great heights.

## PASSIFLORA.

De Candolle and others have proposed a great number of sections of this genus, and

\* Botany of the 'Herald,' p. 129. Turnerads differ, however, from Passiflorads in their fugacious, not persistent, petals, as remarked by Dr. Hooker, Gen. Pl. i. 806.

† Agardh, Theoria Syst. Veg. p. 386,

‡ Lindley, Veg. Kingd. 322.



have also adopted as distinct such genera as *Disemma* (potius *Distemma*\*), *Murucuia*†, *Tetrapathæa*‡, not to mention smaller subdivisions proposed by Bory de St. Vincent or Rœmer. It is not necessary to go into details on these points, the synonymy and references given in the subjoined lists being sufficient for the purpose.

I retain *Astrophea* as proposed by De Candolle, but raise it to the rank of a subgenus, and in it I include a small number of species mostly of erect habit (some even being trees), destitute of tendrils for the most part, with a many-flowered inflorescence, minute bracts, peculiar dilated coronal filaments, an oblong ovary somewhat flattened at the top, and from the angles of which proceed the three awl-shaped styles. To the species enumerated under this head by De Candolle I have added several which are more nearly allied to this group than to any others, though in some instances they differ somewhat in habit.

My second subgenus, *Plectostemma*, is so named from the circumstance that the membranous corona, instead of being flat, is almost universally folded into sharp folds, and frilled at the edge. Under this subgenus are included, as sections, *Tetrapathæa*, *Cieca*, *Dysosmia*, *Decaloba*, *Polyanthea*, *Distemma*, to all of which, with the exception of *Distemma*, the same limits, though a lower rank, are assigned as by previous writers. I can find no valid reason for keeping up *Distemma* as distinct, inasmuch as in some cases the number of rings is more than two, while in those in which it is confined to that number it is not possible to separate the species from those included in *Decaloba* and *Polyanthea*. One or two of the Australasian species, indeed, have the corona flat, as in *Murucuia*; but these are exceptional cases.

The subgenus *Murucuia*, which was regarded as a genus by Tournefort, De Candolle, and others, I prefer to retain in *Passiflora*, and to strengthen it by the transfer of the species included by De Candolle under *Tacsonia*, section *Psilanthus*.

*Granadilla* forms in every way a well-marked subdivision, which I retain under the same limitations as De Candolle, Bentham and Hooker, and others, with the exception that I include in it the species forming the section *Tacsonioides* of De Candolle.

#### TRYPHOSTEMMA.

A genus founded by Harvey upon a single species, a native of Natal. I have added a second species, from Zanzibar, and am inclined to include Peyritsch's genus *Basananthe* under the same heading; but it is perhaps better to wait for further evidence before so doing, especially as the validity of *Basananthe* has been strengthened by the publication of Dr. Welwitsch, who further calls attention to the likeness of one of the species described by him to a *Viola*, and of the other to a *Sauvagesia*§.

\* Labillard. Nov. Caled. 78, t. 79. DC. Prod. iii. 332. End. Gen. 5100.

† Tournefort, Inst. 215. Juss. Gen. 398. DC. Prod. iii. 333. Endlicher, Gen. Pl. 5099.

‡ Raoul in Ann. Sc. Nat. III. ii. 122.

§ Welwitsch, Trans. Linn. Soc. xxvii. p. 29.—“*Basananthe litoralis* habitu *Sauvagesiam erectam* simulat, dum *B. nummularia* habitum *Viola* æmulat, adeoque genus hoc affinitatem inter *Passifloreas* et *Violarieas*, ab Endlichero aliisque auctoribus, imprimis ex fructus structura indicatam, etiam habitu ambarum specierum indigitat.”



## PAROPSIA

is remarkable for containing species some of which are found in West Tropical Africa, others in Madagascar, and others in the Malayan peninsula and islands.

## BARTERIA.

A genus peculiar in the consolidation of its styles. One species was previously described; and I have added a second, whose singular inflorescence has been before alluded to.

The remaining genera of the order I need not here further refer to; some, indeed, such as *Deidamia*, Thouars, *Thompsonia*, R. Br., *Physena*, Noronh., are almost wholly unknown to me, save from the descriptions in recognized text-books. To the genera constituting the tribes *Modeceæ*, *Achariæ*, and *Papayacæ* of Bentham and Hooker I do not here make further allusion, because, for reasons before given, I consider them to form an order apart from true *Passifloracæ*. Regarding the genera belonging to the tribe *Malesherbiæ*, viz. *Malesherbia* and *Gynopleura*, I have also nothing to add.

ENUMERATION OF THE GENERA AND SPECIES OF THE TRIBE *Passifloræ*;  
Benth. et Hook. fil. Gen. Pl. i. 808.

In the following list I have given the names and synonyms of the species included in the tribe *Passifloræ*. The American species are described in my Monograph of American *Passifloracæ*, included in Martius and Eichler's *Flora Brasiliensis*\*. The African species are monographed in the second volume of Prof. Oliver's *Flora of Tropical Africa*†. Of the new species coming from other countries, descriptions are hereto appended, as also of two new genera of the order.

## I. DILKEA. Genus novum.

Flores regulares dichlamydei hermaphroditi 4-8-meri. Floris tubus cylindratus coloratus. Sepala 4-5 oblonga integra subcoriacea. Petala 4-5 sepalis conformia subæqualia tenuiora cum iis e fauce tubi enata. Corona e medio tubi emergens basi membranacea tubulata ad faucem in filamentorum series 3-4 divisa, filamentis exterioribus liguliformibus planis petalis paulo brevioribus, filamentis intermediis numerosis externis brevioribus tenuioribus albidis curvatis, filis intimis setaceis. Stamina 8 hypogyna æqualia, filamenta gracilia erecta ima basi monadelpha. Antheræ ad filamenta dorso infra medium affixa erecta bilocularia, loculis ad latera rima longitudinaliter dehiscentibus. Ovarium stipitulatum ovoideum 1-loculare. Ovula  $\infty$  anatropa funiculata horizontalia vel pendula

placentis parietalibus 4 serie duplici affixa. Stylus filiformis elongatus superne in ramos 4 stigmatosos divisus. Stigmata majuscula crassiuscula reniformia inclusa. Fructus globosus magnitudine aurantii parvi extus coriaceus evalvis?—Arbores vel frutices ecirrati? scandentes ("Sipo" Spruce). Rami teretes vel subangulati foliis delapsis cicatricibus magnis instructi. Folia petiolata alterna vel subopposita integra 1-costata. Petioli crassiusculi. Flores, ut videtur, in glomerulis axillaribus sessilibus vel pedunculatis aggregatis. Pedunculi vel pedicelli floribus breviores basi bracteis parvis subulatis instructi. Flores rubri.

Genus habitu, coronæ indole, nec non staminum, styliorum carpellorumque numero ab affinibus diversum. De inflorescentia aliquantulum dubito. In memoriam amici beati Caroli Wentworth

\* Now (May 1871) passing through the press.

† In the press, May 1871.



Dilke, Baronetti Angli, litterarum, artium, scientiarum, et præcipue horticulturnæ patroni munifici, indefessi, genus dicavi.

1. *D. RETUSA*. Mast. in Mart. et Eichl. Flor. Brasil. (Passifl.) tab. 106. Foliis oblongis subspatulatis apice truncatis retusis vel subbilobis; floris tubo quam sepala parum breviora.

*Habitat* in sylvis densis Barræ, in Brasiliæ prov. Rio Negro. *Spruce*, n. 1320<sup>1</sup>!; in sylvis ad Ega, prov. Rio Negro, *Martius*!

2. *D. ACUMINATA*: Mast. *loc. cit.*, foliis oblongo-lanceolatis abrupte longiusculeque acuminatis; floris tubo quam sepala 5-6-plo breviora.

*Hab.* in sylvis densis Barræ et Panure, prov. Brasiliæ Rio Negro. *Spruce*, n. 1320<sup>3</sup>!

## II. TACSONIA, Juss. Gen. 398.

DC. Prod. iii. 333 (pro parte); Benth. et Hook. fil. Gen. Pl. i. 810. Mast. in Mart. Flor. Bras. (Passifl.) 535 ubi species sunt descriptæ.

Sectio 1. *EUTACSONIA*, DC. *Bracteæ liberæ*.  
(Sp. 1-12.)

### § 1. *Folia simplicia, 1-nervia.*

1. *T. ADULTERINA*, Juss. Ann. Mus. Hist. Nat. vi. 393. = *Passiflora adulterina*, Linn. fil. Suppl. 408.

*Hab.* Nov. Granata.

2. *T. LANCEOLATA*, Mast., sp. nov. in Flor. Brasil. *Hab.* Peruvia (Mathews, 1252).

3. *T. LANATA*, Juss. Ann. Mus. vi. p. 392, t. 59. f. 1.

*Hab.* Nov. Granata.

### § 2. *Folia lobata, 3-5-nervia.*

4. *T. GRACILENS*, A. Gray, Bot. U. S. Explor. Exped. 1854, 639.

*Hab.* Peru (Mathews, 915).

5. *T. PINNATISTIPULA*, Juss. Ann. Mus. vi. 393. = *Passiflora pinnatistipula*, Cav. Ic. v. 16, t. 428. *P. chilensis*, Miers, Travels, ii. 522. *Poggendorffia rosea*, Karsten, Linnæa, xxviii. 438, et Plant. Columb. Spec. Sel. t. 15. p. 29.

Var. *pennipes*, Smith in Rees, Cyclop. n. 48.

*Hab.* Peruvia, Chili, Columbia.

6. *VAN VOLXEMII*, Hook. Bot. Mag. 5571. = *P. antioquiensis*, Karst. Flor. Columb. t. 71.

*Hab.* Nov. Granata.

7. *T. JAMESONI*, Mast., sp. n. in Flor. Brasil. *Hab.* Quito (Jameson).

8. *T. FLORIBUNDA*, Mast. = *Rathea floribunda*, Karst. Flor. Columb. i. t. 38.

*Hab.* Nov. Granata.

9. *T. TRIPARTITA*, Juss. Ann. Mus. vi. t. 60.

*Hab.* Peruvia (Pavon).

10. *T. TRIFOLIATA*, Juss. Ann. Mus. vi. 393. = *Passiflora trifoliata*, Cav. Ic. v. 16, t. 427. *Tacsonia trigona*, DC. Prod. iii. 334.

*Hab.* Peruvia (Pavon, Gay, Matthews, 674, 675; Lobb, 20).

11. *T. MICRADENA*, DC. Prod. iii. 334.

*Hab.* Peruvia.

12. *T. MANDONI*, Mast., sp. n. in Flor. Bras.

*Hab.* Bolivia (Mandon).

Sectio 2. *BRACTEOGAMA*, DC. *Bracteæ basi conjunctim enatæ*. (Sp. 13-25.)

### § 1. *Folia simplicia, 1-nervia.*

13. *T. RUGOSA*, Mast., sp. n. in Flor. Brasil.

*Hab.* Nov. Granata (Schlim, 301).

### § 2. *Folia lobata, 3-5-nervia.*

14. *T. AMPULLACEA*, Mast., sp. n. in Flor. Brasil.

*Hab.* Ecuador (Jameson); Nov. Granata (Lobb).

15. *T. URCEOLATA*, Mast., sp. n. in Flor. Brasil.

*Hab.* Columbia (Lobb, 121).

16. *T. MATTHEWSII*, Mast., sp. n. in Flor. Bras.

*Hab.* Peruvia (Matthews).

17. *T. MANICATA*, Juss. Ann. Mus. vi. 393, t. 59. f. 2.

*Hab.* in Andibus.

18. *T. PEDUNCULARIS*, Juss. Ann. Mus. vi. 395. = *Passiflora peduncularis*, Cav. Ic. v. 15, 426.

Var. *Dombeyana*, DC. Prod. iii. 334.

*Hab.* Peruvia (Matthews).

19. *T. GLABERRIMA*, Juss. Ann. Mus. vi. 394.

Var. *cumbalensis* = *Tacsonia cumbalensis*, Karst. Linnæa, xxx. 161.

*Hab.* in Andibus.

20. *T. PARVIFOLIA*, DC. Prod. iii. 335.

*Hab.* in Andibus.

21. *T. ANASTOMOSANS*, DC. Prod. iii. 335.

*Hab.* in Peruviae montibus.

22. *T. TOMENTOSA*, Juss. Ann. Mus. vi. 394. =



*Passiflora tomentosa*, Lam. Dict. iii. 40, ex descript. nec Cav.

*Hab.* in Peruviae montibus (Matthews).

23. *T. BICORONATA*, Mast., sp. n.

*Hab.* in Nova Granata (Schlim, 418), an *T. mixta* potius varietas?

24. *T. MOLLISSIMA*, H. B. K. Nov. Gen. et Sp. ii. 144; Bot. Mag. t. 4187.

Var. *glabrescens*.

*Hab.* in Andibus.

25. *T. MIXTA*, Juss. Ann. Mus. vi. 394. = *Passiflora Tacso*, Cav. Diss. x. t. 277. *P. longiflora*, Lam. Dict. iii. 39.

Subspecies *TOMENTOSA*, mihi. = *Passiflora tomentosa*, Cav. Diss. x. t. 275, 276, nec Lam. *Tacs. longiflora*, Pers. Enchirid. ii. 223. *Tacsonia mixta*, var.  $\beta$ , DC. Prod. iii. 334. *Passiflora mixta*, Linn. f. Suppl. 408?

Var. *speciosa*, mihi, Mart. Flor. Bras. (Passiflor.) t. 128. f. 1. = *Tacsonia speciosa*, H. B. K. Nov. Gen. et Sp. ii. 143!

Subspecies *QUITENSIS*, mihi. = *Tacsonia quitensis*, Benth. Pl. Hartweg. 183; Bot. Mag. 5876.

Var. *eriantha*, mihi. = *Tacsonia eriantha*, Benth. Plant. Hartweg. 183; Bot. Mag. 5750. *T. serrata*, Karsten, Linnæa, xxx. 160.

*Species exclusæ vel non satis notæ.*

*T. bilobata*, Spreng. = *Passiflora bilobata*, Juss.

*T. Buchanani*, Lemaire. = *P. vitifolia*, H. B. K.

*T. canaliculata*, Juss. = *P. glandulosa*, Cav., var.

*T. citrifolia*, Juss. = *P. citrifolia*, Mast.

*T. Fockeana*, Miquel. = *P. glandulosa*, Cav.

*T. glandulosa*, Juss. = *P. glandulosa*, Cav.

*T. ignea*, Hort. = *T. manicata*, var.?

*T. levis*, Benth. = *P. reflexiflora*, Cav.

*T. Mansoi*, Mart. = *P. Mansoi*, Mast.

*T. pubescens*, DC. = *P. quadriglandulosa*, Rodschd.

*T. quadridentata*, DC. = *P. quadriglandulosa*, Rodschd.

*T. quadriglandulosa*, DC. = *P. quadriglandulosa*, Rodschd.

*T. reflexiflora*, Juss. = *P. reflexiflora*, Cav.

*T. Rohriana*, DC. = *P. glandulosa*.

*T. sanguinea*, DC., Hook. (nec Sm.) = *P. quadriglandulosa*, Rodschd.

*T. sanguinea*, Benth. nec DC. = *P. vitifolia*, H. B. K.

*T. spinosa*, Poepp. et Endl. = *P. spinosa*, Mast.

*T. splendens*, Hort., mihi ignot.

*T. Stoupyana*, DC. = *P. quadriglandulosa*, Rodschd.

*T. subcoriacea*, Gareke. = *P. glandulosa*, Cav.

*T. viridiflora*, Juss. = *P. viridiflora*, Cav.

III. PASSIFLORA, Linn. Gen. n. 1021.

DC. Prod. iii. 322 (pro parte); Benth. et Hook. fil. Gen. Pl. i. 810; Mast. in Mart. Flor. Brasil. (Passiflor.) p. 542, ubi species omnes Americanæ descriptæ sunt.

