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The Society as a body is not to be considered responsible for any facts or opinions advanced in the several papers, which must rest entirely on the credit of their respective authors.

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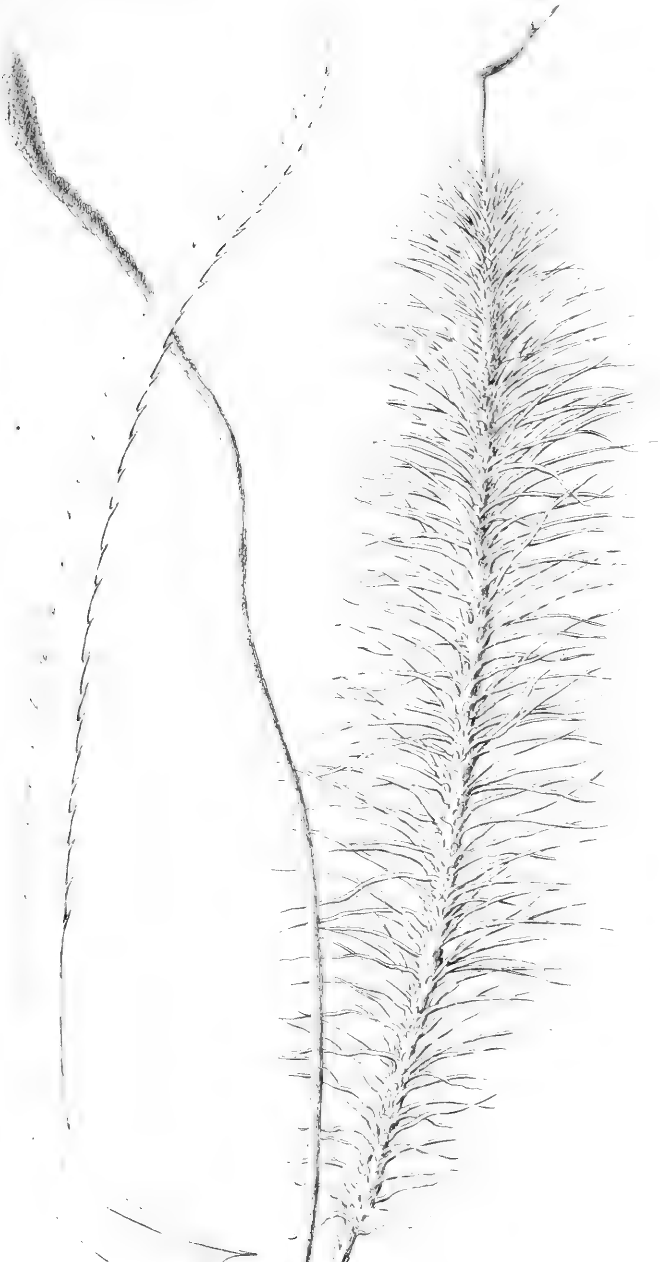

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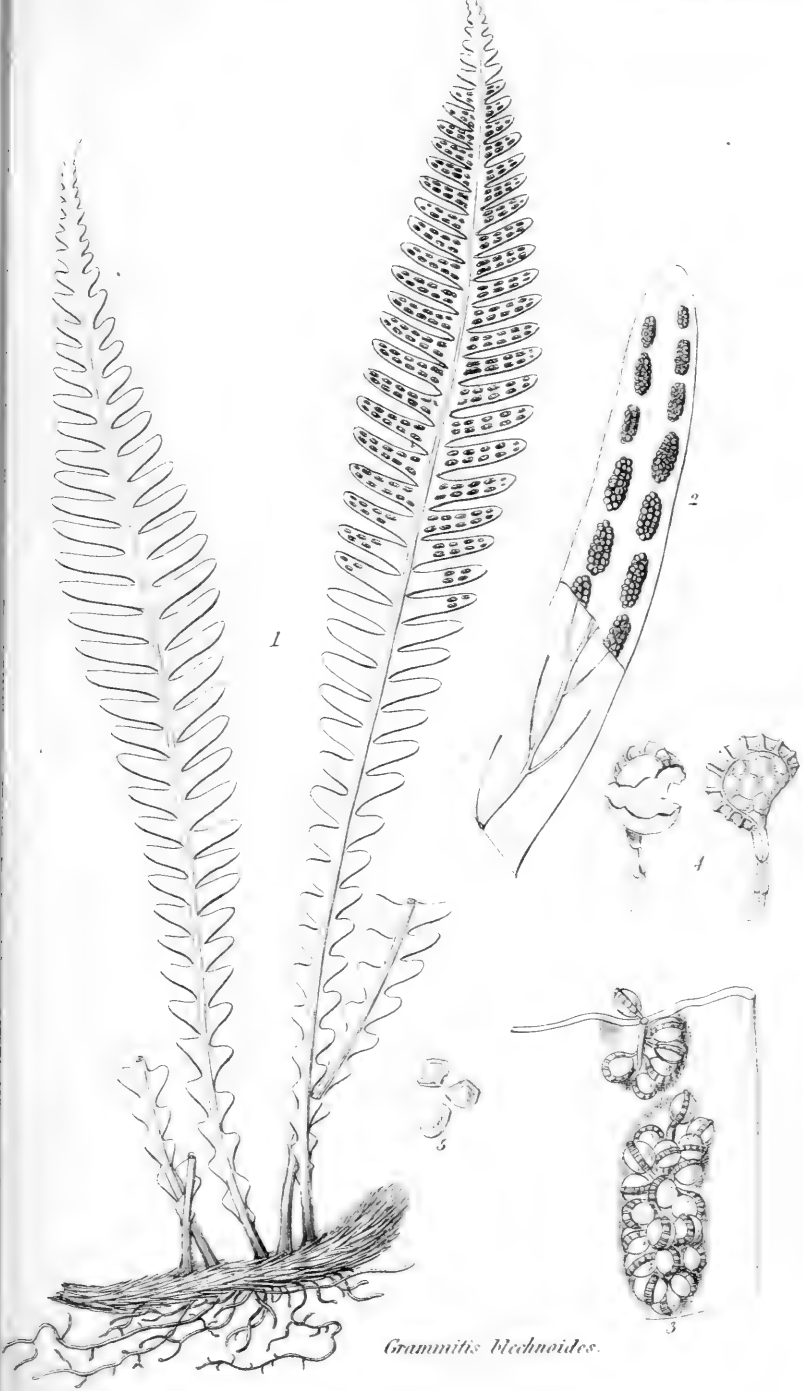

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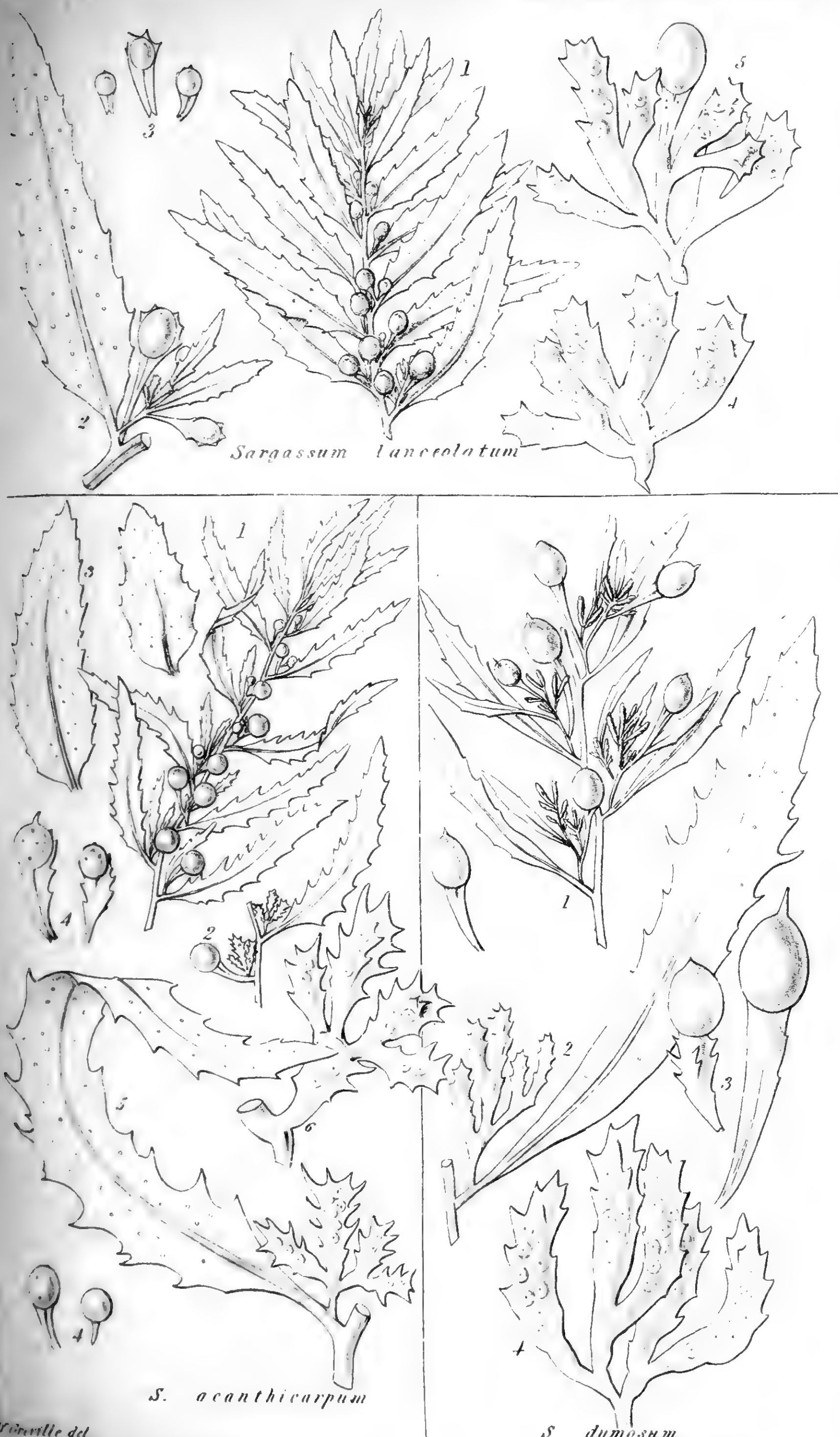