Subgenus I. ASTROPHEA, DC. Prod. iii. l. c. (pro parte). (Sp. 1-13.)

Sectio 1. *Inflorescentia cymoso-paniculata; arbores vel frutices plerumque ecirratae.*

1. *P. ARBOREA*, Spreng. Syst. iii. 42. = *P. glauca*, H. B. Pl. Æquin. i. 76, t. 22.

*Hab.* Nov. Granat., Venezuela, Peruvia (Spruce, n. 6144; Goudot, 1; Fendler, 2548, &c.).

2. *P. EMARGINATA*, H. B. Pl. Æquin. i. 79, t. 23.

*Hab.* Nov. Granat. (Linden, 1409; Schlim, 585, 693, 1148); Venezuela (Fendler, 2548; Funck et Schlim, 1215).

3. *P. OVATA*, Martin in DC. Prod. iii. 322.

*Hab.* Nov. Granat. (Schlim, 285, 1142); Guiana, (Sagot, 210).

4. *P. CITRIFOLIA*, Mast. = *Tacsonia citrifolia*, Juss. Ann. Mus. Hist. Nat. vi. 392.

*Hab.* Guiana Gallica (Sagot, 1287 &c.)

Sectio 2. *Inflorescentia simplex. Frutices vel herbæ perennes, erectæ vel scandentes.*

5. *P. MANSOI*, Mast. = *Tacs. Mansoi*, Mart. Beibl. zur Flora, xxii. 7.

*Hab.* Brasilia (Martius, 276; Gardner, 3194; Warming, 1167; Pohl, 8, fol. tomentosus).

6. *P. CANDIDA*, Mast. = *Tacs. candida*, Pœpp. Nov. Gen. et Sp. ii. p. 59, t. 180.

*Hab.* Brasilia (Pœppig, 2644).

7. *P. COSTATA*, Mast., sp. n. in Flor. Brasil.

*Hab.* Brazil (Spruce, 1670, 1676); Guiana (Apun, 2173).



8. *P. ELLIPTICA*, Gardner in Hook. Lond. Jour. Bot. i. 173.

*Hab.* Brazil (Gardner, 46, 3040; Burchell, 1838; St.-Hilaire, 135).

9. *P. HÆMATOSTIGMA*, Mart. mss. in herb.

*Hab.* Brasilia (Martius Obs. 1136; Sello, 310, 1105; Pohl, 3498).

10. *P. RHAMNIFOLIA*, Mast., sp. n. in Flor. Bras.

*Hab.* Brazil (Sello, 2148, 2125).

11. *P. PENTAGONA*, Mast., sp. n. in Flor. Brasil.

*Hab.* Brazil (Martius, 1221; Weddell, 1216).

Sectio 3. *Inflorescentia spicata. Pedunculi aggregati.*

12. *P. SPICATA*, Mast., sp. n. in Flor. Brasil.

*Hab.* Brazil (Martius).

13. *P. SPINOSA*, Mast. = *Tacsonia spinosa*, Pœpp. et Endl. Nov. Gen. ii. 59, t. 181.

*Hab.* Brazil (Spruce, 1394); Peruvia.

Subgenus II. *PLECTOSTEMMA*, Mast. in Flor. Brasil. (Passifl.) 545.

(*Passifloræ* sectt. *Cieca*, *Dysosmia*, *Decaloba*, *Polyantha*, *Medusæa*, *Disemma*, *Tetrapathæa* auctorum.)

Sectio I. *TETRAPATHÆA. Flores dioici.* (DC. Prod. iii. 323.)

14. *P. TETRANTRA*, Banks et Soland. = *Tetrapathæa australis*, Raoul, Ann. Sc. Nat. ser. 3. ii. 123.

*Hab.* Nov. Zelandia.

Sectio 2. *CIECA. Flores plerumque ebracteati, apetal.* (Sp. 15-26.)

15. *P. PANNOSA*, Sm. in Rees, Cyclop. 28.

*Hab.* Mexico.

16. *P. GRACILIS*, Jacq. Eclog. t. 168.

*Hab.* Brazil (Pohl, 1228); Venezuela.

17. *P. CORIACEA*, Juss. Ann. Mus. vi. 109, t. 39. f. 2. = *P. difformis*, H. B. K. Nov. Gen. et Sp. ii. 136. *P. chypeata*, Sm. in Rees, Cyclop. n. 20.

*Hab.* Mexico (Liebmann, nn. 3, 4, 5, 6, 7, 8, 9); Panama, N. Granat.; Venezuela, Peruvia ad Taropoto (Spruce, 4213, 4522); ins. Antillan.

18. *P. BERTERIANA*, Balb. ex DC. Prod. iii. 325.

*Hab.* Ins. Cuba (Wright, 2604).

19. *P. TENUILOBA*, Engelm. Plant. Lindheim. p. 192.

*Hab.* Nov. Mexico (Wright, 117, 210).

20. *P. PÆPPIGII*, Mast. = *P. lunata*, Pöpp. et Endl. N. Gen. et Sp. ii. 58, t. 178 (1830), nec Smith, nec Juss.

*Hab.* Peruvia.

21. *P. BILOBATA*, Juss. Ann. Mus. vi. 107, t. 37. = *P. Contrajerva*, Sm. in Rees, Cycl. n. 23.

*Hab.* Mexico (Pavon); St. Domingo.

22. *P. BAUHINIIFOLIA*, H. B. K. Nov. Gen. et Sp. ii. 132.

*Hab.* Quito.

23. *P. INAMÆNA*, A. Gray, Pl. Wright. part ii. p. 59.

*Hab.* Texas, Nov. Mexico (Wright).

24. *P. CERATOSEPALA*, Mast. = *Ceratosepalum parviflorum*, CErsted, Fl. Cent. Am. t. 17, absque descript.

† 25. *P. SUBEROSA*, Linn. Amœn. Acad. i. 226. = *P. oliviformis*, Flor. Flum. ix. t. 83. *P. flexuosa*, Gardn. in Hook. Lond. Journ. Bot. i. 174. *P. pseudo-suberosa*, Fisch. ex Walp. Rep. ii. 934.

Var.  $\alpha$ . *minima*. = *P. Walkeriæ*, Wight, Ill. Ind. Bot. ii. 39.

Var.  $\beta$ . *hirsuta*. = *P. hirsuta*, Linn. Amœn. i. 227. *P. villosa*, MacFadyen, Flor. Jam. ii. 151. *P. puberula*, Hook. fil. Trans. Linn. Soc. xx. 222. *P. littoralis*, H. B. K. Nov. Gen. et Sp. ii. 138. ?*P. hispidula*, Knowles et Westc. Flor. Cab. iii. 126. ?*P. nigra*, Jacq. Obs. ii. 27, t. 46. f. 3.

Subvar. *argentea*, Mast., foliis subtus argenteis.

Var.  $\gamma$ . *angustifolia*. = *Pass. angustifolia*, Swartz, Prod. 97. *P. heterophylla*, Jacq. Hort. Schœnb. ii. 181. *P. longifolia*, Lam. Enc. Méth. iii. 40. *P. tridactylites*, Hook. fil. Trans. Linn. Soc. xx. 222.

Var.  $\delta$ . *pallida*. = *P. pallida*, Linn. Amœn. i. 218, excl. syn. *P. Warei*, Nutt. in Sillim. Journ. v. 297. ?*P. Kegehana*, Garcke in Linnæa, xxii. 60.

Var.  $\epsilon$ . *hederacea*. = *P. hederacea*, Cav. Diss. x. 448. *P. peltata*, Cav. Diss. x. 447. *P. Kohautiana*, Presl. *P. globosa*, Flor. Flum. ix. t. 85. *P. lineariloba*, Hook. fil. Trans. Linn. Soc. xx. 222.

*Hab.* per tropicos late diffusa. Miro modo



variat, varietates autem formis transitoriis pluribus conjunctæ sunt.

26. *P. LAWSONIANA*, Mast., sp. n. in Flor. Bras.  
*Hab.* Brasilia austr. (F. Müller 179).

*Species dubiæ mihi incognitæ.*

*P. DICTAMO*, DC. Prod. iii. 324.

*Hab.* Mexico.

*P. TRISETOSA*, DC. Prod. iii. 324.

*Hab.* Mexico.

*P. MACULATA*, Scan. Cat. Hort. Bot. Coll. Hort. Rip. p. 101, ex DC. Prod. iii. 324.

*Hab.* Ins. Antill.

*P. LIMBATA*, Tenore, Ann. Sc. Nat. ser. 2, (1840) xiii. 380.

*Patria incognita.*

### Sectio 3. DYSOSMIA.

*Bracteæ approximatae bi-tripinnatisectæ, segmentis linearibus glanduloso-capitellatis.* (Sp. 27-34.)

† 27. *P. ACERIFOLIA*, Schlecht. et Cham. Linnæa, v. 89. = *Dysosmia acerifolia*, Rœm. Syn. ii. 151.

*Hab.* Mexico (Liebmann, 72; Bourgeau, 3168, 3262); Venezuela (Fendler, 471; Moritz, 1719); Veraguas (Seemann, 1626); Nov. Granat. (Goudot).

28. *P. CLATHRATA*, Mast., sp. nov. in Flor. Brasil.

*Hab.* Brazil (Gardner, 3192; Lindberg, 6231, 3613; Warming, 1172; St.-Hilaire, 465, 2157; Sello, 2335; Claussen, 379).

29. *P. LEPIDOTA*, Mast., sp. nov. in Flor. Brasil.

*Hab.* Brasilia (Sello).

30. *P. PECTINATA*, Griseb. W. Ind. Flor. 294.

*Hab.* Ins. Antill.

31. *P. LIEBMANNI*, Mast.

*Hab.* Mexico (Liebmann, n. 41).

32. *P. VILLOSA*, Vell. Flor. Flum. ix. t. 87.

*Hab.* Brasilia (Burchell, 3989, 4143, 4316; Gaudichaud, 989; Warming, 1168, 1174; Sello, 5079).

† 33. *P. FÆTIDA*, Linn. Amœn. Acad. i. 288. = *P. hirsuta*, Lodd. Cab. t. 173 nec alior. *P. polyaden*, Flor. Flum. tom. ix. t. 92.

Var. *a. gossypifolia*. = *P. gossypifolia*, Desv. in Ham. Prod. Flor. Ind. Occ. p. 28. *P. fœtida*, Lodd. Cab. t. 725, nec Linn. *P. obscura*, Lindl.

Trans. Hort. Soc. vii. 1. *P. hibiscifolia*, DC. Prod. iii. 331, nec Lam.

Var. *β. hirsuta*. = *P. Baraquiniana*, Lemaire, Ill. Hort. vii. t. 276 ex ic.

Var. *γ. nigelliflora*. = *P. nigelliflora*, Hook. Bot. Mag. 3635.

Var. *δ. hastata*. = *P. hastata*, Bertol. Flor. Guatim. 27.

Var. *ε. ciliata*. = *P. ciliata*, Ait. Hort. Kew. iii. 310. *P. hibiscifolia*, Lam. Enc. iii. 39, nec DC. ? *P. hirsuta*, Jacq. Eclog. 123.

Subvar. *quineloba*, Griseb. Cat. Plant. Cub.

Var. *ζ. vitacea*.

*Hab.* per tropicos late diffusa.

34. *P. Vellozii*, Gardn. in Hook. Lond. Journ. Bot. 1845, iv. p. 103. = *P. fœtida*, Flor. Flum. ix. t. 86, fide Gardner.

*Hab.* Brasilia (Gardner, 427; ? Gaudichaud, 1026; St.-Hilaire, 239).

### Sectio 4. DECALOBA, Endl. Gen. 926 (pro parte).

*Bracteæ parvæ, dissitæ, lineares. Flores petalis muniti.*

§ 1. *Inflorescentia cymoso-paniculata.* (Sp. 35-45.) (*Polyanthea*, DC. Prod. iii. 323; *Medusæa*, Lemaire, Flore des Serres.)

#### A. *Folia simplicia, 1-nervia.*

35. *P. MULTIFLORA*, Linn. DC. Prod. iii. 323.

*Hab.* Ins. Antill. Cuba (Wright, 2598); Amer. Central.

36. *P. NEPALENSIS*, Wall. Tent. Flor. Nep. 20, t. 11.

*Hab.* Nepaul.

37. *P. HORSFIELDII*, Blume, Rumphia, 170. = *Disemma Horsfieldii*, Miquel.

*Hab.* Java; ins. Madura.

38. *P. MOLUCCANA*, Bl. Bijdr. 938; Rumphia, 169.

*Hab.* Ins. Ternate.

Var. *β. timorensis*, Bl. Rumphia, l. c.

39. *P. SUMATRANA*, Blume, Rumphia, 170.

*Hab.* Sumatra.

40. *P. SINGAPOREANA*, Wall. Cat. 1232.

*Hab.* Singapore (haud vidi).

41. *P. PENANGIANA*, Wall. Cat. 1233.

*Hab.* Penang (species mihi adhuc ignota).



42. *P. LIGULIFOLIA*, Mast., sp. nov. Foliis coriaceis glabris loriformibus 1-nerviis, apice emarginato-bilobis, basi in petiolum brevem apice biglandulosum angustatis; pedicellis axillaribus, geminis, petiolum 2-3-plo superantibus; floribus diametro expansis, 2-pollicaribus; floris tubo brevi; sepalis petalisque subæquilongis, oblongis; coronæ faucialis filamentis biserialibus, filis exterioribus radiantibus petala æquantibus, filis interioribus 4-plo brevioribus capitellatis; corona membranacea, præcedentibus approximata; gynandrophoro petalis dimidio brevioribus; ovario ovoideo, glabro.

*Habitat* in ins. Loong Kong, prope Hong Kong (Wright, N. Pacific Exped. 481!).

B. *Folia lobata*.

43. *P. SEXFLORA*, Juss. Ann. Mus. vi. t. 37. f. 1. = *P. floribunda*, Lemaire, Flore des Serres, iv. p. 335b; Walp. Ann. ii. 652.

*Hab.* Ins. Antill. Cuba (Wright, 200); Mexico, (Jurgensen, 796, 886; Liebmann, 22, 23, 24, 25, 31, 38).

44. *P. LESCHENAULTII*, Hook. Ic. Plant. iv. 353.  
*Hab.* Ind. Or.

45. *P. CIRRIFLORA*, Juss. Ann. Mus. vi. t. 41. f. 2. ? = *P. septenata*, DC. Prod. iii. 323.

*Hab.* Guiana Gallica.

§ 2. *Inflorescentia simplex* (Eudecaloba).  
(Sp. 46-101.)

A. *Folia simplicia vel obsolete lobata*.

46. *P. TORTA*, Mast., sp. n. in Flor. Brasil.

*Hab.* Brasilia (Spruce, 911<sup>4</sup>); Ins. S. Trinitatis.

47. *P. AURICULATA*, H. B. K. Nov. Gen. et Sp. ii. 131 (1817). = *P. appendiculata*, Mey. Esseq. 223 (1818). *P. Rohrii*, DC. Prod. iii. 326. *P. cyathophora*, Desv. in Ham. Prod. Ind. Occ. 48.

*Hab.* Brasilia (Spruce, 2222, 2962), Am. Centr. Ins. Antill., Guiana, Venezuela &c. (Schomburgk, 287; Fendler, 122; Appun, 870; Sagot, 385; Spruce, 6142).

48. *P. CINEREA*, Pöpp. Nov. Gen. et Sp. ii. 57, t. 177.

*Hab.* Peruvia.

49. *P. MICROPETALA*, Mart. miss. in herb.

*Hab.* Brazil (Martius 3078).

50. *P. POHLII*, Mast., sp. n. in Flor. Brasil.  
*Hab.* Brasilia (Pohl, 2186; Weddell, 2896).

51. *P. TRUNCATA*, Regel, Gart. Flora, viii. (1859) 356.

*Hab.* Brasilia.

B. *Folia manifeste lobata*.

a. *Folia oblonga*.

\* *Folia biloba*.

52. *P. ALNIFOLIA*, H. B. K. Nov. Gen. et Sp. ii. 136. = *P. bogotensis*, Benth. Pl. Hartweg. 184.

*Hab.* Nov. Granat., Ecuador.

+ 53. ? *P. CUNEATA*, Willd. En. Hort. Berol. 696, ex DC. Prod. iii. 332.

*Hab.* Venezuela (Moritz, 1898; Fendler, 483), Panama.

54. *P. ICTHYURA*, Mast., sp. n. in Flor. Brasil.

*Hab.* Brasilia (Gardner, 3191; Sello, 2129, 2149).

55. *P. TUBEROSA*, Jacq. Hort. Schönb. iv. 49, t. 496. = *P. punctata*, Lodd. Cab. 101, nec alior.

*Hab.* Ins. Antill., Guiana Anglic. (Schomburgk, 642), Mexico (Hahn, 48, 41, 133).

56. *P. FURCATA*, Mast., sp. n. in Flor. Brasil.

*Hab.* Venezuela (Fendler, 484).

\*\* *Folia apice triloba*.

57. *P. TRICUSPIS*, Mast., sp. n. in Flor. Brasil.

*Hab.* Brazil (Gardner, 1631; Burchell, 6988, 2; Weddell, 3025).

58. *P. ROTUNDIFOLIA*, Linn. DC. Prod. iii. 338, excl. var. et syn.

*Hab.* Brazil (Martius, 1452, 1220; Warming, 1160<sup>1</sup>, 1160<sup>2</sup>, 1160<sup>3</sup>; Burchell, 5904; Sello, 212, 2128), Ins. Antillan.

+ 59. *P. HOLOSERICEA*, Linn. Amœn. Acad. i. 226.

*Hab.* Mexico (ab omnibus collectoribus fere reportata).

60. *P. MOLLIS*, H. B. K. Nov. Gen. et Sp. ii. 137.

*Hab.* Venezuela (Fendler, 478?), Nov. Granat.

Var. *INTEGRIFOLIA*.

*Hab.* Nov. Granat. (Goudot, n. 11).

61. *P. FUSCINATA*, Mast., sp. nov. in Flor. Brasil.

*Hab.* Mexico (Liebmann, 19).

62. *P. TRIFASCIATA*, Lemaire, Ill. Hort. t. 544.



b. *Folia semiorbicularia.*\* *Folia biloba.*

63. *P. ANDERSONI*, DC. Prod. iii. 326.  
*Hab.* Ins. Antillan.
64. *P. INDECORA*, H. B. K. Nov. Gen. et Sp. ii. 134.  
*Hab.* Peruvia.
65. *P. VESPERTILIO*, Linn. Amœn. Acad. i. t. 10. f. 11. = *P. hemicycla*, Meyer, Essequib. 225. *P. surinamensis*, Miquel, Linnæa, xviii. 363. *P. geminiflora*, DC. Prod. iii. 323.  
*Hab.* Brasilia (Burchell, 9885; Weddell, 3025; St.-Hilaire, 1955), Guiana Gallica (Hostmann, 1095; Sagot, 286), Guiana Anglica (Schomburgk, 38, (154), 664, 1095), Guiana Belgica (Wüllschlægel, 214), Peruvia.
66. *P. RUBRA*, Linn. Amœn. Acad. i. 222, t. 10. f. 9. = *P. capsularis*, Lam. Enc. Méth. iii. 36, non Linn. *P. triquetra*, Lam. Enc. Méth. iii.  
*Hab.* Brasilia (Warming, 1161), Venezuela, Amer. Central, Ins. Antill., Peruvia, Mexico (Liebmann, 28), Ins. S. Trinit. (Sieber, 241).
67. *P. CAPSULARIS*, Linn. Sp. 234. = *P. rubra*, Lam. Enc. Méth. iii. 35, non Linn. *P. piligera*, Gardn. Lond. Journ. Bot. i. (1842) 173. *P. bilobata*, Vell. Flor. Flum. ix. t. 78, nec Juss. *P. pubescens*, H. B. K. Nov. Gen. ii. 132. *P. lunata*, Vell. Flor. Flum. ix. t. 80.  
*Hab.* Brazil (St.-Hilaire, 18<sup>bis</sup>, 704<sup>bis</sup>, 716; Pohl, 3521; Gardner, 41; Peckott, 7; Burchell, 9061; Warming, 1159), Ecuador, Mexico (Liebmann, 29, 30), Nov. Granat. (Goudot, 2).
68. *P. ORGANENSIS*, Gardn. in Hook. Lond. Journ. Bot. iv. p. 104. = ? *P. pertusa*, Vell. Flor. Flum. ix. t. 79. ? *P. obtusa*, Vell. Flor. Flum. ix. t. 81.  
*Hab.* Brasilia (Gaudichaud, 629, 990; Gardner, 428; Sello, 2127).
- Var. *marmorata*, Mast.  
*Hab.* Brazil (St.-Hilaire, 661).
69. *P. LUNATA*, Willd. Sp. Pl. iii. 612. = *P. biflora*, Lam. Enc. Méth. iii. 36. *P. glabrata*, H. B. K. Nov. Gen. ii. 135.  
*Hab.* Mexico (Liebmann, 26, 27), Nov. Granat. (Goudot, 2), Amer. Central, Chagres (Fendler, 121), Venezuela, Ins. Antill.

Var. *costata*, Mast.*Hab.* Guatemala.

70. *P. SPATHULATA*, Mast., sp. n.  
*Hab.* Mexico (Liebmann, 13? 14).
71. *P. MEXICANA*, Juss. Ann. Mus. vi. p. 108, t. 38. f. 2.  
*Hab.* Mexico.
72. *P. JORULLENSIS*, H. B. K. Nov. Gen. et Sp. ii. 133. = *P. Medusæa*, Lemaire ex Bot. Mag. t. 4752.  
*Hab.* Mexico (Liebmann, 30; ? Ghiesbreght, 301).
- \*\* *Folia apice triloba.*
73. *P. LOBBII*, Mast., sp. nov. *loc. cit.*  
*Hab.* Columbia (Lobb).
74. *P. HISPIDULA*, Knowles et Westcott, Flor. Cab. iii. 126 (1840).  
*Hab.* Mexico.
75. *P. ERYTHROPHYLLA*, Mast. *l. c.* ? = *P. TRISETTOSA*, DC. Prod. iii. 324.  
*Hab.* Mexico; Nov. Granat. (Goudot, 2).
76. *P. FILIPES*, Benth. Pl. Hartweg. 118.  
*Hab.* Guayaquil (Hartweg, 661), Mexico (Galeotti, 3656), Texas (Berlandier, 2265, 3046).
77. *P. PENDULIFLORA*, Bert. ex DC. Prod. iii. 326.  
*Hab.* Ins. Antill.
78. *P. OBTUSILOBA*, Mast., sp. nov. *loc. cit.*  
*Hab.* Peruvia.
79. *P. AFFINIS*, Engelm. in Bost. Journ. Nat. Hist. vi. 233.  
*Hab.* Texas (Lindheimer).
80. *P. LUTEA*, Linn. Amœn. Acad. i. 224, t. 10. f. 13.  
*Hab.* Amer. Septent.
81. *P. SICYOIDES*, Schlecht. et Cham. Linnæa, v. p. 89. = *P. odora*, Link et Otto, Ic. Pl. Rar. part i. p. 93, t. 47.  
*Hab.* Brazil (Sello, 3963), Mexico.
82. *P. WARMINGII*, Mast., sp. n. *loc. cit.*  
*Hab.* Brasilia (Warming, 1153; Sello, 3963).
83. *P. BRYONOIDES*, H. B. K. Nov. Gen. et Sp. ii. 140. = *P. exsudans*, Zucc. Abh. math.-phys. Class. der K. Bayr. Akad. Wiss. ii. 342.  
*Hab.* Mexico.
84. *P. MORIFOLIA*, Mast., sp. n. *loc. cit.*  
*Hab.* Tucuman (Tweedie, 1174).



85. *P. KARWINSKII*, Mast., sp. n.  
*Hab.* Mexico (Karwinski, 178).
- Species Australasicæ et Oceanicæ.* (Sp. 86-94.)
86. *P. BRACHYSTEPHANA*, F. Müll., Benth. Fl. Austr. ii. 312.  
*Hab.* Australia.
87. *P. HERBERTIANA*, Ker, Bot. Reg. t. 737; Benth. Flor. Austral. iii. 311. = *Disemma Herbertiana*, DC. Prod. iii. 333.  
*Hab.* Australia.  
 Var.  $\beta$ . *Caleyana*, DC. Prod. iii. 333.  
*Hab.* Australia.
88. *P. CINNABARINA*, Lindl. Gard. Chron. 1855, p. 724, c. ic. xylog.; Bot. Mag. t. 5911.  
*Hab.* Australia.
89. *P. BANKSII*, Benth. Flor. Austr. iii. 312. = *P. coccinea*, Soland. in herb. Banks. *Disemma coccinea*, DC. Prod. iii. 332.  
*Hab.* Australia.
90. *P. GLABRA*, Wendl. Coll. Plant. i. (1805) t. 17. = *P. adiantifolia*, Ker, Bot. Reg. t. 233. *Disemma adiantifolia*, DC. Prod. iii. 333.  
*Hab.* Ins. Norfolk.
91. *P. AURANTIA*, Forst. Prod. 326; Cav. Diss. x. 457. = *Disemma aurantia*, Labill. Sert. Caled. t. 79.  
*Hab.* Ins. Nov. Caledon.
92. *P. BAUERIANA*, Mast. = *Disemma Baueriana*, Endl. Prod. Fl. Norfolk. 123. *Murucua Baueri*, Lindl. Coll. t. 36.  
*Hab.* Ins. Norfolk.
93. *P. BARCLAYI*, Mast. = *Disemma Barclayi*, Seemann, Flor. Vitiens. 96.  
*Hab.* Ins. Viti.
94. *P. VITIENSIS*, Mast. = *Disemma vitiensis*, Seem. Flor. Vitiens. 96.  
*Hab.* Ins. Viti.  
 An huc *D. Storckii*, Seem. Fl. Viti. 96? Specimen haud vidi.
- C. *Folia transverse oblonga, vel ovalia, biloba, lobis latissime divaricatis, lobo intermedio minore nonnunquam interjecto.* (Sp. 95-100.)
95. *P. MAXIMILIANA*, Bory, Ann. Gén. ii. 149, t. 24 (1819). = *P. discolor*, Link et Otto, Ic. Pl.

Select. i. 13, t. 5. *P. retusa*, Hook. et Arnott, Bot. Misc. iii. 325. *P. Vespertilio*, Ker, Bot. Reg. t. 597, excl. syn.; Lemaire, Ill. Hort. 1869, Misc. p. 1, nec Linn.

*Hab.* Brazil (Spruce, 1629; Burchell, 4257; Tweedie, 179; Warming, 1158; Sello, 337, 368; St.-Hilaire, 2626).

96. *P. MISERA*, H. B. K. Nov. Gen. et Sp. ii. 136.

*Hab.* Nov. Granat.

+ 97. *P. PUNCTATA*, Linn. Amœn. Acad. i. 10, f. 12.

*Hab.* Brasilia (Sello, 642; Miers, 4456), Peruvia, Ecuador.

98. *P. SWARZII*, Mast. = *Pass. rotundifolia*, Swz. Obs. Bot. 337. n. 16, non Linn.

*Hab.* Ins. Antill.

99. *P. MICROCARPA*, Mast., sp. n. *loc. cit.*

*Hab.* Brasilia (Sello, 2480, 2486).

100. *P. EXOPERFULATA*, Mast., sp. n. *loc. cit.*

*Hab.* In Andibus Boliviensibus (Mandon, 611).

*Species hujus sectionis vel Ciecæ non satis cognita.*

101. *P. FERRUGINEA*, Mast., sp. nov. *loc. cit.*

*Hab.* Peruvia ad Tarapoto, ubi legit Spruce (4901).

### Subgenus III. MURUCUIA.

Sectio I. *Corona membranacea ad faucem tubi sita, erecta vel deflexa* (Eumurucua). (Sp. 102-105.)

102. *P. MURUCUIA*, Linn. Sp. Pl. ed 3, vol. ii. p. 1357. = *Murucua ocellata*, Pers. Enchir. ii. 222. *Passiflora orbiculata*, Cav. Diss. x. 286. *Murucua orbiculata*, Pers. Enchir. ii. 222.

*Hab.* Ins. Antillan.

103. *P. PERFOLIATA*, Linn. Willd. Sp. Pl. iii. 611. = *P. cephalima*, Bory, Ann. Gén. ii. 152, t. 22. *P. normalis*, Linn. Amœn. Acad. v. 408.

*Hab.* in ins. Antillan.

104. *P. OBLONGATA*, Swarz, Fl. Ind. Occ. ii. 1135. = *P. elongata*, Poiret, Enc. Méth. Suppl. ii. 839.

Var. *lyrifolia*, Tussac ex Griseb. W. Ind. Flor. 295.

*Hab.* Ins. Antill. Cuba (Wright, 165<sup>5</sup>, 198<sup>2</sup>, 1615; Wullschlägel, 842).

105. *P. CUPREA*, Linn. Amœn. Acad. i. 219, t. 10, f. 3.



Var. *Cavanillesii*, Mast. = *P. cuprea*, Cav. Diss. x. t. 273. *P. Cavanillesii*, DC. Prod. iii. 323.

*Hab.* Ins. Antill.

Sectio 2. *Corona membranacea e tubo versus basin enata, erecta vel deflexa.* (Sp. 106–111.)

(*Tacsonia* sect. *Psilanthus*, DC. pro parte.)

\* *Flores apetalæ* (§ *Pentaria*).

106. *P. LANCIFOLIA*, Desv. in Ham. Prod. Flor. Ind. Occ. ex DC. Prod. iii. 331. = *P. vegalis*, Macfadyen, Flora of Jamaica, 151.

*Hab.* Ins. Antill.

107. *P. VIRIDIFLORA*, Cav. Ic. v. t. 424. = *Tacs. viridiflora*, Juss. Ann. Mus. vi. 389. *Pass. tubiflora*, H. B. K. Nov. Gen. et Sp. ii. 139.

*Hab.* Mexico (Liebmann, 32, 37, 39).

\*\* *Flores dichlamydei* (§ *Decaria*).

108. *P. BICUSPIDATA*, Mast. = *Tacs. cuneata*, Benth. Pl. Hartweg. 183. *Tacs. bicuspidata*, Karst. Linnæa, xxx. 160.

*Hab.* In Nov. Granat.

109. *P. TRINERVIA*, Mast. = *Tacs. trinervia*, Juss. Ann. Mus. vi. 390, t. 58.

*Hab.* Venezuela, Nov. Granat. (Linden, 1127; Holton, 707; Triana, 369).

110. *P. SANGUINOLENTA*, Mast. Gard. Chron. 1868, 1162.

*Hab.* Peruvia (Lobb, 151).

*Species haud satis nota.*

111. *P. HETEROPHYLLA*, Lam. Enc. Méth. iii. 41.

Subgenus IV. GRANADILLA, DC.

(*Anthactinia*, Bory.)

Sectio 1. *Bracteæ conjunctim enatæ.* (Sp. 112–117.)

§ 1. *Folia simplicia.*

A. *Stipulæ lineares.*

† 112. *P. SEEMANNI*, Griseb. in Bonplandia, 1858, p. 7.

*Hab.* in America Centrali (Fendler, 120).

113. *P. MALIFORMIS*, Linn. (Willd.), Sp. Pl. iii. 608. = *P. ornata*, H. B. K. Nov. Gen. et Sp. ii. 129.

*Hab.* Brasilia, Nov. Granata (Goudot, 1, 8; Linden, 1185; Hartweg, 1020), Venezuela, Ins. Antill., Cuba (Wright, 199).