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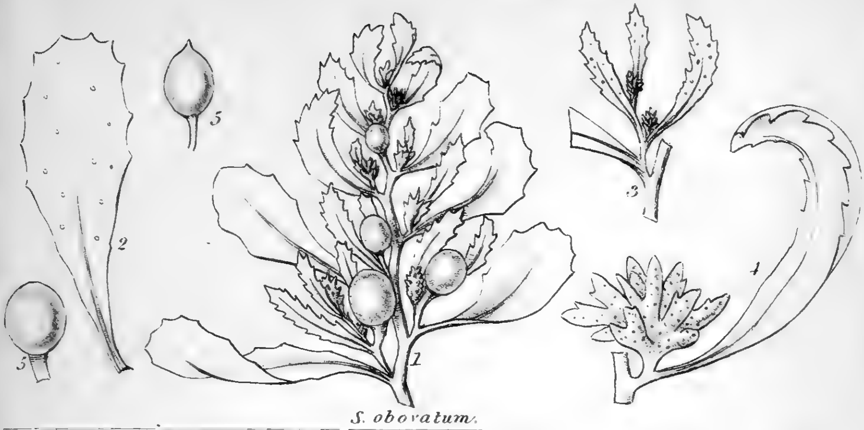

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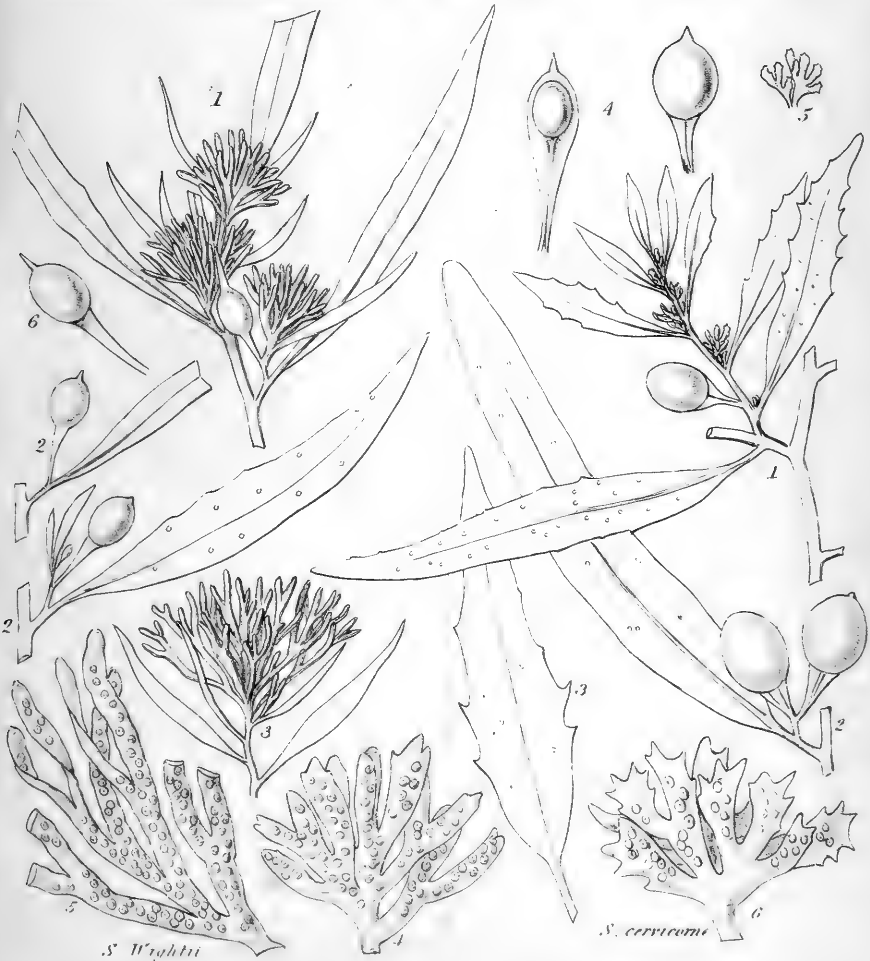

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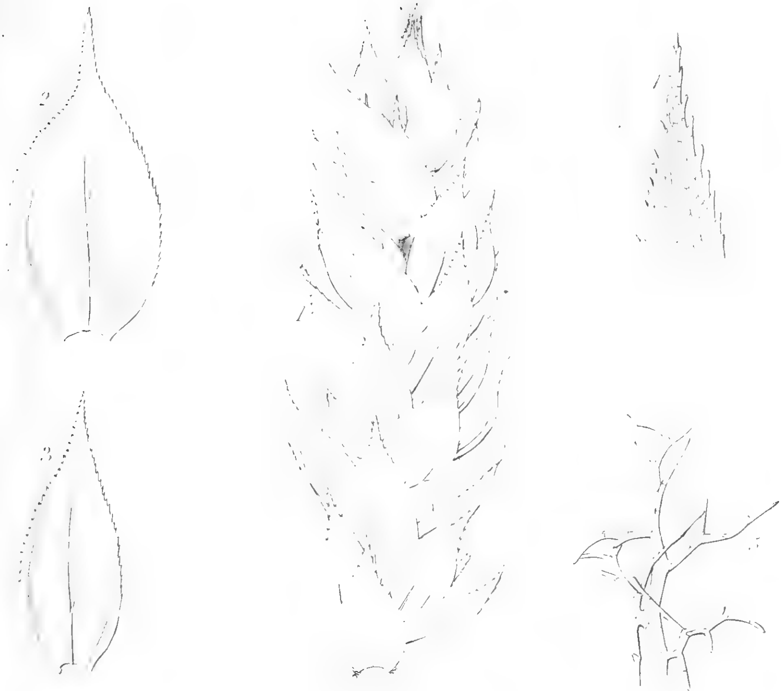

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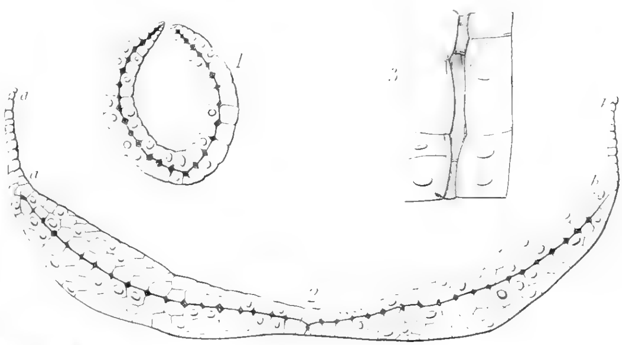

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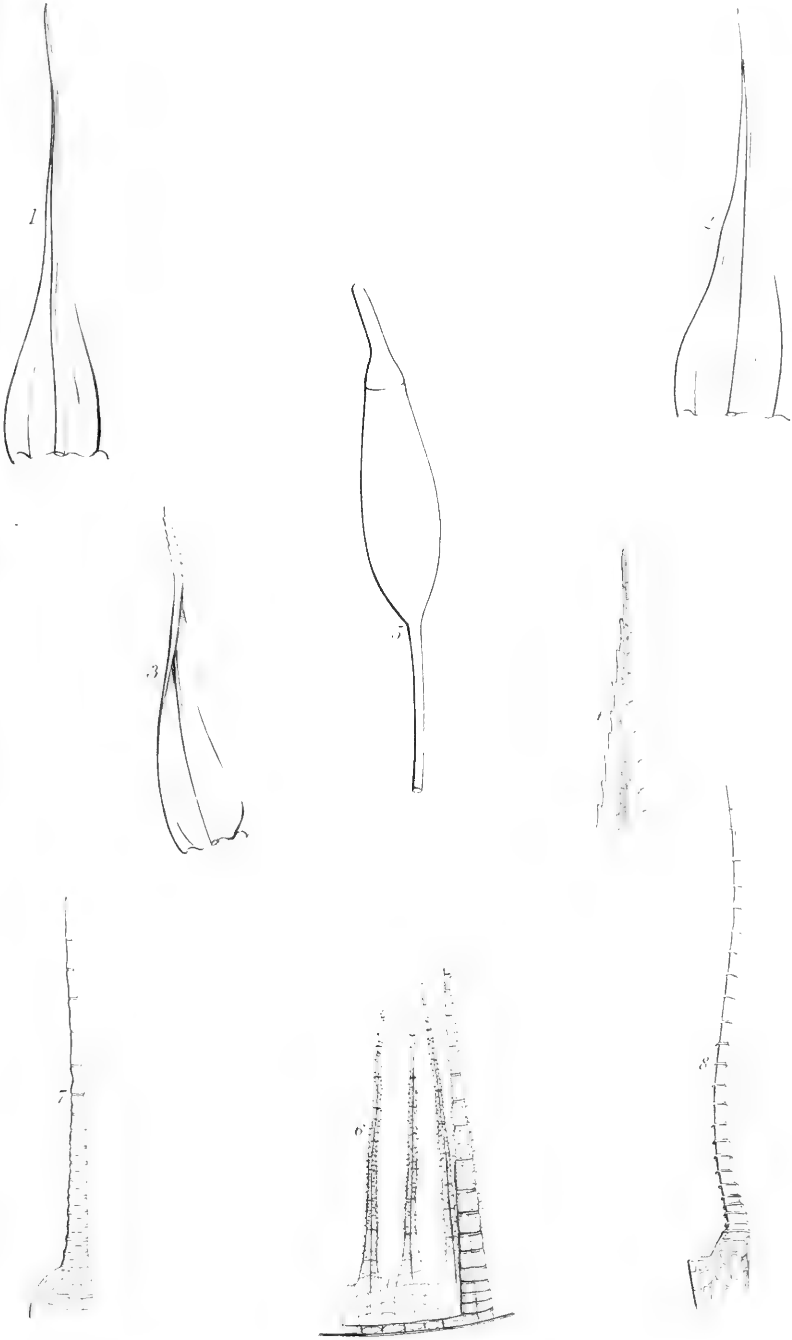

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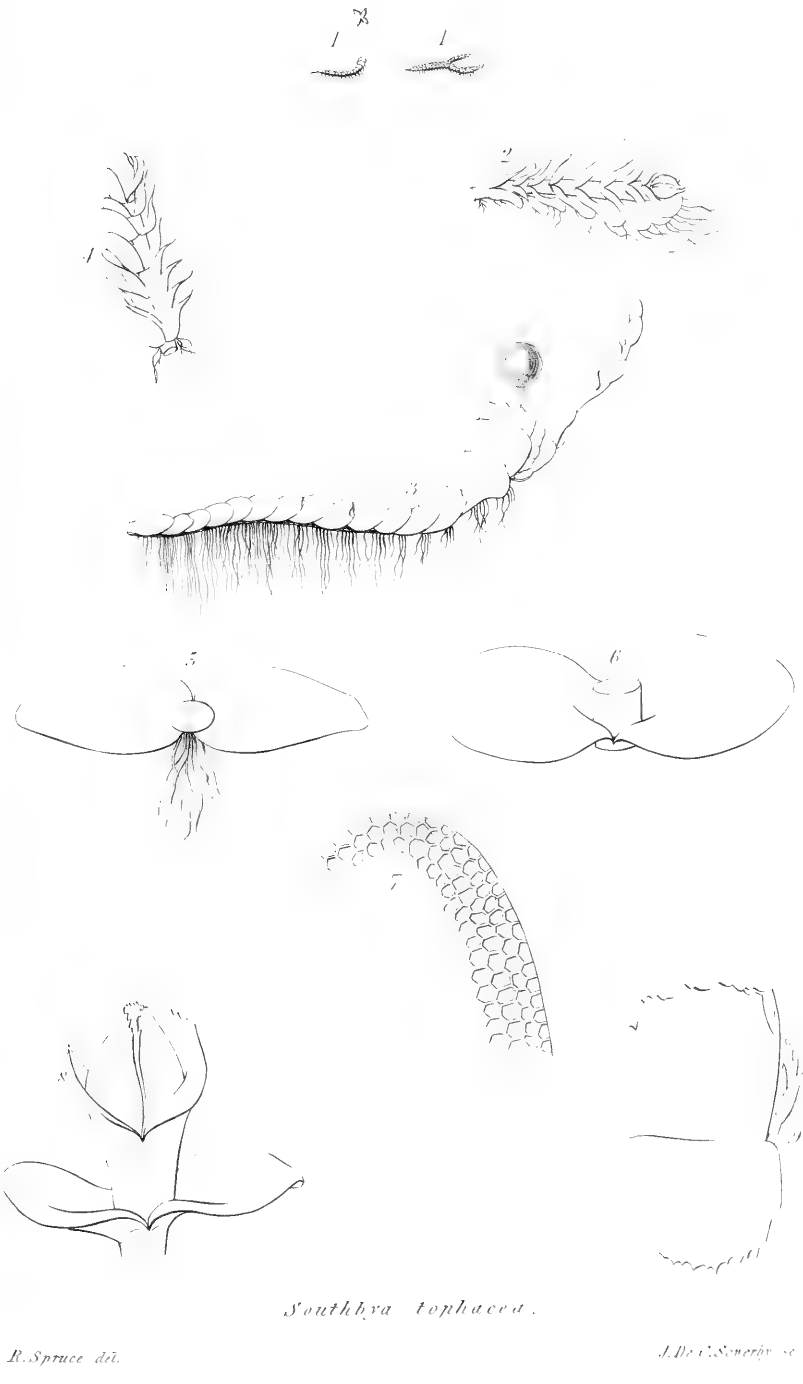

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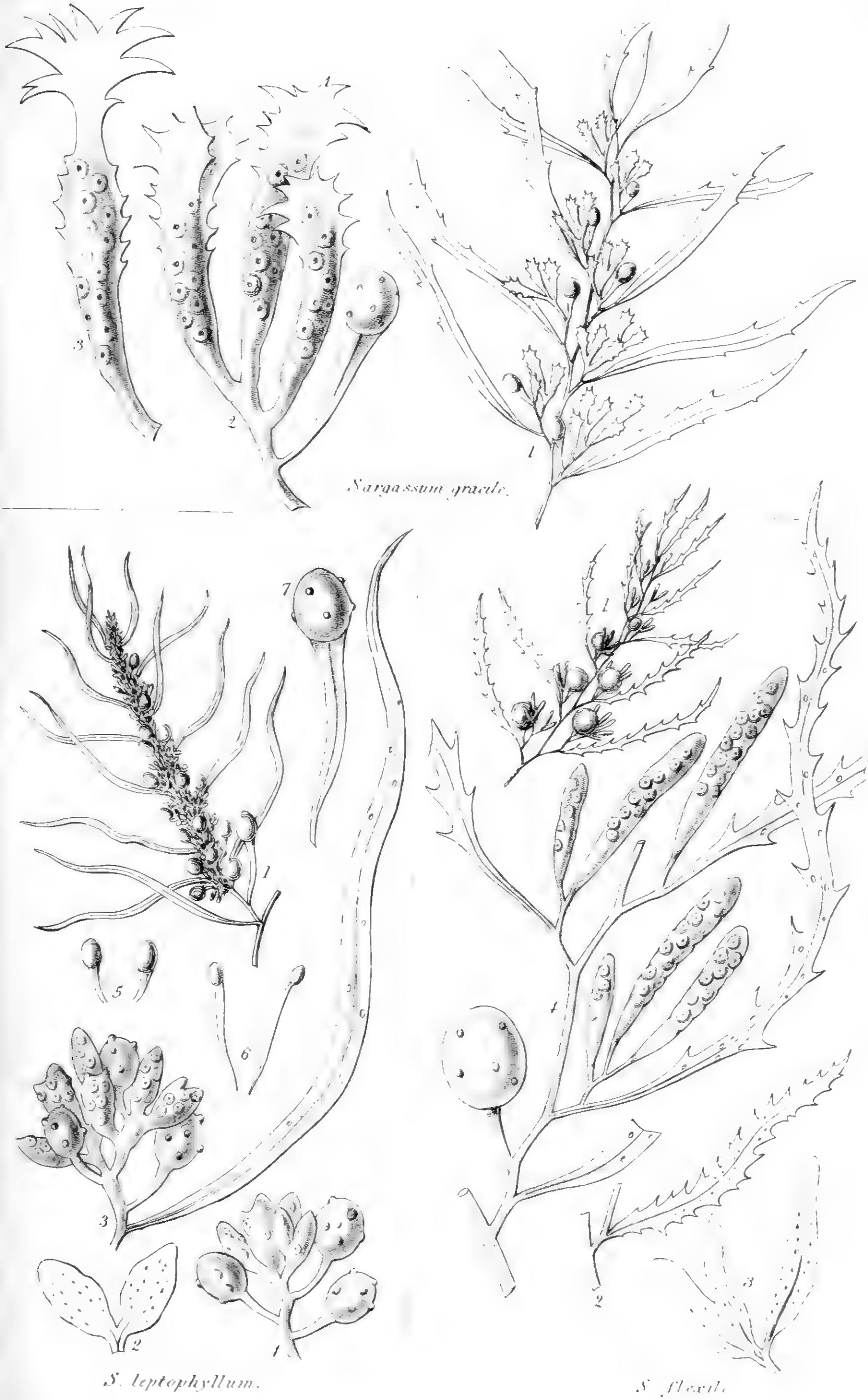

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TRANSACTIONS

OF THE

BOTANICAL SOCIETY.

I. *A Supplement to "A Synopsis of the British Rubi."* No. I.

By Charles C. Babington, M.A., F.L.S., F.G.S. &c.

Read 10th December 1846, and 14th January 1847.

The publication of my Synopsis of the British *Rubi* has already resulted in the discovery of several additional British forms of this difficult but beautiful genus. These I purpose publishing at intervals as time will allow me to determine them with accuracy.

9*. *R. Grabowskii* (Weihe ?); caule arcuato anguloso glabro, aculeis æqualibus valde declinatis deflexisve basi dilatatis, *foliis quinato-digitatis* planis *supra opacis* glabris *subtus cinereo-tomentosis* acute dentatis, *foliolo terminali cordato abrupte cuspidato infimis pedicellatis intermediis incumbentibus,* paniculæ compositæ inferne foliosæ ramis ascendentibus: rachi pilosa summa pedunculisque tomentosis, *fructibus pubescentibus.*

R. Grabowskii, *Weihe in Wimm. et Grab. Fl. Siles.* ii. 32 ?

R. nitidus ? var. rotundifolius, *Bloxam MSS. in Fasc. of Rubi.*

Stem arching, angular, furrowed when young, glabrous (young shoots slightly hairy), ultimately purple; prickles moderately numerous, rather short, yellow, from a broad red base, strongly declining or deflexed, nearly equal, confined to the angles of the stem. Leaves quinate-pedate; stipules almost linear; petioles and midribs with numerous strong much-hooked prickles; leaflets finely toothed: teeth pyramidal, glabrous opake and dark green above, ashy white and finely woolly with the veins rather yellow beneath; terminal leaflet broader than long, cordate below, abruptly cuspidate, sides regularly rounded; lateral similar but proportionably rather longer and almost exactly round; basal elliptical-ovate, rather unequal, overlapping the lateral leaflets, which themselves overlap the terminal leaflet.—Flowering shoot long, nearly glabrous; prickles numerous, rather slender, declining. Leaves nearly all ternate, ashy green beneath; petioles and midribs beneath with many short hooked purplish yellow prickles; leaflets like those of the barren stem, but the lateral ones lobed on the lower side; stipules very slender. Panicle narrow, compound, not setose, very prickly throughout: prickles slender declining or deflexed; rachis pilose below, becoming more hairy upwards, its summit and the peduncles and pedicels tomentose; about three lower branches axillary, short, racemose-corymbose, about six-flowered; ultra-axillary part compact, cylindrical, abrupt, branches short and corymbose; terminal flower subsessile; lower bracts leaf-like but inconspicuous, upper trifid hairy and tomentose. Sepals woolly, loosely reflexed from the oblong black pubescent fruit.