B. *Stipulæ late ovatæ acutæ.*

† 114. *P. LIGULARIS*, Juss. Ann. Mus. vi. p. 113, t. 40. = *P. Lowei*, Heer in Regel. Gart. Flor. 1852, p. 69, t. 14. ? *P. serratistipula*, DC. Prod. iii. 328.

*Hab.* in Amer. Centr. (Goudot, 3; Mandon, 608), Mexico (Galeotti, 3668), Bolivia.

§ 2. *Folia lobata.*

115. *P. TRILOBA*, Ruiz et Pav. ex DC. Prod. iii. 330. = *Passiflora colubrina*, Poepp. et Endl. Nov. Gen. ii. 58 (1838).

*Hab.* Peruvia (Spruce, 4052; Pöppig, 2171).

116. *P. VELATA*, Mast., sp. nov. *loc. cit.*

*Hab.* Venezuela (Fendler, 2329; coll. 2. 1879; Moritz, 1318).

117. *P. SERRATA*, Linn. Amœn. Acad. i. 232, t. 10. f. 21.

Var. *digitata*, DC. Prod. iii. 330.

*Hab.* Brasilia, Peruvia, Guiana, Ins. Antill.

Var. *digitata*, Brasilia (Burchell, 9963).

Sectio 2. *Bracteæ liberæ.* (Sp. 118–180.)

§ 1. *Floris tubus limbo brevior, carnosulus.*

A. *Caules ramique valde tetragoni; folia simplicia.*

† 118. *P. QUADRANGULARIS*, Linn., DC. Prod. iii. 328.

*Hab.* In hortis tropicis ubique culta, in Brasilia, ut videtur, spontanea (Burchell, 9489, 3180).

119. *P. ALATA*, Aiton, Hort. Kew. iii. 306; Wendland, Coll. Plant. ii. t. 46 (1810). = *P. tetradena*, Vand. ex DC. Prod. iii. 331. ? *P. pyriformis* DC. Prod. iii. 331.

Var.  $\alpha$ . *brasiliana*. = *P. brasiliana*, Desf. Cat. Hort. Paris. ed. 3, p. 411. *P. phœnicea*, Lindl. Bot. Reg. t. 1603. *P. maliformis*, Flor. Flum. ix. t. 73. *P. oviformis*, Rœmer, Synops. Monogr. ii. 167.

Var.  $\beta$ . *latifolia*. = *P. latifolia*, DC. Prod. iii. 328.

Var.  $\gamma$ . *mauritiana*. = *P. mauritiana*, Du Petit Thouars, Ann. Mus. vi. t. 65. *P. mascarensis*, Presl, Bemerk. 72.

*Hab.* in Brasilia (Pohl, 920, 3108; Garduer, 4689; Warming, 1157; Gaudichaud, 1043; Lund, 1180; Sello, 2123; St.-Hilaire, 287).



Var.  $\alpha$ . Brasilia (Burchell, 3180).

Var.  $\beta$ . Peruvia (Pavon).

Var.  $\gamma$ . Ins. Sancti Mauritii, et Bourbon.

120. *P. MACROCARPA*, Mast. Gard. Chron. 1869, 1012.

*Hab.*? Brasilia (Wallis), Peruvia (Spruce), Venezuela, Nov. Granat. cult.

B. *Caules ramique teretes vel angulares, haud alati.*

a. *Folia simplicia.*

121. *P. BAHIENSIS*, Klotsch? Linnæa, xv. 293.

*Hab.* Brazil.

122. *P. RIPARIA*, Mart. MSS.

*Hab.* Brazil (Martius, 3228; Spruce, 2191).

123. *P. MIERSII*, Mast., sp. n. *loc. cit.*

*Hab.* Brazil (Burchell, 1378, 3919, 4300; Warming, 1166; St.-Hilaire, 225; Sello, 290; Weddell, 717).

124. *P. GLANDULOSA*, Cav. Diss. x. t. 281. = *Tacs. glandulosa*, Juss. Ann. Mus. vi. 391. *T. Stoupyana*, DC. Prod. iii. 335. *T. Rohriana*, DC. Prod. l. c. *T. Fockeana*, Miquel, Linnæa, xviii. 364. *T. subcoriacea*, Garcke, Linnæa, xxii. 62.

*Hab.* Brazil (Burchell, 9303), Guiana Angl. Belgic. et Gallic. ab omnib. collector. reportata.

125. *P. VARIOLATA*, Pœpp. et Endl. Nov. Gen. ii. 58, t. 179.

*Hab.* Brazil (Spruce, 2868, 2247).

126. *P. LONGIPES*, Juss. Ann. Mus. vi. 111, t. 38. f. 1.

*Hab.* in Nov. Granat. et Guiana Britannica (Schomburgk, n. 279).

127. *P. SUBROTUNDA*, Mast., sp. n. *loc. cit.*

*Hab.* Brazil (Gardner, 1632, 6030).

128. *P. TILIÆFOLIA*, Cav. Diss. x. t. 285.

*Hab.* in Peruvia (Pavon).

129. *P. COLORATA*, Mast., sp. n. *loc. cit.*

*Hab.* in Brazil (Sello, 5960).

130. *P. ÆRSTEDII*, Mast., sp. n. *loc. cit.*

*Hab.* in Costa Rica (Ærsted).

131. *P. JILEKI*, Wawra, Bot. Erbgeniss. der Reise d. Kais. von Mexico, &c., p. 59, tab. 8.

*Hab.* Brazil (St.-Hilaire, 716; Glaziou, 3020; Sello, 5960).

132. *P. AMABILIS*, Hook. Bot. Mag. 4406.

*Hab.* Brazil (Sello, 599).

133. *P. MARGINATA*, Mast., sp. n. *loc. cit.*

*Hab.* Brasil. merid. (Sello, 2126).

134. *P. LAURIFOLIA*, Linn. Sp. Pl. ii. 1356. = *P. acuminata*, DC. Prod. iii. 328. *P. tinifolia*, Juss. Ann. Mus. vi. 113, t. 41. f. 2.

*Hab.* Brasilia (Burchell, 9504, 9988; Gardner, 1663; Spruce, 1172, 1394, 3390), Guiana Belgica (Hostmann, 541, 543), Guiana Gallica (Sagot, 281, 287; Spltzgerber, 2), Guiana Anglica, ins. Antillan.

135. *P. SERRATIFOLIA*, Linn. Amœn. Acad. i. 217, t. 10. f. 1.

*Hab.* Mexico (Jurgensen, 934; Liebmann, 75; 76, 77, 78, 79, 80, 81, 82; Linden, 894), in Guiana Belgica, Antill. &c.

136. *P. NITIDA*, H. B. K. Nov. Gen. et Sp. ii. 130. = *P. nymphæoides*, Karst. Linnæa, xxx. 165.

*Hab.* Brazil (Pœppig, 2584, 2893, 2712; Spruce, 3472; Burchell, 9988; Pohl, 924), Guiana Belgica (Wullschlägel, 1475), Guiana Anglica (Schomburgk 956), in Nov. Granat.

137. *P. MALACOPHYLLA*, Mast., sp. n. *loc. cit.*

*Hab.* Brazil (Warming, 1178).

138. *P. GUAZUMIFOLIA*, Juss. Ann. Mus. vi. 112, t. 39, f. 1. = *P. theobromifolia*, DC. Prod. iii. 331.

*Hab.* in Nov. Granat.

139. *P. COCCINEA*, Aublet, Guiana, t. 324. = *P. velutina*, DC. Prod. iii. 327. *P. fulgens*, Morren, Belgique Horticole, 1866, vol. xiii. p. 193.

140. *P. MUCRONATA*, Lam. Enc. Méth. iii. 33 (1789). = *P. albida*, Ker, Bot. Reg. t. 677. *P. pallida*, Vell. Flor. Flum. ix. t. 70.

*Hab.* Brasilia (Gaudichaud, 1039; Tweedie, 1371; Burchell, 1542, 2906; Lund, 1182, 1187; Sello, 110, 214, 2147, 2124; Peckott, 354).

b. *Folia 3-5-7-lobata.*

141. *P. PEDATA*, Linn. Amœn. Acad. i. 233, t. x. f. 22.

*Hab.* in Guiana Angl. (Schomburgk, 633), ins. Antill. Cuba (Wright 2600).

An huc *P. helleborifolia*, Wallis (nomen tantum)?

142. *P. TRISECTA*, Mast., sp. nov. *loc. cit.*

*Hab.* in Bolivia (Pentland).

143. *P. PALMATISECTA*, Mast., sp. nov. *loc. cit.*

*Hab.* Tucuman (Tweedie, 1170).



144. *P. SPECIOSA*, Gardn. in Field. Sert. Plant. t. 17.

*Hab.* Brazil (Gardner, 426, 4691; Glaziou, 1598; Weddell, 3395; Sello, 2132, 2150; St.-Hilaire, 590; Warming, 1171, 1185; Claussen 379, 380; Pohl, 923).

145. *P. QUADRIGLANDULOSA*, Rodschd. Obs. p. 77 (1796); Meyer, Primit. Flor. Essequeb. (1818) p. 226. = *Tacsonia sanguinea*, DC. Prod. iii. 334. *Tacs. quadriglandulosa*, DC. Prod. iii. 335. *Tacs. quadridentata*, DC. l. c. *Tacs. pubescens*, DC. l. c. *Passiflora guianensis*, Miquel, Linnæa, xviii. 751.

*Hab.* Brazil (Spruce, 1789, 1616), Guiana, Ins. Sct. Trinitatis.

+ 146. *P. VITIFOLIA*, H. B. K. Nov. Gen. et Sp. 180. = *P. sanguinea*, Sm. in Rees, Cycl. *P. punicea*, DC. Prod. iii. 329. *Tacs. Buchanani*, Lemaire, Ill. Hort. t. 519. *Pass. servitensis*, Karst. Linnæa, xxx. 163. An huc *P. caracasana* (Willd.), Spreng. Syst. Pl. iii. 40? et *P. multiformis*, Jacq. Fragm. 169, t. 67. f. 1?

Var. *minor*, Mast.

Var. *involucrata*, Mast.

*Hab.* in Brasilia (Sello, 2150, 2132), in Nov. Granat. (Linden, 1652; Goudot, 1844; Cuming, 1222), in Amer. Centr. (Fendler, 118; Seemann, 562).

Var. *minor*.

*Hab.* in Brasilia.

Var. *involucrata*.

*Hab.* in Brasilia.

147. *P. RECURVA*, Mast., sp. n. *loc. cit.*

*Hab.* Brasilia (Gardner, 2877).

148. *P. MIDDLETONIANA*, Paxt. Mag. Bot. ix. (1842) t. 51.

*Hab.* —? An forma hortensis?

149. *P. CININNATA*, Mast. Gard. Chron. 1868, 966; Hook. Bot. Mag. 5737.

*Hab.* Brasilia (Gardner, 1025, 1315, 1630; Claussen, 382; St.-Hilaire, 753).

150. *P. INCARNATA*, Linn. Amœn. Acad. i. 230, t. 10. f. 19.

*Hab.* Amer. Septent.

151. *P. EDULIS*, Sims, Bot. Mag. 1989. =? *P. cuneifolia*, Cav. Diss. x. t. 292. *P. incarnata*, var.  $\beta$ , Bot. Reg. t. 152?. *P. diaden*, Flor. Flum. ix.

t. 90? *P. rigidula*, Jacq. Eclog. ii. t. 124? *P. pallidiflora*, Bertoloni, Sylloge Plant. hort. Bonon. 1827, p. 6.

Var.  $\alpha$ . *verrucifera*. = *P. verrucifera*, Lindl. Bot. Reg. xxvi. t. 52.

Var.  $\beta$ . *Kerrii*. = *P. Kerrii*, Spreng. Syst. Veg. iii. 39.

Var.  $\gamma$ . *pomifera*. = *P. edulis*, Flor. Flum. ix. t. 89, haud Sims. ? *P. serratifolia*, Jacq. Obs. Bot. part ii. p. 26, t. 46. f. 2, non Linn. *P. pomifera*, Rœmer, Synop. Monog. ii. 179.

Var.  $\delta$ . *rubricaulis*. = *P. rubricaulis*, Jacq. Eclog. t. 169.

*Hab.* Brasil. merid.

+ 152. *P. MEMBRANACEA*, Benth. Pl. Hartweg. 83.

*Hab.* Guatemala (Hartweg).

153. *P. ALBA*, Link et Otto, Ic. Pl. Rar. t. 33.

*Hab.* Brasilia (Gardner, 4690), Mexico (Liebmann, 33, 34), Peruvia, Venezuela (Fendler, 2327).

154. *P. MERIDENSIS*, Karsten, Linnæa, xxx. 165.

*Hab.* Venezuela. (Species mihi incognita.)

155. *P. GRITENSIS*, Karsten, Linnæa, xxx. 163.

*Hab.* Venezuela. (Species mihi incognita.)

156. *P. TETRADEN*, Vellozo, Flor. Flum. t. ix. 91. = *P. sidæfolia*, Rœmer, Synops. Monog. ii. 173.

*Hab.* Brasilia (Peckott, 588).

157. *P. MOOREANA*, Hook. Bot. Mag. 3773.

*Hab.* La Plata (Tweedie).

158. *P. CORNUTA*, Mast., sp. nov.

*Hab.* Brasilia (Burchell, 8537).

159. *P. VIOLACEA*, Vellozo, Flor. Flum. (1827) ix. t. 84.

*Hab.* Brazil (Pohl, 922, 60, 3464; Warming, 1152; Claussen, 378; St.-Hilaire, 1623, 988; Sello, 1149, 2130; Guillemain, 834).

160. *P. AMETHYSTINA*, Mikan, Delect. Flor. et Faun. Bras. fasc. iv. c. ic. color. bona. = *P. onychina*, Lindl. Bot. Reg. ser. nov. 1838, t. 21.

*Hab.* Brazil (Sello, 709, 2131; Claussen, 33; Guillemain, 378, 384).

161. *P. GARDNERI*, Mast., sp. n. *loc. cit.*

*Hab.* Brazil (Gardner, 3193; Pohl, 2484).

162. *P. SUBULATA*, Mast., sp. n. *loc. cit.*



*Hab.* Peruvia.

An eadem ac *P. subpeltata*, Ortega?

163. *P. PALLENS*, Pœpp. = *P. stipulata*, Benth. ex Griseb. Plant. Wright. Cubens. 2599, nec Aublet.

*Hab.* Cuba (Wright, 2599), Venezuela (Fendler, 2327).

164. *P. FILAMENTOSA*, Willd. Sp. Pl. iii. 623. = var.  $\beta$ , Bot. Reg. 584. *P. palmata*, Lodd. Bot. Cab. 97.

*Hab.* Brasil. aust. (Gaudichaud, 1719).

165. *P. ACTINIA*, Hook. Bot. Mag. 4009.

*Hab.* Brasil. aust. (Burchell, 2822).

166. *P. PILOSA*, R. et P. ex DC. Prod. iii. 330. = *P. menispermiifolia*, H. B. K. Nov. Gen. et Sp. ii. 137.

*Hab.* Peruvia.

167. *P. GLAUCA*, Aiton, Hort. Kew. (1789) iii. 308.

*Hab.* Venezuela, Mexico, Guiana Belgica, Nov. Granat.

168. *P. STIPULATA*, Aublet, Pl. Guian. (1775) t. 325.

*Hab.* Guiana.

169. *P. ADENOPHYLLA*, Mast., sp. n. *loc. cit.*

*Hab.* Mexico (Linden, 877; Galeotti, 5664; Hahn, 2437).

170. *P. SPRUCEI*, Mast., sp. n. *loc. cit.*

*Hab.* in Ecuador, prope Guayaquil (Spruce, 6459).

171. *P. CAMPANULATA*, Mast., sp. n. *loc. cit.*

*Hab.* Brasil. aust. (Weddell, 1333).