Near Cadeby, Leicestershire, *Rev. A. Bloxam.* August?

Obs. 1. This plant agrees so nearly with the elaborate description in the 'Flora Silesiæ' that that work might perhaps be referred to without doubt. In the Silesian plant the panicle is described as "ampla, pyramidata, apice acuta, usque fere ad apicem foliosa," but it is not so in our plant. In that the under side of the veins of the leaves is said to altogether want any longer hairs—in our plant those veins are clothed with longer hairs.

Obs. 2. This is an interesting connecting link. The clothing of the panicle and of the young lateral branches from the barren shoot is that of *R. nitidus.* It differs from that species by its hooked prickles; very abrupt leaflets opake above and whitish beneath, the lower and intermediate ones overlapping; and its woolly fruit. Its leaves much resemble those of that form of *R. discolor* named *R. abruptus* by Lindley, but that has silky barren and flowering shoots and rachis, and a very different panicle. Perhaps the most remarkable character of this plant is found in its woolly fruit, by which it is distinguished from all the allied species. The authors of the 'Flora Silesiæ' have not described the fruit of their plant. Arrhenius mentions a pubescent-fruited variety of *R. corylifolius,* but our present subject can scarcely be confounded with that species.

10. *R. discolor,* W. et N.

In place of the description of the varieties (Trans. ii. 256) it is proposed to substitute the following.

α. discolor; caule strigoso-sericeo, aculeis declinatis deflexisve, fo-

liolis marginem versus sæpissime decurvatis supra glabriusculis subtus albis tenuissime tomentosis, paniculæ racemosæ tomentosæ ramis decompositis.
R. discolor, *Rub. Germ.* 46. t. 20; *Arrhenius, Rub. Suec.* 32.
R. fruticosus, *Sm. Eng. Bot.* 715.

β. thyrsoideus (Bell Salt.!); caule subglabro, aculeis rectis, foliolis planis supra glabris subtus viridi-cano- vel candicanti-tomentosis, panicula elongata thyrsoidea tomentosa.
R. thyrsoideus (*Wimm.*), *Arrhen. Rub. Suec.* 28.
R. fruticosus, *Rub. Germ.* 24. t. 7.
R. discolor *var.* lividus, *Bloxam MSS. in Fasc. of Rubi.*

γ. macroacanthus (Bell Salt.!); caule sparsim patenteque piloso, aculeis validis pilosis rectiusculis paululumve deflexis, foliolis planis supra pilosis subtus pubescenti-canis mollibus, paniculæ pubescentis ramis racemosis paucifloris.
R. macroacanthos, *Rub. Germ.* 44. t. 18.

δ. argenteus (Bell Salt.); caule patente-piloso, aculeis rectis, foliolis planis subtus argenteo-cano-pubescentibus, paniculæ pubescentis ramis racemoso-compositis paucifloris.
R. argenteus, *Rub. Germ.* 45. t. 19.

Obs. 1. Since the publication of my former account of this species I have seen reason to modify my views concerning its varieties. I now think that Dr. Bell Salter is correct in referring tab. 7 of the 'Rub. Germ.' to the *R. thyrsoideus* of Arrhenius; his and my *var. β.* of this species. The former difference between us originated from none of my specimens of *R. thyrsoideus* having well-developed panicles. A plant given as *R. discolor* var. *lividus* in Bloxam's 'Fasciculus of Rubi' is what I consider as the true *R. thyrsoideus.*

Obs. 2. The former "Obs. 2" (Trans. ii. 237) is not correct. I believe that the lower (axillary) branches of the panicle ascend in all the varieties, and the upper (ultra-axillary) branches usually spread at a considerable angle to the rachis. I am not well-acquainted with *var.* δ, having only one rather doubtful specimen; the character of it is therefore a compilation from books.

12*. *R. Balfourianus*; caule arcuato teretiusculo patenti-piloso, aculeis paulo inæqualibus tenuibus rectis vix declinatis, foliis quinatis subtus mollibus pallide viridibus, foliolo terminali cordato ovatove acuto, *infimis subsessilibus intermediis incumbentibus*, paniculæ corymboso-diffusæ tomentosæ setosæ bracteis foliaceis trifidis, *sepalis* ovato-lanceolatis tomentosis setosis *erecto-patentibus* apice foliaceis vel filiformi-attenuatis.
R. Balfourianus, *Bloxam MSS. in Fasc. of Rubi.*

Stem roundish, striated; pubescence of scattered patent hairs; prickles moderate, scattered, nearly equal, straight, very slightly declining, reddish yellow. Leaves large, quinate, dull green and pilose above, pale green soft and downy with the veins yellow beneath, crenate-serrate-apiculate; terminal leaflet cordate or ovate, acute, on a long stalk; lateral leaflets ovate, acute, shortly stalked; basal subsessile, ovate, overlapping the intermediate pair; general and partial petioles pilose, with few distant rather stout depressed yellow prickles; midribs similarly armed; stipules lanceolate, leaf-like, attenuated at both ends.—Flowering shoot with scattered hairs. Leaves ternate or quinate; leaflets ovate, pilose above, downy beneath. Panicle corymbose or diffuse, tomentose, pilose, setose; lower branches axillary, upper ones subtended by trifid leaf-like bracts. Flowers mostly on long stalks; terminal one shortly stalked or subsessile; sepals ovate-lanceolate, very broad, attenuated into a long leaf-like or setaceous point, often slightly trifid at the end like the uppermost bracts, downy on both sides, setose, brownish green, erect-patent when the hemispherical fruit is ripe.

Near Rugby, Warwickshire, *Rev. A. Bloxam*. August?

Obs. It is difficult to determine the position of this plant. Its stem, pubescence, and prickles place it near to *R. sylvaticus*, whilst its usually much more lax and diffuse panicle, and especially the erect or embracing calyx of the fruit seem to separate it widely from that species; in the latter point and in some others of less moment, it is nearly allied to *R. Borreri*, from which its barren stem abundantly distinguishes it. The lower leaflets also overlapping those of the intermediate pair distinguishes it from both of those species.

Named by Mr. Bloxam in honour of Professor John Hutton Balfour, M.D., of Edinburgh, and in paying this just compliment to my valued friend I fully concur with him.

19. *R. rudis*, Weihe.

ε. *denticulatus*; foliolo terminali quadrangulari-obovato cuspidato basi cordato late inepteque dentato: dentibus denticulatis.

Stem angular, striated; hairs very few; setæ and aciculi not many, short. Terminal leaflet with a somewhat square outline widening slightly upwards and then narrowing rapidly to a cuspidate termination, cordate below. Leaflets all stalked; margin with broad but very shallow and scarcely distinguishable teeth, fringed with small acute prominent denticulations; dark green and pilose above, pale yellowish green beneath. Panicle exactly like that of the typical *R. rudis*.

Loxley near Sheffield, *Rev. W. W. Newbould*.

Obs. This is a very curious variety, in which the coarse serratures of *R. rudis* are reduced in length but not in width, and are thus converted into very broad and very shallow teeth; the whole margin is also fringed with minute points or denticulations. It is very near in general character to *R. rudis β. Leightonii,* but differs in the above respects.

22. *R. fusco-ater,* Weihe.

δ. *subglaber*; caulis petiolorumque aculeis subæqualibus setisque paucis, aciculis brevibus pilisque paucissimis, foliis apiculato-dentatis supra glabris subtus tomentosis, foliolo terminali cordato cuspidato, paniculæ diffusæ tomentosæ pilis subnullis setis aciculisque brevibus aculeis elongatis.

Distinguished from all the other forms of *R. fusco-ater* by its almost total want of hairs on the panicle, and the nearly glabrous and more uniformly prickly stems. Its panicle is much divided and spreads in an irregular manner. It is the plant mentioned in the Synopsis as received from Mr. Coleman. Mr. Adamson's plant noticed in the same place is more nearly allied to the typical *R. fusco-ater.*

Mangrove Lane near Hertford, *Rev. W. H. Coleman.* On the canal bank between Claverton and the Dundas aqueduct near Bath.

25. *R. glandulosus,* Bell.

δ. *dentatus*; caule subanguloso piloso setoso, aculeis parvis paucis, *foliolo* terminali ovato cuspidato basi cordato inæqualiter mucronato-*dentato,* paniculæ hirtæ aculeis paucis tenuibus rectis declinatis setis brevibus multis apice et ramis paucis brevibus distantibus divaricatis paucifloris corymbosis.

Whole plant of an ashy green colour. Barren stem rather angular with small not very numerous yellow prickles; hairs and setæ abundant, nearly equal, short. Leaves very like those of *R. Bellardi* but different in colour, thinner, much less hairy (with scattered hairs on both sides), the terminal leaflet cordate at the base*; petioles armed like the stem, except that the prickles are deflexed (this is also the case in the *R. Bellardi* from Terrington Car—in the 'Rubi Germ.' they are represented straight). On the flowering shoot the hairs are more numerous relatively to the setæ than on the barren stem; both are very short; prickles few, scattered, short, very slender. Leaves all ternate, the uppermost 1—3 excepted, which are usually simple. Branches few-flowered, subcorymbose; panicle corymbose at the end; sepals lanceolate with an attenuated point, setose, acicular, reflexed from the fruit.

Abundant near Twycross, Leicestershire, *Rev. A. Bloxam,* from whom my specimens were received.

* The leaves are almost invariably ternate, but rarely a quinate leaf occurs.

Obs. Very closely resembling the typical *R. glandulosus* (*R. Bellardi*), but differing remarkably in its colour, the dentition of its thin leaves and its fewer prickles and aciculi, and more numerous hairs on the barren stem. N.B. A specimen of this bramble will be found in Bloxam's 'Fasciculus of Rubi.'

25*. *R. Güntheri* (Weihe); caule subanguloso sparsim piloso et setoso, *aculeis* inæqualibus nonnullis *validis sed brevibus* rectis declinatis multis, *foliis ternatis* vel quinatis inæqualiter *dentato-serratis* concoloribus supra glabris subtus ad venas pilosis pallide viridibus, foliolo terminali late obovato cuspidato, *paniculæ thyrsoideæ* hirtæ inferne foliosæ aculeis paucis tenuibus rectis declinatis setis brevibus *apice et ramis* brevibus ascendentibus *multifloris paniculatis*.
R. Güntheri, *Weihe, Rubi Germ.* 63. t. 21.

Prickles rather numerous on the barren stem, remarkably declining, but straight, short, their base thick; hairs few; aciculi more numerous; setæ rather plentiful, short and nearly equal (in an old shoot now before me the hairs, aciculi and setæ have nearly all fallen off). Leaves ternate or (in very rare instances from the subdivision of the unequal lateral leaflets) quinate, green on both sides, nearly or quite glabrous above, rather paler, and with yellowish downy and hairy veins beneath; terminal leaflet broadly obovate, cuspidate, slightly cordate or emarginate below; lateral leaflets placed nearly at right angles with the intermediate leaflet as in *R. glandulosus* and *Bellardi*, unequally ovate or lobed on the lower margin, cuspidate; all irregularly but rather strongly dentate-serrate; general and partial petioles and midribs beneath armed similarly but less strongly than the stem, and their prickles are often deflexed; stipules linear, hairy, setose. Flowering shoot long, very hairy, with rather numerous, short (and a few longer) slender declining prickles; aciculi and setæ short, not longer than the hairs, not very numerous, except in the upper part of the shoot and amongst the flowers. Leaves ternate; leaflets nearly equal, rather obovate or lanceolate, green and hairy on both sides with paler veins beneath; general and partial petioles armed like the shoot but with more numerous prickles; the two or three uppermost leaves simple, ovate or cordate-ovate, often lobed on one or both sides. Panicle long, narrow, with three or four axillary short panicled branches, and a long slightly compound panicled ultra-axillary summit with very short branches, each bearing four or five long-stalked flowers. Sepals downy, setose, ashy, with a long point, reflexed from the fruit.

Hartshill Wood, Warwickshire, in abundance, *Rev. A. Bloxam*, to whom I am indebted for most beautiful specimens.

Obs. 1. This plant very much resembles *R. glandulosus*, of which I was once inclined to consider it as a variety; but its panicle is so different from that of all the forms of that species as to claim specific distinction. Its leaves (on the barren stem) are often exactly like those of typical *R. glandulosus* (*R. Bellardi*) in look and form, but differ greatly in their dentition. In one of the specimens now before me the panicle is almost exactly like that represented in the 'Rubi Germ.' as characteristic of *R. thyrsiflorus,* except that its upper ultra-axillary portion is narrower from its shorter branches; other specimens have the ultra-axillary part shortened and the axillary branches lengthened, thus approaching some forms of *R. glandulosus.*

Obs. 2. *R. Güntheri* is referred by Arrhenius to *R. glandulosus,* to which it is doubtless very nearly allied. Its armature seems to differ and so does its panicle. Probably *R. thyrsiflorus* (Weihe) is only a form of this species; and together, they will take a place close adjoining to, but not absorbed in, *R. glandulosus.*

N.B. This plant is named, on my recommendation, *R. glandulosus* var. *subracemosus* in the 'Fasciculus of Rubi,' issued lately by the Rev. A. Bloxam.

II. *Notice of a new species of* Dawsonia. By Robert Kaye Greville, LL.D., F.R.S.E., F.L.S. &c.

Read 11th March 1847.

No one can take the most cursory glance at the subject of the present notice without being satisfied that it is distinct from the only other described species, *Dawsonia polytrichioides* of Hooker; and yet it is extremely difficult to draw up such a character as shall distinguish it on paper, if we except the much larger size. The latter feature however is so decided, that practically there can be no hesitation in pronouncing between the two species.

The single specimen which I possess of the new species, which I propose to name *Dawsonia superba*, was sent to me from Australia a few years ago by my friend Augustus Erskine, Esq., Deputy-Assistant Commissary-General in that country.

In the same parcel were some New Zealand plants, but from those with which the *Dawsonia* was associated in the collection, I have little doubt that it, as well as the previously known species, is an Australian plant. My specimen is fully fourteen inches high, whereas the tallest of those of *D. polytrichioides*, as described both by Dr. Robert Brown and Sir W. J. Hooker, do not exceed four inches, including the seta. The *leaves* are an inch in length (nearly three times longer than in *D. polytrichioides*), linear-subulate, less rigid than in the last-named species, and spreading in a more lax manner, spinuloso-dentate, but only toothed at the back of the nerve near the apex. At the lower extremity the very wide membranaceous sheath is of a fine purplish pink colour. *Seta* three-fourths of an inch in length. *Capsule* with the operculum, resembling that of *D. polytrichioides*, but twice as large.

Dawsonia superba; procera, foliis uncialibus, rigidiusculis, sublaxe patentibus. Plate I.

Hab. Australia.

III. *Notice of Plants collected in the line of the Rideau Canal, Canada West.* By Philip Whiteside Maclagan, M.D., Royal Canadian Rifle Regiment.

Read 13th May 1847.

The plants were collected in May 1843 on the line of the Rideau Canal. This great work, which commences at Bytown on the Ottawa and terminates near Kingston on Lake Ontario, was constructed several years ago by the Royal Engineers in order to obviate the disadvantages of the frontier route from Upper to Lower Canada. Its length is 137 miles, but like our own Caledonian Canal its course is naturally marked out by a string of lakes and rivers, so that the extent of actual *canal* is very small, but there is a very extensive series of large locks and dams for rendering the shallow streams connecting the lakes navigable. The summit level of the canal is 290 feet above Bytown, so that there is not sufficient elevation to affect the character of the vegetation; but in other respects there is sufficient variety in soil and situation to produce a good deal of diversity in the botany of the different stations on the line. As I happened to be passenger in a very slow steamer which occupied nearly four days in the transit, I had an opportunity of examining a good deal of the country, and on several occasions, by walking on from one lock to the next, collected a good many plants before the vessel came up. The points which I examined most minutely were—Smith's Falls, about half-way between Bytown and Kingston; the Isthmus and Davies's Locks some miles further on; Jones's Falls, thirty miles north of Kingston; and Kingston Mills, within five miles of the latter town. At Bytown itself, although the banks of the Ottawa appear very promising, I could do little in the way of collecting. *Cupressus thyoides* was then new to me, and the common Juniper is abundant, but except these and one or two *Carices*, nothing of interest occurred. The prevailing rock here is a compact limestone with numerous large granite boulders on the surface.

For the first fifty or sixty miles from Bytown the line of canal is extremely uninteresting, passing through what is called drowned land, where the original forest has been killed by the damming up of the Rideau river. Nothing can be conceived more melancholy than the aspect of these extensive tracts of dead trees still erect, but devoid of bark and leaves. I do not know that the cause of death in these so-called drowned lands is well-ascertained, for one would hardly *à priori* anticipate that the immersion of a tree in water to a depth of three or four feet would prove fatal. The process of decay too, so far as I have seen, appears to be unusually rapid, especially as compared with what takes place after a tree has been killed by burning or girdling, *i. e.* removing a ring of bark near the ground. It was gratifying after passing two days of this dismal country to be allowed two or three hours' collecting among the woods near Smith's Falls —a large village in the Bathurst district. In a damp and rich wood there was a profusion of *Dentaria diphylla, Panax trifolium, Mitella diphylla,* and *Erythronium americanum. Mitella nuda,* a small delicate species, occurred on a mossy rock; and in drier portions of the bush, *Phlox divaricata, Pedicularis canadensis, Trillium erectum, Trientalis americana* and *Waldsteinia fragarioides* occurred in plenty. The form of *Trillium erectum* which I found was constantly the dark purple variety, nor have I observed any other in Canada. *Trientalis americana* is hardly to be distinguished from the European species except by the more acute form of both the leaves and petals; though it is possible that discriminating characters might be found on a more minute comparison of the two plants than I have been able to institute. *Waldsteinia fragarioides* appears to be rather a local species. I have never seen it either in Upper or Lower Canada except in the Kingston district. *Convallaria racemosa* and *pubescens* were found sparingly near Smith's Falls; *Asarum canadense* in its favourite habitat, the darkest recesses of the wood, among rich black mould; and *Actæa alba* and *Leontice thalictroides* in broken ground about the margin of the bush. Both these last species are popularly known under the name of *Cohoosh*—the former *white* and the latter *blue.* Blue cohoosh is in some parts of the province a popular remedy in acute rheumatism. The season was too early for collecting aquatic plants. *Menyanthes trifoliata* and *Caltha palustris* were sparingly in flower. *Viola cucullata* and *Viola blanda,* both frequenting moist ground, were abundant everywhere, and there is likewise a pubescent variety of the former species on dry ground, the *V. congener* of some authors. Four other violets were picked in various situations around the village—*V. rostrata, V. pubescens, V. canadensis* and *V. Mullenbergii,* the latter nearly allied to *V. canina.* A few stunted trees of *prickly ash, Zanthoxylon americanum,* were observed just coming into flower, and this with the *Antennaria plantaginifolia* and *Aspidium marginale* nearly completes the list of my evening's gatherings. The rock at Smith's Falls appears to belong to the same series as that at Bytown—a member of the Silurian group. But a few miles further on, the primary rocks, granite, &c., appear, and at the Rideau and Indian lakes give quite a new character to the landscape. Several new plants likewise appear at the "Isthmus" and at Davies's Locks which serve to unite two of the lakes. *Corydalis glauca,* both here and at Kingston Mills, seems to confine itself entirely to the granite, but the other species here observed, e. g. *Saxifraga virginiensis, Aquilegia canadensis,* and the beautiful little *Polygala paucifolia,* are not so particular. Here too I picked a species of *Turritis* which appears to come nearest to *patula,* though not entirely accordant with the character of that species. The siliquæ when I gathered it were rather depending than patulous, but after being confined in the vasculum for some hours they became nearly erect. It appears to me quite possible that some of the species of this section, whose characters depend very much on the direction of the seed-vessel, may ultimately prove to be not really distinct.