172. *P. TUCUMANENSIS*, Hook. Bot. Mag. 3636.

*Hab.* Brasil. merid. Tucuman (Tweedie, 181, 1173; Gibert, 43).

173. *P. EICHLERIANA*, Mast., sp. n. *loc. cit.*

*Hab.* Brasil. merid. (Sello, 358; Gaudichaud, 482).

174. *P. PICTURATA*, Ker, Bot. Reg. t. 673.

*Hab.* Brasil (Burchell, 9573), Guiana Belgica.

175. *P. CÆRULEA*, Linn. Amœn. Acad. i. 231, t. 10. f. 20.

*Hab.* Brasil. merid. (Sello, 149, 738, 2235), Uruguay (St.-Hilaire, 2291).

176. *P. CALCARATA*, Mast., sp. n. Glabra, caule

tereti; foliis subrotundis trilobis glanduloso-ser-ratis subtus glaucis, petiolo lamina æquilongo medio biglanduloso; stipulis magnis ovato-lanceo-latis; pedunculis petiolis brevioribus; bracteis stipuliformibus; floribus late campanulatis; sepalis dorso sub apice longiuscule calcaratis, coronæ fau-cialis pluriserialis filamentis distinctis patentibus petala subæquantibus; corona membranacea e fauce tubi emergente basi tubulata margine bre-viter filamentosa; ovario oblongo glabro.

*Hab.* Ins. Madagascar (Bojer in herb. Kew.). Species insignis.

§ 2. *Floris tubus elongatus cylindratus, basi ventricosus.*

177. *P. REFLEXIFLOBA*, Cav. Ic. v. t. 425. = *Tacs. reflexiflora*, Juss. Ann. Mus. vi. 393. *Tacs. lævis*, Benth. Bot. Sulph. 100. *T. hastata*, Ruiz et Pav.?

*Hab.* in Amer. centrali (Hartweg, 662), in Peruvia ad Tarapoto (Spruce, 3923).

178. *P. SETACEA*, DC. Prod. iii. 329. = *P. Sururuca*, Flor. Flum. ix. t. 88.

*Hab.* Brazil (Gardner, 47; Pohl, 920; Glaziou, 1538; Lund, 1183; St.-Hilaire, 403; Weddell, 583; Gaudichaud, 1034).

179. *P. RACEMOSA*, Brotero, Trans. Linn. Soc. t. xii. p. 71, tab. 6. = *P. princeps*, Hort.

*Hab.* Brazil (Gardner, 47; Warming, 1165; Glaziou, 3018; Weddell, 169, 191; Gaudichaud, 1032; Pohl, 921 et 291; St.-Hilaire, 181).

180. *P. RADDIANA*, DC. Prod. iii. 329. = *P. kermesina*, Hort. ? *P. dentata*, Arrab. Flor. Flum. ix. t. 94.

*Hab.* Brazil (Gardner, 48; Blanchet, 3303; St.-Hilaire, 197; Burchell, 9901; Glaziou, 3018).

Sectio 3. *Bracteæ liberæ, foliaceæ. Corona mem-branacea, brevis, arcte longitudinaliter plicata, margine crispato.* (Sp. 181-184.)

(Habitus sect. *Granadillæ*; corona *Plectostem-matis*.)

† 181. *P. HAHNII*, Fournier, Rév. Hort. 1869, p. 430, c. tab. color.

*Hab.* Mexico (Hahn).

† 182. *P. PULCHELLA*, H. B. K. Nov. Gen. et



Sp. ii. 134. = *P. rotundifolia*, Jacq. Obs. Bot. part ii. (1767), nec Linn. nec Swz. *P. divaricata*, Griseb. Bonplandia, 1858, p. 7. *P. rotundifolia*,  $\beta$ . *Jacquinii*, DC. Prod. iii. 326.

*Hab.* in Amer. Central. (Fendler, 2330).

183. *P. SILVESTRIS*, Vellozo, Flor. Flum. ix. t. 74.

*Hab.* Brazil (St.-Hilaire, 1689!).

184. *P. MEDITERRANEA*, Vell. Flor. Flumin. ix. t. 72.

*Hab.* Brazil.

*Species ad Granadillam, ut videtur, pertinentes haud satis cognitæ.*

*P. ELEGANS*, Mast., sp. n. *loc. cit.*

*Hab.* in Brasilia meridionali (Fox, Bonpland).

*P. ATOMARIA*, Planchon MSS. in herb. Kew.

*Hab.* in Nov. Granata (Triana).

*P. ARISTULATA*, Mast., sp. n. *loc. cit.*

*Hab.* in Peruvia ad Tarapoto (Spruce, 3988).

*P. CYANEA*, Mast., sp. n. *loc. cit.*

*Hab.* in Venezuela ad Topo, prov. Caraccas (Burchell; Fendler, coll. 2, n. 469).

*P. NEILLII*, Regel, Flora (B. Z.), xxxii. (1849) p. 184.

*P. GARCKEI*, Mast. (sp. innominat a cl. Garcke descript. in Linnæa, xxii. 60. n. 49 (1849).

*P. OVALIS*, Vell. Flor. Flum. ix. t. 75, icon tantum.

*P. PALLIDA*, Lour. Coch. Chin. 644, ex DC. Prod. iii. 331. (An forte *Malpighiacea* quædam?)

*P. HERMANNI*, DC. Prod. iii. 332.

*P. ARVENSIS*, Vell. Flor. Flum. ix. t. 71.

*P. VERRUCULOSA*, Weinmann, Syll. Pl. i. 228.

*Hab.* Nov. Holl.

+ *P. ADENOPODA*, Fl. Mex. ined. ex DC. Prod. iii. 330.

*P. PATULA*, Wendl.? nomen tantum.

*P. HONDALA*, Steudel? nomen tantum.

IV. *TRYPHSTEMMA*, Harv. Thes. Cap. t. 51. Benth. et Hook. Gen. Pl. i. 811.

1. *T. NATALENSE*, Harv. Thes. Capens. t. 51.

*Hab.* Natal.

2. *T. ZANZIBARICUM*, Mast., sp. n. in Oliv. Flor. Trop. Afr. ii. 508.

*Hab.* Zanguebar.

V. *BASANANTHE*, Peyr. in Wawr. et Peyr. Sert. Benguel. 29. Benth. et Hook. Gen. Pl. i. 812.

1. *B. LITTORALIS*, Peyr. Sert. Benguel. 30; Mast. in Oliv. Flor. Trop. Afr. ii. 509.

*Hab.* Benguella (Welwitsch).

2. *B. NUMMULARIA*, Welwitsch, Trans. Linn. Soc. xxvii. p. 28, t. ix.; Mast. in Oliv. Flor. Trop. Afr. ii. 509.

*Hab.* Angola (Welwitsch).

*Obs.* Genus, ut videtur, a *Tryphostemmate* haud satis diversum.

VI. *PAROPSIA*, Noronh. ex Benth. et Hook. Gen. Pl. i. 812.

1. *P. GUINEENSIS*, Oliv. Journ. Linn. Soc. viii. 161.

*Hab.* Africa occid. trop., Old Calabar.

2. *P. GREWIOIDES*, Welw. in herb.: Mast. in Oliv. Fl. Trop. Afr. ii. 505.

*Hab.* Angola (Welwitsch).

Habitu *Smeathmannias* refert; florum conformatione autem ad *Paropsias* accedit.

3. *P. EDULIS*, Du Petit-Thouars ex DC. Prod. iii. 322.

*Hab.* Madagascar. (Non vidi.)

4. *P. MALAYANA*, Planch. in herb. Kew. (nomen). Foliis angustis ellipticis, longiuscule acuminatis; floris tubo campanulato; ovario globoso.

*Hab.* Malacca (Griffith, 2514, pro parte; Main-gay, 662).

5. *P. VARECIFORMIS*, Mast. Foliis oblongis, acuminatis; floris tubo brevissimo; ovario pyriformi. = *Trichodia vareciformis*, Griff. Notul. iv. 571.

*Hab.* Malacca (Griffith, 2514, pro parte; Main-gay, 658, 663).

VII. *SMEATHMANNIA*, Soland. ex R. Br. in Tuckey, Congo, 439. Benth. et Hook. Gen. Pl. i. 812. *Bulowia*, Schum. et Thonn. Pl. Guin. ii. 21.

1. *S. PUBESCENS*, R. Br., DC. Prod. iii. 322.

*Hab.* Afric. trop. occident.



2. *S. LÆVIGATA*, R. Br., DC. Prod. iii. 322.  
*Hab.* Afric. trop. occident.

VIII. *BARTERIA*, Hook. fil. Journ. Linn. Soc.  
v. 14, t. 2. Benth. et Hook. i. 812.

1. *B. NIGRITIANA*, Hook. fil. *loc. cit.*  
*Hab.* Afric. trop. occident.
2. *B. FISTULOSA*, Mast. in Oliv. Flor. Trop.  
Afric. ii. 511.  
*Hab.* Afric. trop. occident., Fernando Po.

IX. *CROSSOSTEMMA*, Planch. in Hook. Niger  
Flora, 364. Benth. et Hook. Gen. Pl. i. 813.

1. *C. LAURIFOLIUM*, Planch. *l. c.*  
*Hab.* Afric. trop. occident.

X. *DEIDAMIA*, Thouars ex Benth. et Hook. f.  
Gen. Pl. i. 811.

Species 5, Madagascarienses, a me non visæ.

XI. *THOMPSONIA*, R. Br. ex Benth. et Hook.  
Gen. Pl. i. 811.

Genus a me non visum, a cl. Brown nomine  
tantum indicatum.

XII. *ATHERANTHERA*, genus novum, e tribu  
*Modeccearum*, *Modeccæ* affine.

Flores dichlamydei, unisexuales, masculi hucusque tantum recogniti. Sepala 5, æqualia, primo inter se æqualiter distantes, postea, ob petalorum inæqualitatem, sepala duo a reliquis sunt amota. Petala 5, imbricata, concava, demum inæqualia. Corona nulla. Stamina 10, quorum 5 sterilia, basi cohærentia, petalisque adnata. Filamenta plana, liguliformia, superne demum torta. Antheræ subglobosæ, uniloculares (connectivo in mucronem curvatum exeunte), primo introrsæ, postea, tortis filamentis, extrorsæ rimaque lon-

gitudinali unica dehiscentes. Pollinis cellulæ sphæricæ. Pistilli rudimentum minutum.—Herba cirrata, late scandens. Folia alterna, petiolata, cordata, late ovato-acuta, repando-dentata. Petioli eglandulosi. Stipulæ nullæ. Flores paniculatim dispositi.

Genus hucusque floribus masculis recognitum sepalis, petalis, staminibusque, ab affinibus valde diversum. Quoad habitum *Modeccam* refert.

*A. WELWITSCHII*, Mast. in Oliv. Flor. Trop. Afric. ii. 520.

*Hab.* in dumetosis ad sylv. oras Mala de Pungo, Angola (Welwitsch!).

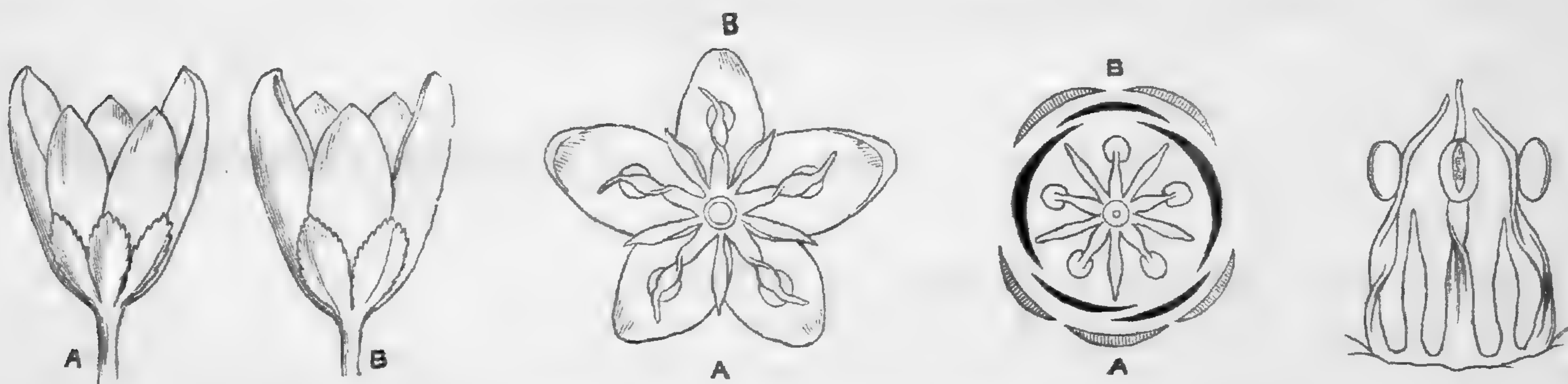
Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.



1. Flos masc. a latere visus. 2. Altero latere visus. 3. Flos arte explanatus. 4. Diagramma. 5. Stamina fertilia tria et staminodia duo monstrat.

GEOGRAPHICAL DISTRIBUTION.

In the 'Flora Brasiliensis' I have given a Table showing the distribution of the species of *Passifloreæ*, so that a few general remarks are all that is necessary in this place. The species are almost wholly tropical in their distribution, which extends in America from about lat. 40° N. to lat. 40° S. The largest number of distinct genera are to be found in tropical Africa; but the species are there comparatively few. On the other hand, the



American genera are few, but they comprise by far the larger number of the species. The Asiatic and Australasian species are not numerous, and their distribution is tropical or subtropical.

The American species of *Passiflora* may roughly be distributed in the following manner, according to the regions they inhabit.

*United States.* Two species are found in this region. One, *P. lutea*, is found in Pennsylvania and southwards (Gray); it belongs to the *Decaloba* section. The other, *P. incarnata*, is nearly allied to the Brazilian *P. edulis*, which belongs to the subgenus *Granadilla*, and, being so far separate from the remainder of its allies of the same subgenus, may be considered an outlier.

*Texas and New Mexico* have a few distinct-looking species belonging to the sections *Cieca* and *Decaloba*.

*Mexico* has several distinct and peculiar species belonging to the subgenera *Cieca* and *Decaloba*.

*Central America*, from about lat. 15° N. to lat. 8°, has a few species, mostly of Mexican type, and also a few Granadillas. *P. quadrangularis*, indeed, is found wild in the woods of Nicaragua.

The *West Indies* have about thirty species, eleven of which are peculiar to the islands. The species of the section *Murucuia* are confined to this district. There are eight species belonging to the section *Decaloba*, and as many to *Granadilla*; but none of the latter are peculiar. On the whole the West-Indian region, so far as Passion-flowers are concerned, is one of the most distinctly marked.

The *Galapagos Islands* contain two or three distinct varieties, which, indeed, were considered to be species by Dr. Hooker. They pass by so many shades into continental varieties of the protean *P. suberosa*, that, although noteworthy as local or insular forms, I cannot hold them to be specifically distinct.

*Venezuela and N.E. New Granada* contain several species belonging to the sections *Decaloba* and *Granadilla*.

*Guiana and the Amazon district.* So far as plants of this order are concerned, the regions above named may be taken together. Rich in species, many of them peculiar, this district is one of the most remarkable of the whole. *Dilkea* is peculiar to it, as also are two of the species of *Passiflora* belonging to the subgenus *Astropheia*, several Granadillas, and some Decalobas. Ciecas are scarce. True Tacsonias, in my sense of the word, are absent.

*Western Andes*, including, in general terms, the western districts of New Granada, Ecuador, Peru, Bolivia, and Chile. This region is the home of the Tacsonias, many of which grow at great heights on the mountains. No Tacsonias proper are found beyond this district. *T. pinnatistipula* occurs furthest to the south in Chile.

In the lower equatorial regions a few species of *Granadilla* and *Decaloba* are found, and a few Ciecas.