At Jones's Falls, where I remained upwards of an hour, the most striking plant was *Clematis verticillaris,* a handsome flowered species ascending the trees and rocks to a height of twenty or thirty feet. On a bare clay bank I observed a violet not elsewhere seen by me in Canada, which appears to be *V. ovata* of DeCandolle, which Torrey and Gray make a variety of *V. sagittata.* It presented a character unnoticed by these authors, viz. having the peduncles (previously erect) closely prostrate after flowering. A small variety of *Cardamine hirsuta* also grew there which is the *C. virginiana* of some authors, and may perhaps be a distinct species. *Hippophaë canadensis* appears to have a marked liking for the neighbourhood of waterfalls, this being the third or fourth such situation in which I have seen it, and here it grows in profusion along with *Ribes Cynosbati* and *floridum,* a species nearly allied to our common black currant. One of the few grasses in flower at this early season, *Urachne asperifolia,* is rather a rare one, and the only other which I procured was *Milium pungens* of Torrey. *Asplenium melanocaulon* closely resembling our *A. trichomanes* occurred here, and at several other places in crevices of the rocks.

Kingston Mills, the last station on the canal to which I referred, was not examined at all at this time, but as during a subsequent residence at Kingston in 1845–6, I had frequent opportunities of collecting in that neighbourhood, I mention the more interesting results here to render the account of the district more complete. At Kingston Mills the canal is carried through a deep glen, surrounded by rounded hills of granite protruding through the limestone strata, and then unites with the Cataragui river, a broad, sluggish stream with extensive marshy banks which bear a profusion of *Acorus Calamus.*

On one of the southern declivities of the granite with a very scanty covering of soil, the *Corydalis glauca* reappears in great profusion and beauty, accompanied by *Silene antirrhina, Aspidium rufidulum* and *Polygonum cilinode,* a remarkable species sending long runners to a distance of ten or twelve feet over the rocks. *Arabis hirsuta, Lepidium ruderale* and *Turritis stricta* were found more sparingly in the same situation. In the damp valley itself, among the under brush composed of *Loniceræ* and *Ribes prostratum, Cornus canadensis* with *Anoplon biflorum* made their appearance. The latter, the *Orobanche uniflora* of older authors, occurs very sparingly; and of another uncommon species, the *Ranunculus fascicularis,* I only observed one small patch.

From this catalogue it will be observed that the vegetation of this district (which lies in about 76° W. longitude and between 44° and 45° N. lat.) resembles much more that of the lower or eastern than of the upper section of the province; and the rarity as well as the poor appearance of the *Podophyllum peltatum* and *Zanthoxylon americanum,* when they do occur—species abundant in Western Canada—show that they nearly reach their northern and eastern limit at the Rideau Canal.

IV. *List of Plants gathered during a short visit to Iceland in* 1846. By Charles C. Babington, M.A., F.L.S., F.G.S. &c.

Read 10th June 1847.

It may perhaps be said that the following list of Icelandic plants is scarcely deserving of the space which it occupies, containing as it does so very few additions even to Hooker's 'Icelandic Flora' contained in his 'Tour in Iceland,' and still fewer to Vahl's 'Liste des Plantes' published in Gaimard's 'Voyage en Islande' (Min. et Géol. p. 371). That fact however is itself deserving of notice, from its proving that those parts of the island to which the researches of most botanists have been necessarily confined were very carefully examined, and that therefore M. Vahl's 'Liste' of 432 flowering plants is not a very imperfect catalogue of the Icelandic flora.

Circumstances over which I had no control restricted the time which I could devote to collecting plants in Iceland within very narrow limits,—far narrower than I had promised myself when leaving England. We landed at Reikiavic on June 29, 1846, and sailed from that port on July 13, after which day a continuance of stormy weather detained us so long off the Icelandic coast as effectually to prevent a visit which we had planned to some of the Fiords in the eastern part of the island. My collections were therefore confined to that small south-western district which was examined by several former visitants. The barren character of the country surrounding Reikiavic renders it very unpropitious to the botanist, and the long journey on horseback to and from the Geysers is not favourable to collecting.

The neighbourhood of Reikiavic consists of low hills, the surface of which is fully half covered with lumps of rock and large stones, between which the soil, although fertile in appearance and probably in reality, is often nearly devoid of vegetation; scattered plants of *Dryas octopetala*, *Lychnis alpina*, *Cerastium latifolium*, *Arenaria norvegica* and a few other species were observed. The lower grounds are very boggy, but far from rich in plants; a very few species of *Carex* and *Scirpus* occupying nearly the whole surface.

The above description will apply to a considerable portion of the country which we visited, but occasionally a small hollow occurred covered by a beautiful turf (*Festuca ovina* and *Poa pratensis* chiefly), amongst which grew rather numerous specimens of *Geranium sylvaticum, Orchis latifolia, Habenaria viridis* and *H. hyperborea*. Such spots were mostly very small. Near Thingvalla (a place of great note in Icelandic history), which is situated upon an ancient lava-current and is at a considerable distance from the sea, there is rather an extensive district of cavernous lava full of deep hollows and cracks upon which a much more luxuriant vegetation occurs. This is called a "forest" by the Icelanders, being well-covered with low bushes, the highest not exceeding six feet, of *Betula glutinosa, B. intermedia, B. nana* (remarkably large), and beautiful but dwarf willows, especially *Salix lanata* and *S. phylicifolia*. The neighbourhood of the Geysers does not appear to be rich in plants, nor does the hot water, which issues from the ground in a state of active ebullition, seem to hasten their growth. I could not perceive that individuals growing in the warm mud by the side of steaming currents were at all more forward than others at a distance from the heated spots. It is stated that vegetation continues on this peculiar tract throughout the year, but that the want of sun-light will not allow the plants so situated to benefit by their exemption from the frost and snow to which their neighbours are subject.

During a visit of one day to the head of Hval Fiord, a deep inlet bounded by mountains situated about forty miles towards the north from Reikiavic, I had an opportunity of examining the damp ledges on the face of a mountain of moderate elevation (estimated by us at 2500 feet), and thus learned something of the alpine vegetation. It may be observed that the slopes of the mountains are usually quite dry and therefore perfectly barren, and that it is only in the few cases where the lava is more solid or the rocks basaltic that wet spots occur. The following plants may be mentioned as inhabiting the steep and moist slope of this mountain, named Reinevalla-hals: *Draba rupestris, Arabis alpina, Silene acaulis, Stellaria cerastoides, Saxifraga rivularis, S. Hirculus* (also not unfrequent in the bogs), *S. nivalis* and *Veronica alpina*. On its exposed and nearly dry but peaty summit there were *Viola palustris, Sibbaldia procumbens, Alchemilla alpina, Andromeda hypnoides* and a few others.

There is great reason to think that a rich and almost unexplored field for botanical research exists in the northern part of Iceland. All the accounts of that part of the island describe it as by far the most fertile portion of the country. It is also believed that the eastern districts would well repay examination.

The wet climate of Iceland and its short and cloudy summer render it very unfavourable to vegetation. We could not learn from the Governor and other intelligent gentlemen that any arable land exists in the country, (unless the cultivation of potatoes in the northern district may be considered as an exception,) and attempts to grow vegetables in what may in courtesy be denominated gardens, do not seem to be often made by any of the inhabitants except those of Danish origin. On the 3rd of July the people of Reikiavic were planting out turnips in their little plots of garden ground, and potatoes were just coming up in a few places. In the Governor's garden there were also some very fine radishes. I saw no other culinary plants except mustard and cress, unless archangel may be so considered. The cultivation of flowers does not seem to be attempted in the open ground, but a very few are preserved in pots in some of the Danish houses. In one house I noticed a carnation, a scarlet Chinese rose, mignionette, and a small fuchsia; all of them showing conspicuously that they were with difficulty preserved alive.

Hooker in his 'Tour,' and also in 'Mackenzie's Travels in Iceland,' gave as complete a list of Icelandic plants as he was able to prepare, and in the recent French work upon Iceland by M. Gaimard will be found a similar list of species compiled by M. Vahl. In the following list of the plants collected by me, the names of those few species are printed in italics which are not included in M. Vahl's list. I have also added the localities of a few of the more interesting plants. I am deeply indebted to Dr. Boott for examining and naming my specimens of *Carex*, with which difficult genus he is known to be peculiarly well acquainted, and his long-promised Monograph upon which is anxiously expected.

List of species of Plants gathered in Iceland between June 29 *and July* 13, 1846.

Ranunculaceæ.

Thalictrum alpinum.
Ranunculus aquatilis.
 Batrachium heterophyllum, *Fries.*
R. hyperboreus.
R. acris.
R. repens.
Caltha palustris.

Cruciferæ.

Arabis alpina.
A. petræa.
Cardamine hirsuta. The terminal leaflet of the lower leaves is rounder and less angular than in the British plant.
C. pratensis.
Draba rupestris. Reinevalla-hals.
D. incana.
Draba incana β. hebecarpa, *Koch.*
D. verna.
Capsella Bursa-pastoris.
Cakile maritima.

Violaceæ.

Viola canina.
V. palustris.

Caryophylleæ.

Silene maritima.
S. acaulis.
Lychnis alpina.
Sagina procumbens.
S. nodosa, *E. Mey.*
Spergula arvensis.
Alsine peploides.
A. rubella. Near Reikiavic and on Reinevalla-hals.

Arenaria norvegica.
A. ciliata, *Hook. Icel. Fl.*
Stellaria cerastoides.
S. media.
Cerastium triviale.
C. alpinum.

Geraniaceæ.

Geranium sylvaticum.

Rosaceæ.

Spiræa Ulmaria.
Dryas octopetala.
Geum rivale.
Rubus saxatilis.
Fragaria vesca.
F. collina, *Vahl, Liste?*
Potentilla Comarum.
P. anserina.
P. alpestris.
P. aurea, *Hook.*
P. maculata, *Vahl?*
Sibbaldia procumbens. Summit of Reinevalla-hals.
Alchemilla vulgaris.
A. alpina.

Onagrariaceæ.

Epilobium montanum γ. humile, *Bab.*
E. palustre.
E. virgatum.
E. alpinum.

Halorageæ.

Myriophyllum spicatum.
Hippuris vulgaris.

Portulaceæ.

Montia fontana.

Crassulaceæ.

Sedum villosum.
S. Rhodiola.

Saxifragaceæ.