*North-east Brazil* is not rich in species; the majority are species of *Granadilla*.

*Central Brazil*, including the east-coast regions, has a large number of species of *Granadilla*, but few peculiar species.



*South Brazil*, as far south as the Rio Grande, also contains a large number of *Grana-dillas*, but few of which are peculiar to the district.

The *Argentine Provinces* contain but few species; but a large proportion are peculiar, those from Tucuman in particular.

*Asia*. A few species of *Passiflora* are found in Central India, one in Nepal, a few in the Malayan peninsula, others in the Malayan islands; and one new species (see *ante*, p. 632, n. 42), very interesting from its isolation, was found by Mr. C. Wright in a small island off Hong Kong\*. These Asiatic species belong almost exclusively to the subsection *Polyanthea*; and some of them were included in the so-called genus *Distemma*, which, however, for reasons previously stated, I cannot concur in retaining. *P. Walkeriæ*, a so-called species from Ceylon, I believe to be a form of *P. minima*, probably introduced to Ceylon. *P. nepalensis* occurs as far north as Nepal. I have reason to believe that there are a few undescribed species in Cochin China; I infer this from a cursory glance at some species in the Paris herbarium, but which time did not allow me to examine. In addition to *Passiflora*, the genus *Paropsia* is represented in Malacca.

*Oceanic species*. Under this head I include species found in the Fiji Islands, New Caledonia, and Norfolk Island. These are for the most part peculiar species of *Passiflora*, belonging to the group *Polyanthea*, and forming, as it were, a transition from the Indian species just referred to to the next or

*Australian group*, which comprises a small number of forms of the same general aspect as those just mentioned.

*West Tropical Africa*. Here we have no truly wild *Passiflora*, but a number of distinct and peculiar paucitypic genera, such as *Barteria*, *Smeathmannia*, *Crossostemma*, and *Paropsia* in the north, and *Basananthe*, *Atheranthera*, and *Machadoa* in the south. *Paropsia* is remarkable for having species in Western Africa, Madagascar, and the Malay archipelago. *Tryphostemma* is peculiar to East Africa, unless, as I believe is the case, the western genus *Basananthe* forms a part of it, in which case the genus has representatives on both sides of the continent.

*South Africa* has the very peculiar genera *Acharia*, *Ceratosicyos*, and *Tryphostemma*.

*Madagascar*, so far as known at present, contains some peculiar genera, such as *Deidamia*, *Physena* (of which we know little), a *Paropsia*, and a new species of *Passiflora*

\* Mr. Wright has favoured me with the following note referring to this species:—"Mr. Stimson (the zoologist) and myself hired a Chinaman and his boat for a short excursion of two or three days among the islets of the coast eastward of Hong Kong. On one of the smallest which we examined, overgrown with rank grass, perhaps uninhabited at some time of the year, and grazed upon by goats carried there for the sake of the grass, I found the *Passiflora*, to all appearance, indigenous. I had the impression on my mind then that *all* the *Passifloras* were American; hence the vividness of my recollections about it. The name of the islet was written in accordance with the pronunciation of the boatman. It was a very small one, and would hardly appear in any thing like a gazetteer, and only on a chart of large scale.

“CHARLES WRIGHT.

“P.S.—We know the queer mistakes made by travellers among peoples whose language they know but imperfectly or not at all, in the application of names or utterances to objects for which they were not intended. Hence some very odd trivial names have originated. Now it is quite possible that Loong Kong was *not* the name of the island, but of some very different thing, though we so understood our boatman.—C. W.”



belonging to the section *Granadilla* (see *ante*, p. 638, n. 176)—a section, as we have seen, having its head quarters in Brazil.

*Bourbon* and *Mauritius* contain a form of *Passiflora alata*, by some considered distinct—a view I cannot assent to. I should deem it most probable that the species in question has been introduced from America at some period or another, and undergone a slight modification in course of time.

In this brief review of the principal phenomena of geographical distribution of *Passifloreæ* I have hitherto omitted to speak of other tribes than the *Passifloreæ* and also of such species as *Passiflora quadrangularis*, which is cultivated in most parts of the tropics for the sake of its fruits, but which is probably of Central-American origin. Jacquin speaks of it as in cultivation in the West Indies, but not as wild. In Nicaragua, however, it appears to be truly wild, and perhaps in Brazil also. *P. foetida*, in one or other of its varieties, is widely distributed throughout the tropical and subtropical regions of the globe. Perhaps its large sticky involucre has had something to do with its diffusion, burr-fashion, over so wide an area. Its medicinal or esculent qualities seem hardly sufficiently important to account for its wide dispersion. *P. foetida* and its varieties occur wild in the West Indies and Brazil. *P. suberosa* and some of its varieties (var. *minima* for example) are also widely dispersed, one can hardly guess how or why; for there seems no special facility in its organization to account for its wide diffusion, and the plant has no prominent ornamental or useful qualities. The head quarters of this species are in the West Indies; but forms of it are very abundant in Brazil. The Galapagos forms have been previously alluded to. *P. edulis*, a Brazilian species, is also cultivated in the warmer parts of the world, and is likely to establish itself as a quasi-spontaneous plant in suitable localities. It has been found in Australia, probably as an escape from gardens (?).

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\* In order to avoid unnecessary repetition, only a few of the more important publications are here cited; others are referred to elsewhere, and especially in the enumeration of species.



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To these references might be added many others relating to the history and legends associated with *Passiflora edulis* (Granadilla). A list of such references is given in Linnæus's paper in the 'Amœnitates Academicæ' above cited; others are mentioned in the dissertations of Cavanilles and of C. Morren above mentioned.

## EXPLANATION OF PLATES.

### PLATE LXIV.

1. *Pass. quadrangularis*. To the left is the peduncular tubercle beginning to divide into flower-stalk (*b*) and tendril (*a*); to the right is the foliar tubercle; *c*, the future leaf; *d*, stipule. The small line beneath the figure denotes the actual size; the  $\times$  shows the position of the axis.
2. Early stage of leaf, *a*, and tendril, *b*.
3. Upper surface of young leaf, showing the central groove.
4. Early stage of leaf, peduncle, &c.: *a*, stipule already well developed; *b*, leaf; *c*, tendril; *d*, peduncle with bracts.
5. Early stage of leaf, flower, &c.: *a*, leaf turned down, showing gland at the upper end of the incipient leaf-stalk; *b, b*, stipules; *c*, tendril; *d*, flower-stalk; *e, e, e*, bracts; *f*, flower-tubercle.
6. Leaf from 5, separated; seen from the side and more highly magnified; the lower pair of glands are the most advanced in development.
7. *Pass. alata*: *a*, earliest stage of the flower; *a, b, c*, bracts; *d*, tendril; *e*, floral tubercle.
8. Flower further advanced, seen from the side; only three of the sepals are yet distinguishable.
9. Flower still further developed, seen from the side; the bracts have greatly increased in size, and are now nearly equal; the calyx has five sepals.
10. Flower in a still further stage of development, seen from the top, and a little flattened artificially; 1-5 are the sepals, all now provided with their *corniculus*. Between the sepals are five petal-tubercles.



11. In addition to the parts shown in fig. 10, the 5 stamen-tubercles are here seen opposite the sepals.
- 11a. Young anthers from 11.
12. Longitudinal section through a portion of a flower further developed than 11, and showing the three carpellary tubercles.
13. Gynæcium from a flower more advanced than 12. The styles remain separate, but the bases of the carpels are inseparate.
14. One petal with the stamens, their filaments now obvious.
15. Portion of a flower more advanced than 14. At the base of the petal may be seen the corona just appearing, also the commencement of the receptacular tube and of the gynophore.
16. Section through the pistil of 15, enlarged, showing the origin of the ovules as little conical or sub-globular tubercles from the wall of the pistil.
17. Portion of the same flower as 15, showing the corona.
18. All the parts of the flower are apparent in this section.
19. *Pass. racemosa*. Portion of the placenta from a young bud, showing the progressive development of the ovules.
20. Separate ovules, showing nucleus, secundine and primine; curvature taking place.
21. Top view of ovule.
22. *Pass. alba*. Ovule fully formed. At the apex of the funicle is a little expansion, which is the beginning of the arillus.
- 23, 24. Further stages in the development of the arillus.
25. Arillus laid open.
26. *Pass. fœtida*. Ripe seed.
27. *Pass. alba*. Primine partially cut away to show the secundine marked with pits.
28. Fragment of an ovule showing at *a* the primine turned on one side; at *b* the inner surface of the secundine next the nucleus, and marked with conical projections corresponding to the pits on the outer surface; *c*, cut edge of the secundine.

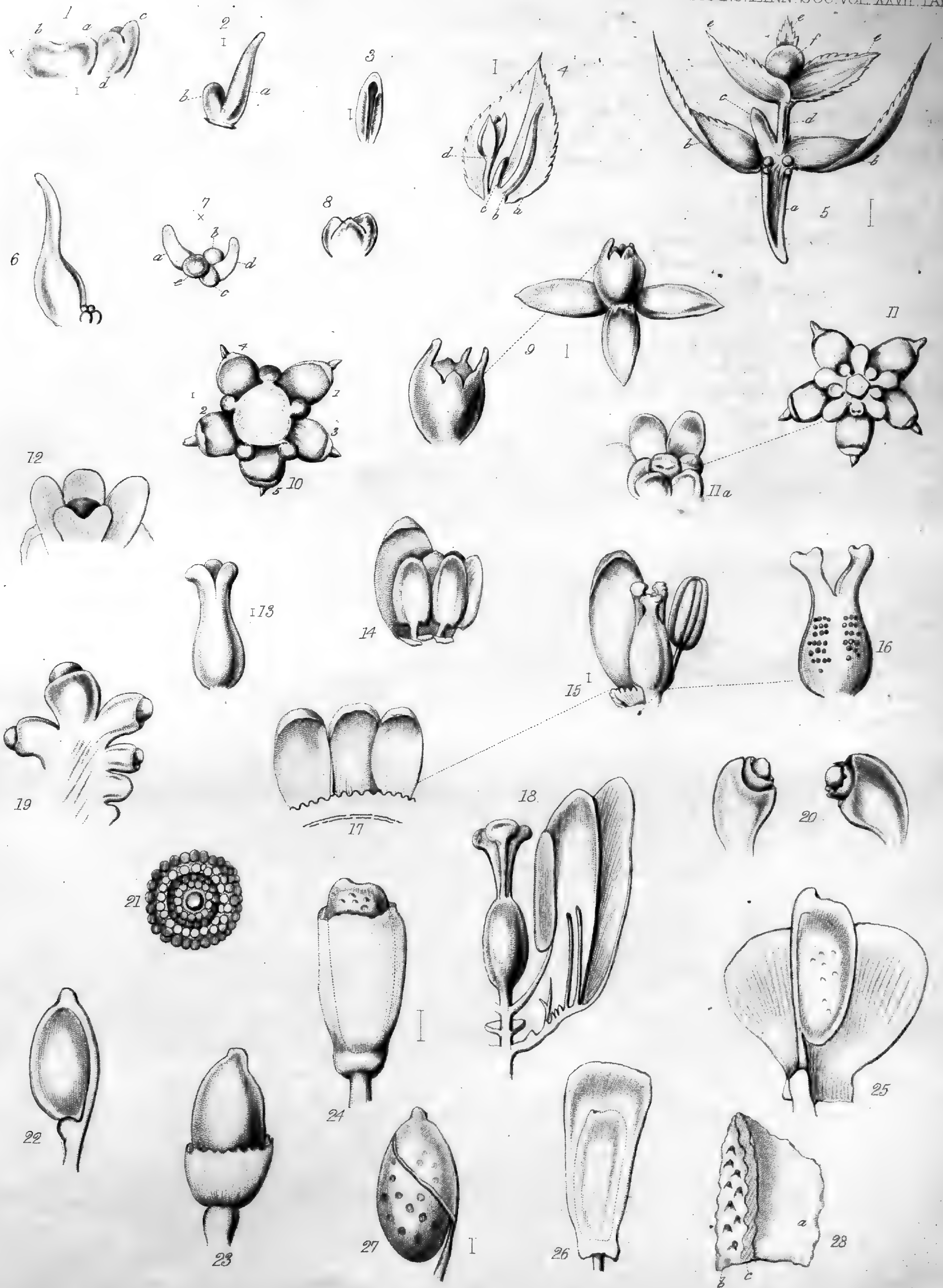
## PLATE LXV.

1. Female flower of *Modecca tamnifolia*. A portion of the tube of the flower is removed to show the position of the staminodes (much enlarged).
2. Section lengthwise through the middle of the flower: *a*, gynophore; *b*, inner staminode; *c*, outer staminode; *d*, petal; *e*, sepal; *f*, corona.
3. Diagram showing the arrangement of the parts; the letters refer to the same organs as in the preceding figure.
4. *Pass. cincinnata*. Section through the flower, and intended to show the manner in which the stamens curve over and deposit the pollen among and upon the inner threads of the corona: *a*, bract; *b*, sepal; *c*, petal; *d*, outer thick threads of the corona; *e*, stamen, beneath which are the inner fine threads of the corona; *f*, the honey-secreting portion of the flower-tube.
5. Top view of a portion of the flower of *Passiflora cincinnata*, showing the stamens bent down so as to come into contact with the inner threads of the corona. (Figures 1-5 drawn by Mr. Worthington Smith, F.L.S.)
6. Portion of the stem of *Passiflora quadrangularis*, magnified 200 diam. (see text).
7. *Pass. punctata*. Epidermis and gland of leaf (*ocellum*), raphides, &c. (see text).
8. *P. quadrangularis*. Section of petiole, showing the arrangement of the vascular bundles, × 25 (see text).
9. Section across midrib, × 25 (see text).
10. Section through thread-like tip of the filament, × 250.

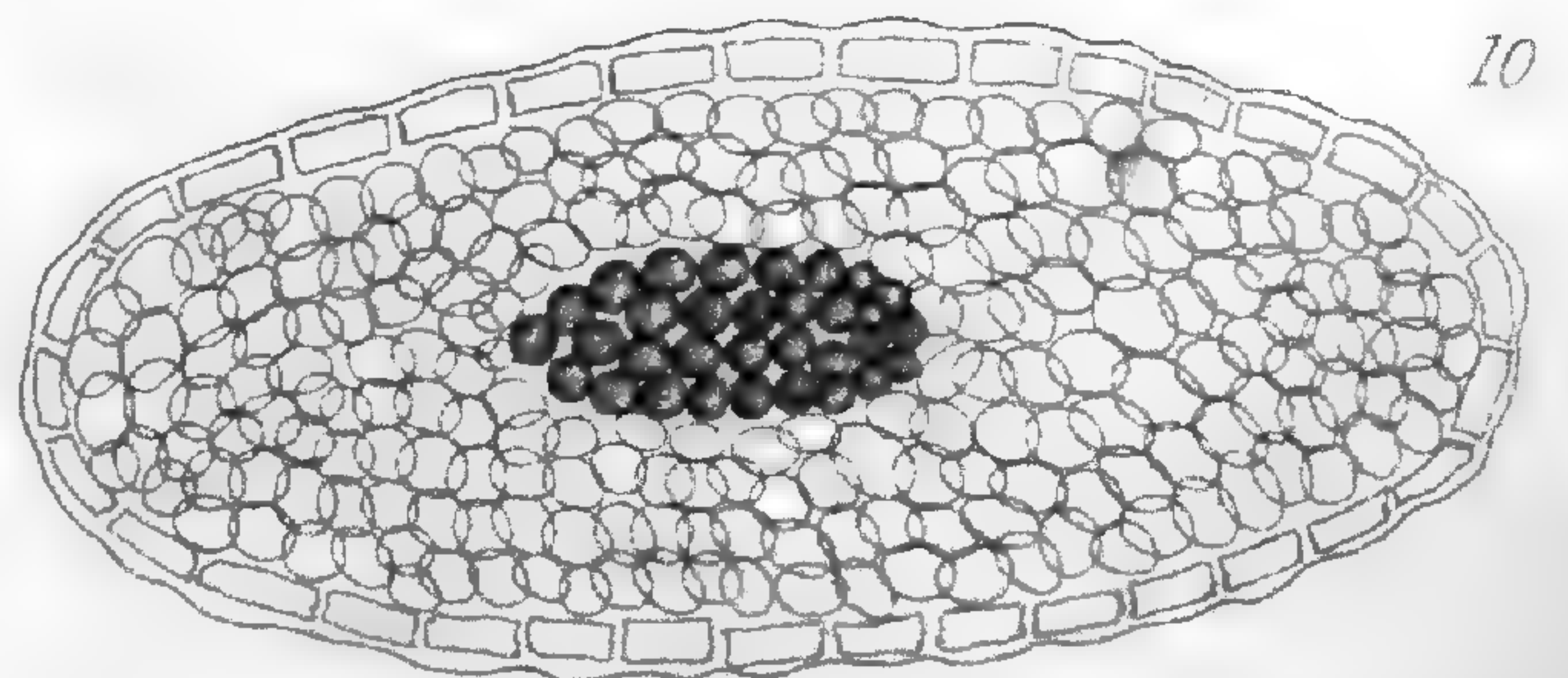
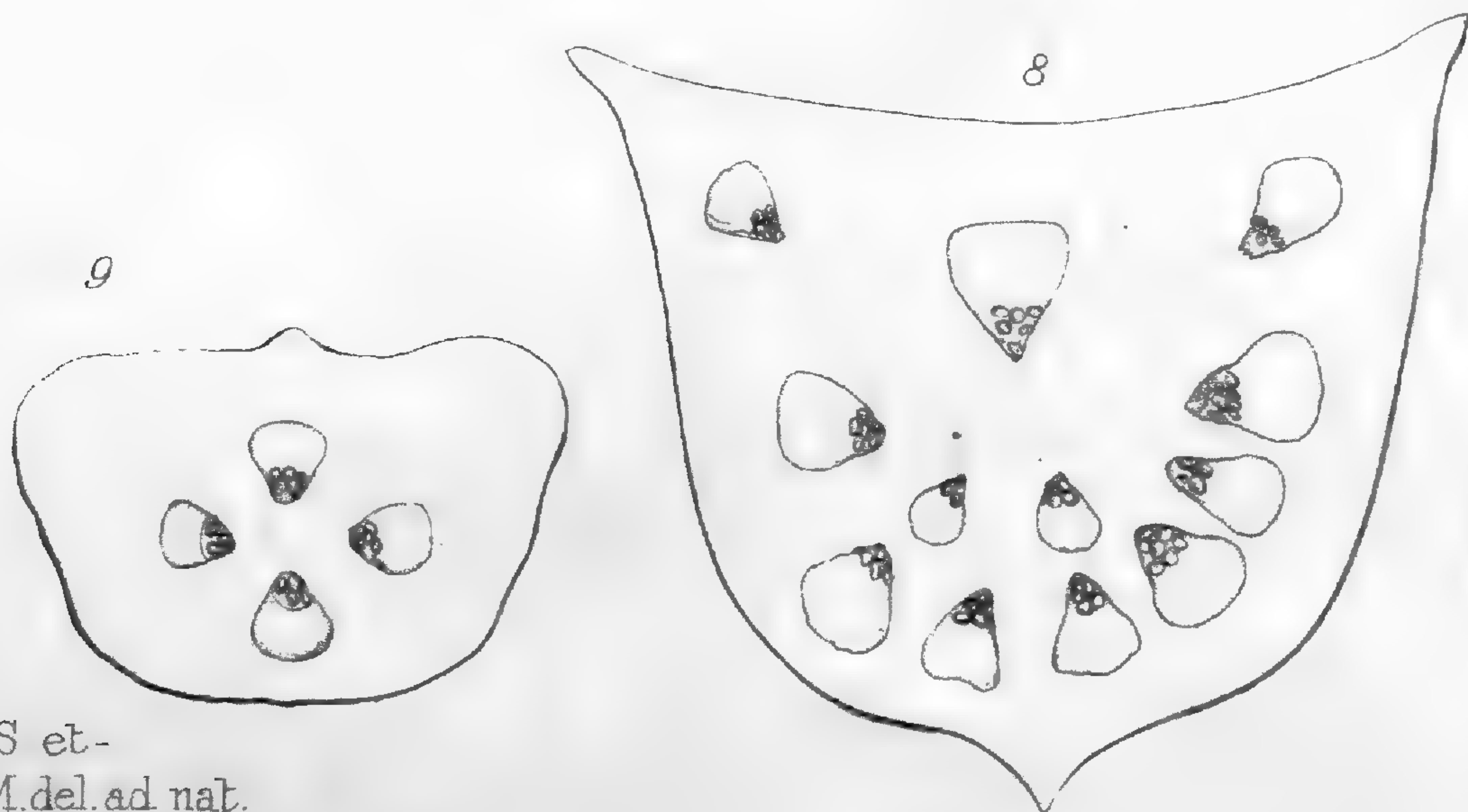
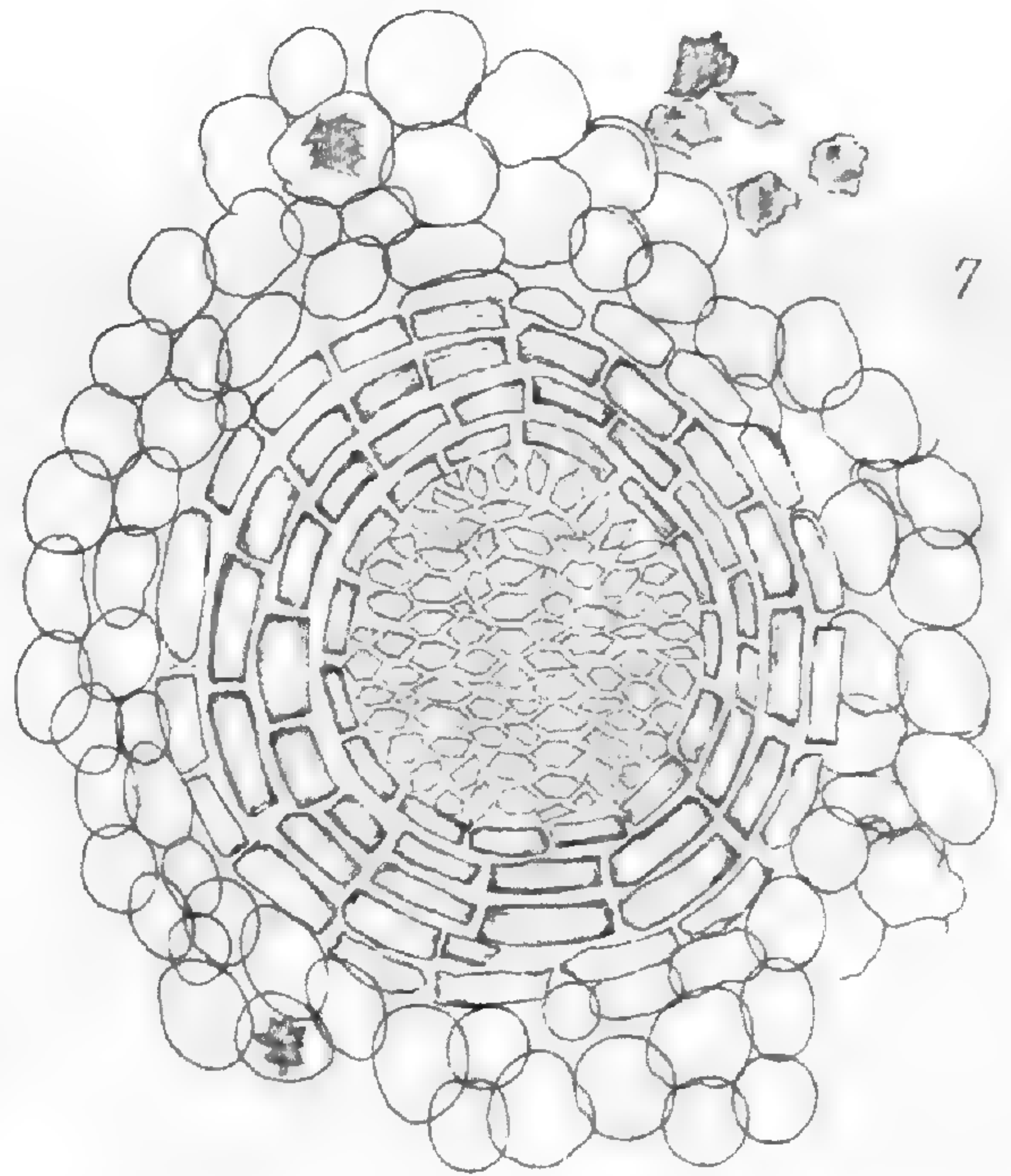
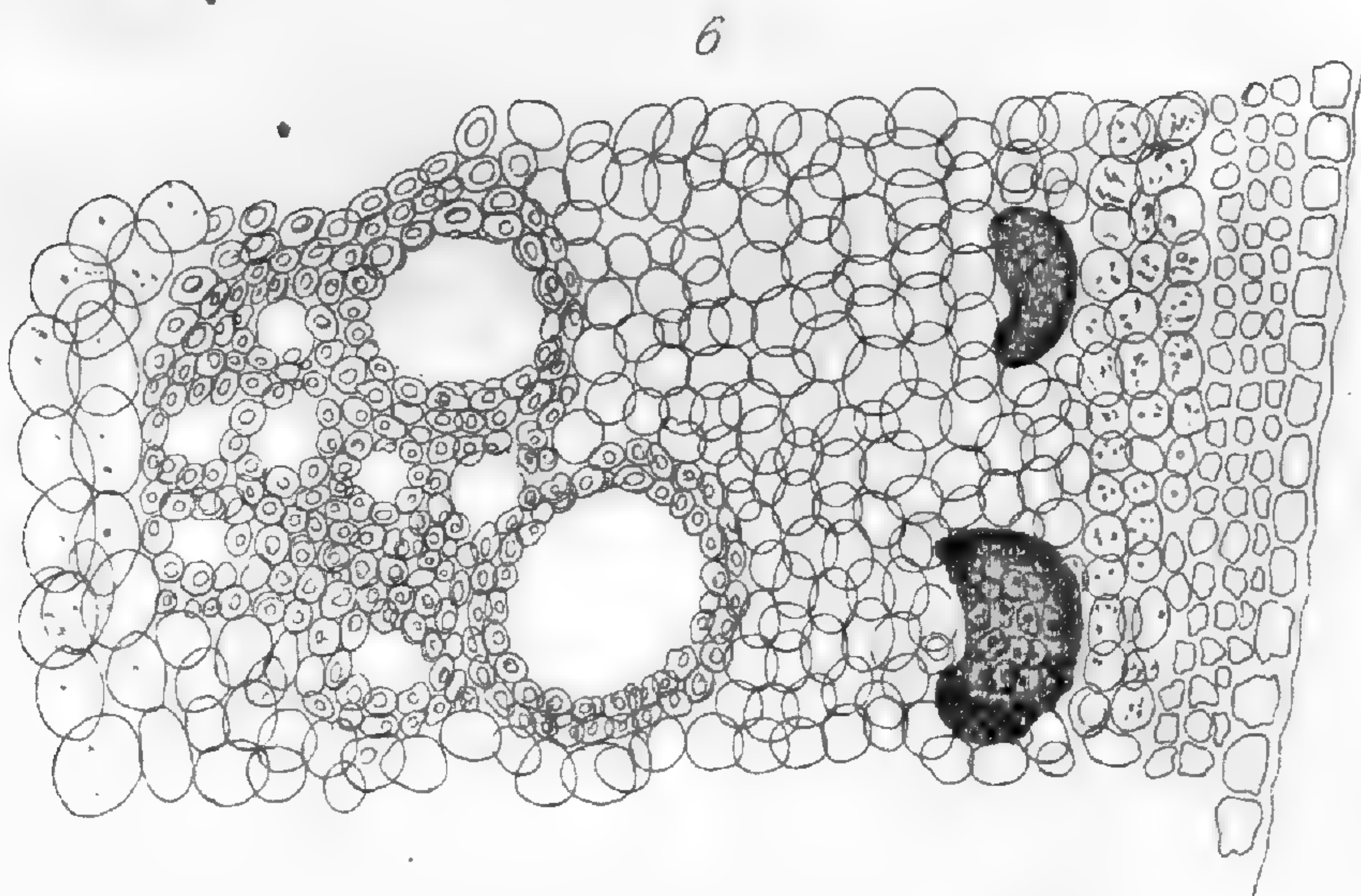
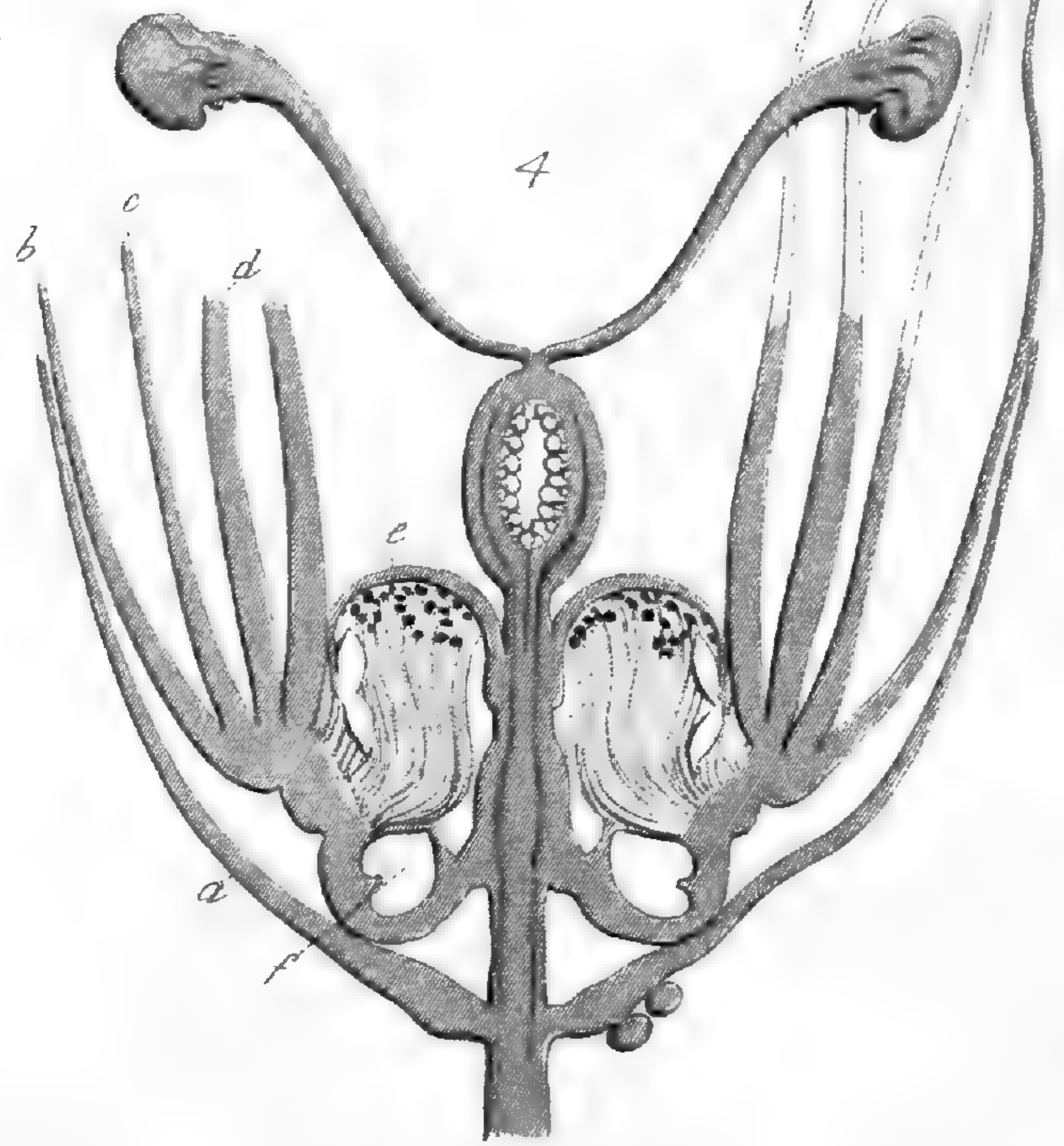