Saxifraga stellaris.
S. Hirculus.
S. cæspitosa.
S. hypnoides. Reinevalla-hals.
S. nivalis. Descending to the sea level.
S. rivularis. Reinevalla-hals.
S. oppositifolia.
Parnassia palustris.

Umbelliferæ.

Carum Carui. Thingvalla (naturalized).
[Angelica Archangelica. I have no specimen of this, and only saw it in patches of cultivated ground.]

Rubiaceæ.

Galium boreale.
G. verum.
G. pusillum.

Compositæ.

Erigeron alpinus.
Gnaphalium uliginosum.
Oporinia autumnalis.
O. autumnalis β. Taraxaci.
Taraxacum officinale.
Hieracium alpinum.
H. cæsium, Fries.
H. Lawsoni.
Pyrethrum inodorum.

Ericaceæ.

Vaccinium uliginosum.
Arctostaphylos Uva-ursi.
Andromeda hypnoides. Summit of Reinevalla-hals.
Calluna vulgaris.
Pyrola minor.

Gentianaceæ.

Menyanthes trifoliata.
Gentiana campestris.
G. nivalis.

Boragineæ.

Steenhammera maritima.
Myosotis versicolor.
M. intermedia, *Link.*

Rhinanthaceæ.

Rhinanthus minor.
Bartsia alpina.
Veronica serpillifolia.
V. alpina. Reinevalla-hals.
V. saxatilis. Near Reikiavic.

Labiatæ.

Thymus Serpillum, *Linn., Fries,* not *Sm.*
Prunella vulgaris.
Galeopsis Tetrahit.

Lentibulareæ.

Pinguicula vulgaris.

Plumbagineæ.

Armeria maritima.

Plantagineæ.

Plantago maritima.
P. major.

Chenopodiaceæ.

Atriplex patula?

Polygoniaceæ.

Polygonum viviparum.

Polygonum aviculare.
Rumex domesticus. Only observed near the houses of Reikiavic.
R. acetosella.
R. acetosa.
Oxyria reniformis.
Kœnigia islandica.

Empetreæ.

Empetrum nigrum.

Urticaceæ.

Urtica urens. Plentiful about the houses of Reikiavic. Believed to be an introduction; confined to one garden at the time of Hooker's visit.

Amentaceæ.

Betula glutinosa.
B. alba, *Vahl?* Thingvalla.
B. intermedia, *Thom.*
B. fruticulosa, *Vahl?* Thingvalla.
B. nana. Thingvalla.
Salix glauca, *Linn.*, not *Sm.* Reinevalla-hals.
S. phylicifolia. Thingvalla.
S. lanata.
S. pyrenaica var. *norvegica*, Fries. Reinevalla-hals.
S. herbacea.

Orchidaceæ.

Orchis latifolia.
Habenaria viridis.
H. hyperborea.

Melanthaceæ.

Tofieldia palustris, *Huds.*

Juncaceæ.

Juncus balticus. Is this the *J. effusus* of Hooker's Fl., or *J. arcticus* of Vahl's List?
J. supinus.
J. bufonius.
J. trifidus.
J. triglumis.
Luzula spicata.
L. multiflora.

Alismaceæ.

Triglochin palustre.

Aroideæ.

Sparganium natans.

Potamogetoneæ.

Potamogeton lanceolatus, Sm.
P. nigrescens, *Fries.*
Potamogeton filiformis. Maria Havn, Hval Fiord.
Zostera angustifolia, *Reich.*

Cyperaceæ.

Scirpus cæspitosus.
Eleocharis uniglumis.
Eriophorum capitatum.
E. polystachion γ. elatius, *Koch.*
Elyna spicata.
Carex dioica.
C. chordorhiza. Maria Havn, Hval Fiord.
C. incurva.
C. curta.
C. atrata.
C. capillaris.
C. vaginata.
C. rariflora.
C. cryptocarpa, Meyer.
C. filipendula, *Drej.*
C. vulgaris, *Fries.*
C. hyperborea, Drej.
C. rigida.

Gramineæ.

Anthoxanthum odoratum.
Alopecurus geniculatus.
Phleum commutatum.
Agrostis alba.
Arundo stricta. Near the Geysers and at Maria Havn, Hval Fiord.
Sesleria cærulea.
Aira alpina.
Trisetum subspicatum β. ciliatum.
Poa annua.
P. pratensis.
P. alpina.
P. Balfourii, Parn.
P. cæsia.
P. cæsia β. glauca.
Festuca ovina.
F. rubra γ. arenaria.

Equisetaceæ.

Equisetum umbrosum. Thingvalla.
E. palustre.

Filices.

Polypodium Dryopteris.
P. Phegopteris.
Woodsia ilvensis.
Athyrium Filix-fœmina.
Cystopteris fragilis α.
C. fragilis β. dentata.
Botrychium Lunaria.

Lycopodiaceæ.

Lycopodium selaginoides.

V. *Description of two new Mosses from Jamaica.* By William Wilson, Esq.

Read 11th November 1847.

Pilotrichum, *Beauv.*

P. funale (nov. sp.?); surculo pendulo vel procumbente vage ramoso, ramis simplicibus foliis ovatis acuminatis concaviusculis, plicato-striatis serrulatis iranidenerviis siccitate erectis.

Hab. in arborum cortice? Port Royal, Ins. Jamaicæ; legit G. M'Nab, M.D.

Surculus biuncialis et ultra. Rami subsecundi, semiunciales. Folia nitida, lutescentia, tenuissime areolata, siccitate haud tortilia. Fructus et flores desunt.

Very much like *Pterigynandrum nigrescens β. illecebrum* (Bridel, Br. Un. ii. 193), but differing thus: leaves more acuminate, serrulate; areolæ smaller and narrower; the foliage too, when dry, is somewhat glossy.

The typical *Pt. nigrescens* (Swartz) is distinguished from these two forms thus: leaves narrower, of thinner texture, more lax, pale green. Still it is doubtful, in the absence of fruit, whether the three forms should not be referred to one species.

Pilotrichum may (for the present) be considered as a subgenus of the Bridelian genus *Neckera*, with hairy calyptræ. It is adopted as a genus by Hornschuch in the 'Flora Brasiliensis,' and was first proposed by Pal. de Beauvois.

Omalia, *Brid.*

O. lentula (nov. sp.); caule distiche sub-bipinnatim ramoso, foliis distichis ovato-falciformibus acuminatis serrulatis enervibus, perichætialibus lanceolato-attenuatis.

Hab. in arborum cortice? Port Royal; legit G. M'Nab, M.D.

Caules bi-triunciales. Rami complanati, breves. Folia nitidissima, læte-viridia, tenuissime areolata, superne serrulata. Florescentia dioica?

Evidently allied to our British *Omalia trichomanoides* (Bridel), *Hypnum trichomanoides* (Hooker and Taylor), but readily distinguished by its nerveless, acuminated and more falciform leaves and more shining habit. It has still greater resemblance to *Neckera* (*Distichia*) *glabella* (Bridel), which probably belongs to the genus *Omalia* (the true *Distichiæ* having the leaves rugose or undulated). From the last-named moss, ours differs in its smaller size and ovate-acuminate leaves.

VI. *Diagnostic Characters of five new species of Cryptogamic Plants from Jamaica.* By Thomas Taylor, M.D.

Read 11th November 1847.

Leskea, *Hedw.*

1. *L. angustifolia* (Tayl.); caule exiguo erecto subramoso, surculis flexuosis, foliis laxis distichis ex angusta basi lineari-oblongis obtusis apiculatis apice dentatis ruptinervibus substriatis surculorum ad apices arcte compressis ad basin minutis vel subnullis.

On *Danæa alata* (Sm.), Jamaica. In *Dr. R. K. Greville's* Herbarium.

Three to four lines high, pale yellowish green, shining. Leaves in eight to ten pairs, those at the top adpressed into a spike; their inferior margin incurved at the base. This species is strongly allied to *L. Novæ-Hollandiæ* (Schwaeg.), and may well be supposed to belong to the same genus even in the absence of fructification. It may be distinguished by its far smaller size, its more obtuse leaves, and by their shorter nerve. In one instance the stem is prolonged at the top into a flagelliform shoot, destitute of all but minute rudimentary leaves.

Phragmicoma, *Dumort.*

1. *P. affixa* (Tayl.); caule debili repente vage ramoso seu subdichotomo, foliis laxe imbricatis erecto-patentibus oblongo-rotundatis margine subundulatis apice parce denticulatis lobulo minuto vel subnullo, stipulis rotundatis integerrimis, calyce demum axillari oblongo-obcordato compresso ore integerrimo.

On *Danæa alata* (Sm.), Jamaica. In *Dr. R. K. Greville's* Herbarium.

Five or six lines long; very pale olive, nearly whitish: a female flower and a branch issuing from near the top of the past year's shoot. Leaves flaccid, often entire, sometimes with three or four obtuse teeth; the perichætial erect, oblong, subdentate. Capsule pale, splitting half-way down; its valves broadly ovate. The leaves by no means imbricated, flaccid, irregular in outline, variously twisted: the indistinct lobules and the large cells serve to keep the present distinct from all described species.

Radula, *Nees.*

1. *R. Grevilleana* (Tayl.); caule implexo repente subpinnato, ramis patentibus, foliis imbricatis erecto-patentibus integerrimis lobo

superiori obovato-rotundato, inferiori minuto trapezoideo, calyce demum axillari elongato ovato-oblongo apice compresso truncato, basi angustato pedicelliformi, perigoniis minutis linearibus ramorum fere ad apices usque productis lobulo monandro.

On *Danæa alata* (Sm.), Jamaica. In *Dr. R. K. Greville's* Herbarium.

Very minute, three to four lines long, olive-coloured, closely adhering to the subjacent fern; a calyx and an innovating branch terminating the preceding year's shoot. Leaves touching, more patent than erect; the perichætial broadly elliptical, short. Capsule linear, very narrow. Perigonia on short lateral branches with ten or twelve pairs of minute imbricated ventricose leaves, each containing a spherical anther. The exserted part of the pedicel about as long as the calyx; this is on a narrow pedicel or nearly cylindrical opake base contained within the perichætium; it is nearly as long as the shoots. This species differs from *R. buccinifera* (Tayl.) by the smaller size, more imbricated leaves, whose tops are not so rounded, and by the calyx bulging at the base, and so by no means obconical.