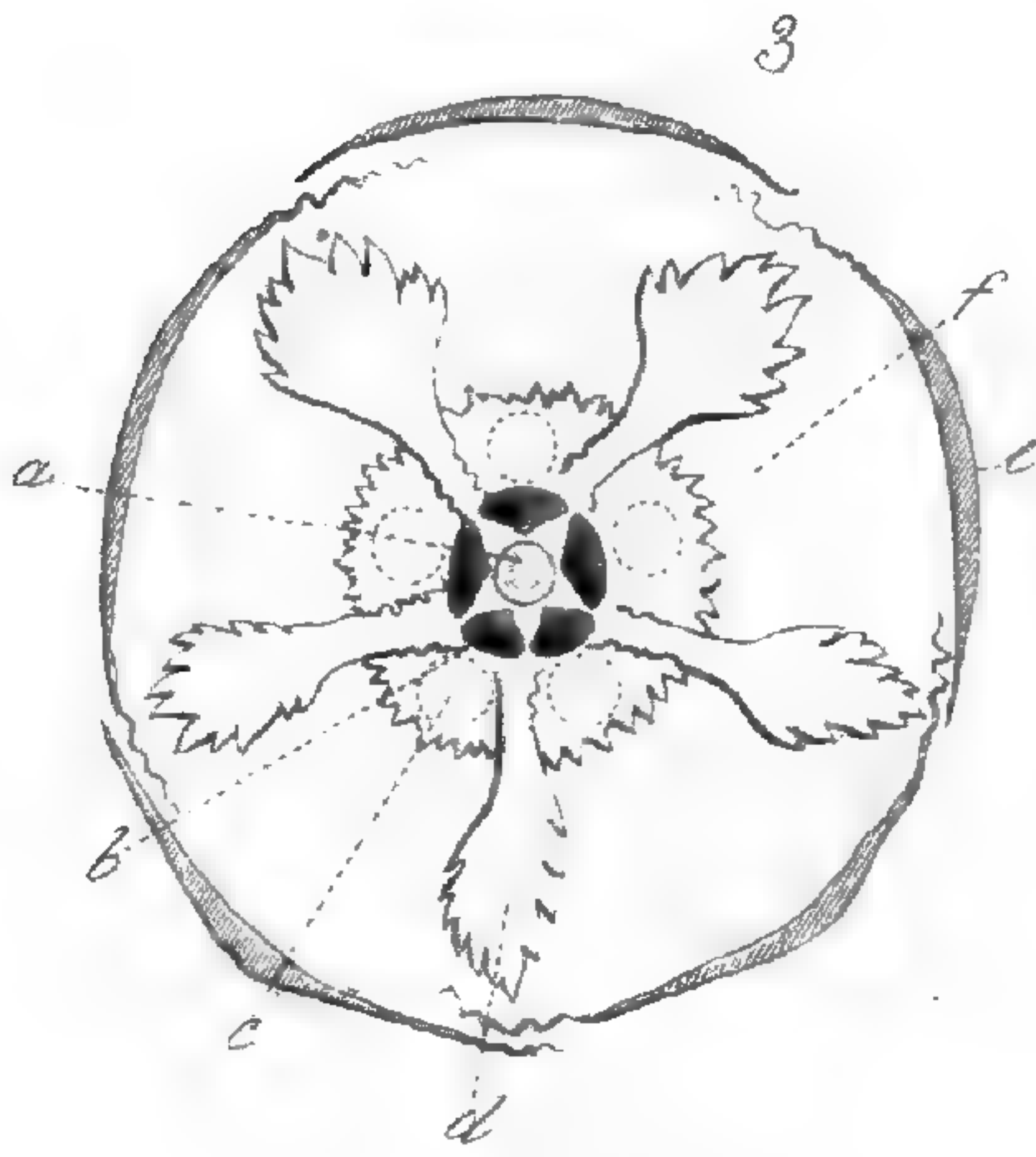
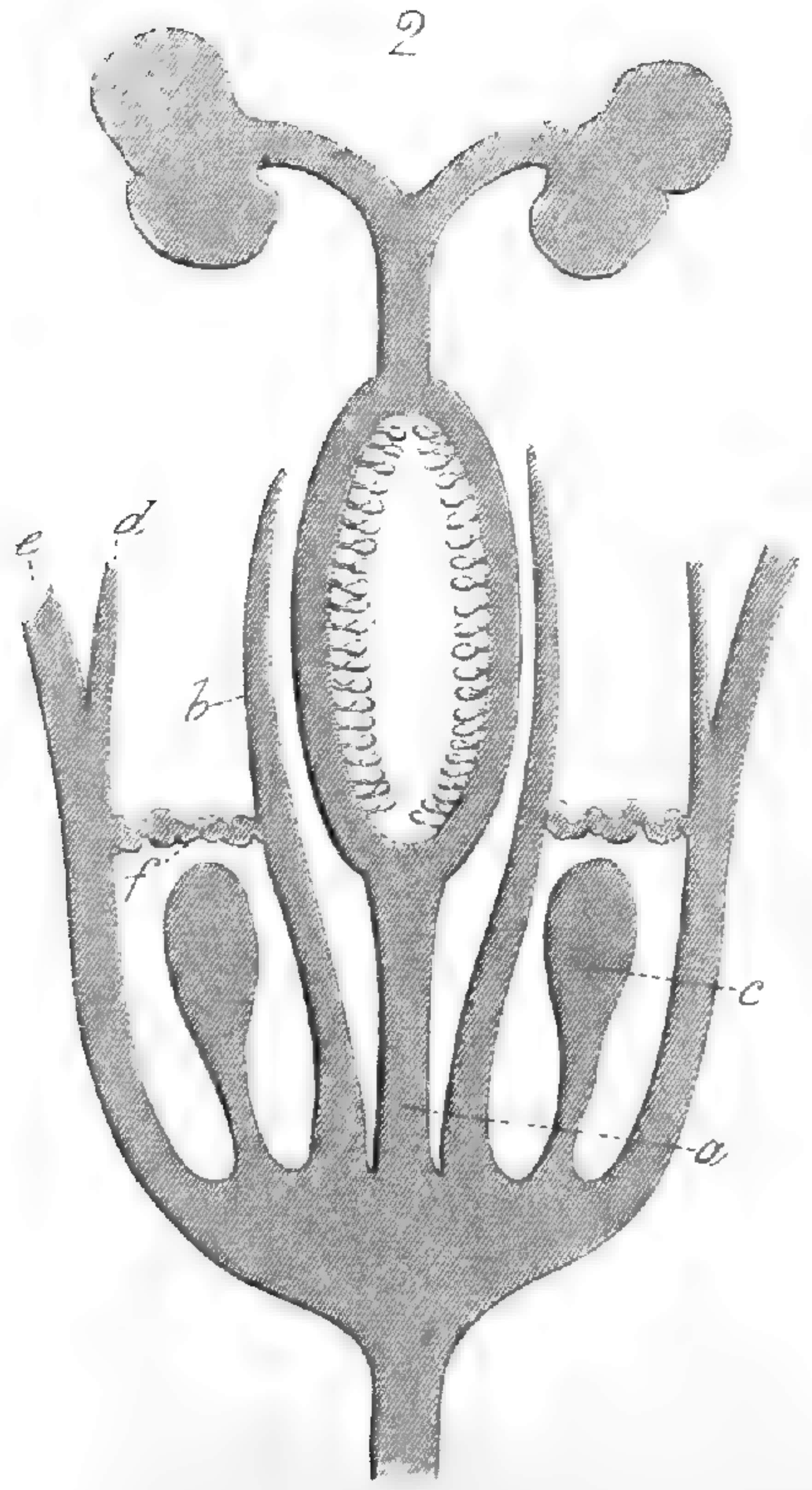
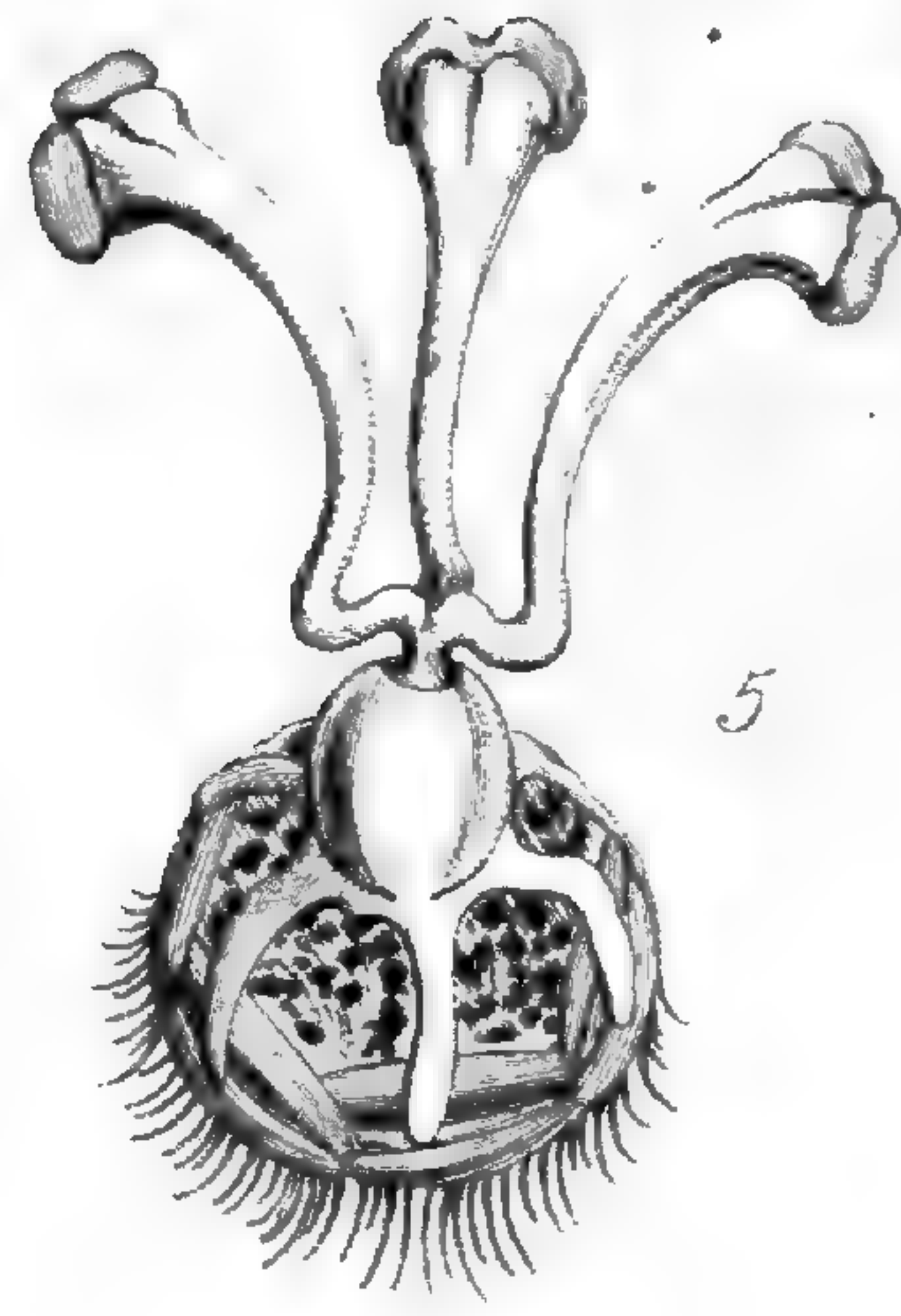
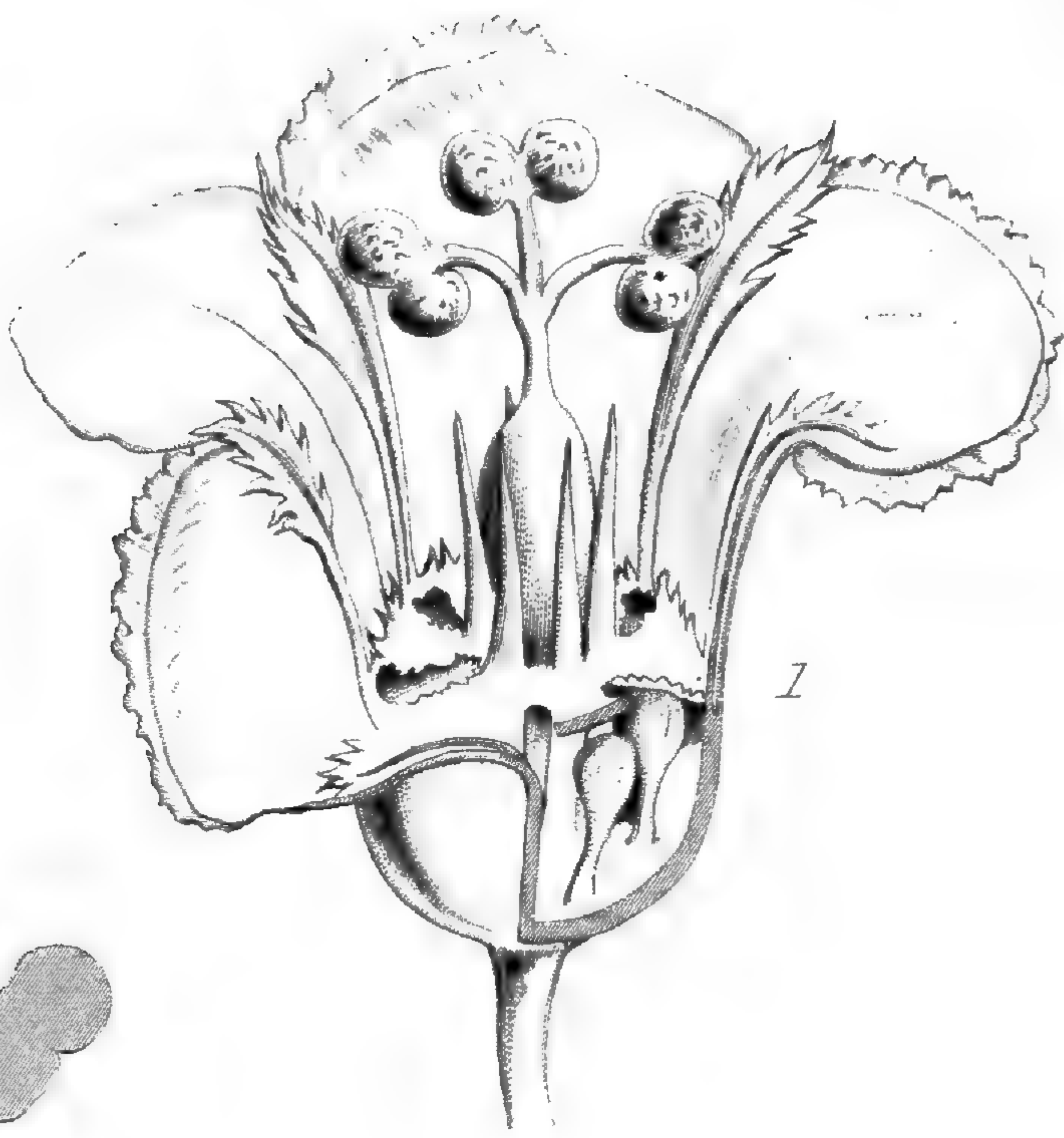














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