Plagiochila, *Nees et Mont.*

1. *P. sub-bidentata* (Tayl.); caule repente laxe cæspitoso, surculis decumbentibus subflexuosis, foliis basi imbricatis erecto-patentibus margine ventrali basi gibboso oblique ovatis acutis apice subbiciliatis, calyce oblongo ore oblique subtruncato dentato.

On *Schlotheimia cirrosa* (Hook.), Jamaica. *Dr. J. M'Nab.*

Shoots one or two inches long, scarcely one line wide, brown, attenuated above. Perigonial spikes one or two in the course of the shoots. Perichætial leaves upright, adpressed to the base of the calyx; this has a marginate angle on the upper side, and the mouth roundly truncate and split on one side. Pedicel just exposing the capsule out of the calyx. This differs from *P. abrupta* (Lindl.) by the procumbent shoots, which are longer and more attenuated above; by the wider bases of the leaves, which at the ventral margin form a crest below the stem; by the teeth of the leaves being so slender as to be mere cilia, and by the minuter cells of the leaves.

Parmelia, *Ach.*

1. *P. ochroleuca* (Tayl.); thallo laciniato-lobato, lobulis ultimis brevibus sinuato-divaricatis præmorsis retusisve albo-cinereo madore immutato tenuissime albo-reticulato subtus albido-fibrilloso, apotheciis submarginalibus concavis margine incurvo demum gemmis planis subrotundis coronato, disco castaneo subtus nudo.

Port Royal, Jamaica. *Dr. J. M'Nab.*

Thallus three to four inches wide, when dry waved on the surface; sinus of the lobes oblong: margin brownish; surface pale ash-coloured, whiter beneath, where the pale fibrils resemble those of a *Peltidea.* Disc of the apothecia concave when dry, flat or slightly convex when moistened and then assuming a lighter colour. The disc is naked beneath, that is, it is destitute of a thallodal layer, hence the apothecia seen by transmitted light are pellucid in the centre. Allied to *Sticta Leylandii* (Tayl.), which however differs by the upper surface being covered with closely set clusters of buds, by the smaller size and darker colour, by the shorter fibrils beneath the thallus, and by the apothecia receiving at length a short podetium from the thallus. The genus *Sticta* seems scarcely separable by a decisive character from *Parmelia,* and this again in another direction passes into *Lecanora.*

VII.—*On* Anacharis Alsinastrum, *a supposed new British Plant.* By Charles C. Babington, M.A.; *with a Synopsis of the species of* Anacharis *and* Apalanthe. By J. E. Planchon, doct. ès sc.

Read 9th December 1847.

Before describing the plant to which this paper more especially refers, it is desirable to state the reasons which have caused the adoption of the generic name *Anacharis* rather than *Udora.* By the kindness of Sir W. J. Hooker I have had an opportunity of examining the numerous specimens of plants referable to these and allied genera preserved in his Herbarium in company with my friend Dr. Planchon, its efficient Curator; and I take advantage of this opportunity of acknowledging my obligations to him for the very liberal manner in which he has placed his manuscript notes at my disposal. In Richard's Memoir upon the Order *Hydrocharideæ,* where the genera *Elodea* and *Anacharis* were characterized, only the male flowers of the latter are described and figured. In the Herb. Hooker. there are male and female specimens, collected by Tweedie in La Plata, which agree well with Richard's description of *Anacharis* (*callitrichoides*) taken from Montevideo specimens of the male plant. They differ from Drummond's Saskatchawan *Udora* (*A. canadensis,* Planch.) by having petals to the male flowers, and their sheaths less inflated: it seems probable that this is the *Elodea canadensis* of Michaux, who (or Richard) has apparently been misled to consider it as of the genus *Elodea* by the very great resemblance of its female flowers to the hermaphrodite flower of *E. guyanensis.* Indeed, in the absence of the males, the female flowers of some species of *Anacharis* (*A. Alsinastrum* for example) might well pass for hermaphrodite flowers from which the anthers had been accidentally removed: the female flower of *A. Alsinastrum* differs from the hermaphrodite flower of *E. guyanensis* (Rich.) solely by wanting the anthers (the filaments existing), and in the somewhat differently shaped stigmas; in these respects agreeing with Nuttall's description of his genus *Udora.* It would seem from these facts that Richard's *Anacharis* is the male of Nuttall's *Udora,* in which genus also *Elodea canadensis* (Michx.) must probably be placed.

It should be observed that the 'Fl. Boreali-Americana' was published, from his father's notes, by the younger Michaux in 1803, and that as the genus *Elodea* is found there, it would appear that he is the true author of the name, and that the *E. canadensis* is therefore a triandrous plant. But the name *Elodea* is expressly claimed by Richard (Mém. de l'Instit. 1811, Pt. 2. p. 4) in these words: "genre encore peu connu, et auquel j'ai donné le nom d'*Elodea*;" and as it is well known (as I learn from Dr. Planchon) that Richard greatly assisted the younger Michaux in the preparation of his work, although he did not allow his name to be placed on its title-page, there can be no doubt that this genus was named and described by him. This will account for the North American plant being placed in Triandria, not Diœcia; for *E. guyanensis* is triandrous, and the look of the plants is so similar, that Richard might well be led to consider *E. canadensis* as of the same structure when inspecting dried specimens alone. Of the hermaphrodite structure of *E. guyanensis* Richard had convinced himself by seeing it alive in its native waters, and it is highly probable that he saw only the female flowers of *E. canadensis*, with three barren filaments, and considered them as hermaphrodite.

I need scarcely remark, that *Anacharis* (1811) is by far an older name than *Udora* (1818), and that as it has been shown, it is hoped conclusively, that they are synonymous, the former must be employed. Nuttall does not seem to have seen Richard's original paper (Mém. Inst. 1811, Pt. 2), for he quotes a figure of the seed from the 'Annales du Muséum,' where a copy of that part of the plate of *Elodea* is inserted. Had he seen the memoir itself, he would doubtless have identified his plant with the genus *Anacharis*, and not have conferred a new name upon it.

In the Hookerian Herbarium a plant is preserved collected by Schweinitz in the United States of America, which Dr. Planchon has determined to belong to the genus *Elodea*, Rich., but as that name is employed elsewhere, he proposes to name it *Apalanthe Schweinitzii*.

The genus *Anacharis* may be characterized as follows:—

Anacharis, *Richard*.

Flores dioici. *Masc.* Spatha tubulosa, ore inflato bifido, uniflora; flore pedicellato. Perianthium sexpartitum, laciniis exterioribus calycinis ovato-oblongis; interioribus petaloideis linearibus, aut nullis. Stamina 9; filamenta basi in columnam brevem connata; antheræ oblongæ, basi affixæ, loculis connectivo angusto sejunctis. —*Fem.* Spatha tubulosa, ore paululum dilatato bifido obliquove, uniflora. Perigonii tubus filiformis, elongatus; limbus sexpartitus, laciniis ovalibus, conformibus, exterioribus calycinis, interioribus petaloideis. Staminodia tria, laciniis exterioribus opposita, subulata; antheræ nullæ. Ovarium inferum. Stylus setiformis cum perigonii tubo connatus; stigmata tria, bifida vel emarginata. Bacca subtrigona, unilocularis, oligosperma.—Herbæ perennes (vel annuæ, *Rich.*)*, aquaticæ, caulescentes, radicantes. Folia verticillata vel opposita, sessilia. Spathæ axillares.

Anacharis, *Rich. in Mém. de l'Institut,* 1811, ii. p. 61. t. 2 (mas). Udora, *Nutt. Gen. N. Amer. Plants,* ii. 242.

A. Alsinastrum (nov. sp.?); foliis ternis ovali-oblongis obtusis subtilissime serrulatis, spatha floris masculi (ignota), floris feminei tubulosa ovarium sessilem pluries superante apice bifida, perigonii laciniis latis subæqualibus, stigmatibus ligulatis reflexis emarginatis.

Hab. In ponds connected with the canal at Foxton Locks near Market Harborough, Leicestershire, where it was discovered by Miss Mary Kirby, flowering sparingly, at the beginning of September 1847.

Plant submersed; stem solid, round, semitransparent, several feet long, branching at irregular and distant points, clothed throughout with whorls of leaves. Leaves three (rarely four) in each whorl, oblong, 3–4 lines long, $1\frac{1}{2}$–2 lines broad, obtusely-pointed, minutely and closely serrulate, diaphanous, formed throughout (a continuous semitransparent midrib excepted) of longitudinal rows of small oblong green cells, of which the two or three marginal rows are colourless and quite transparent; edge furnished with very minute closely-placed (except towards the base, where they are altogether wanting or very distant) spinulose teeth pointing forwards; end formed of two curves meeting at an obtuse angle and tipped with a spinous point similar to the marginal ones; uppermost leaves blunter than the lower ones, and often quite obtuse; all spreading at right angles from the stem, their extremity rather reflexed; lower internodes about as long as the leaves, lowest much longer and with opposite and short leaves, upper scarcely half their length; the node marked by a transverse dull red line. Roots long, threadlike, diaphanous, from the points at which branches have sprung.—Female flowers from the axils of the upper whorls, solitary. Sheaths sessile, solitary, linear, slightly enlarged at the end, deeply bifid. Flower

* *A. callitrichoides*, Rich., is expressly stated by that author to be annual, our plant is undoubtedly perennial. In a growing plant, now (Dec. 22, 1847) before me, the old stem is losing its leaves, which have nearly all decayed and fallen off, and appears to be itself on the point of death, but several clusters of young shoots have sprung from it, at the base of which roots are produced. In the spring each of these clusters will probably appear to be an independent young plant. This may account for the supposed annual duration of some of the species.

sessile; tube very long (so as to reach the surface of the water), filiform; limb six-parted; divisions oval, similar, three exterior, three interior rather narrower and more acute. Filaments three, subulate, without anthers. Style adnate to the tube; stigmas ligulate, reflexed, notched, fringed.—Male flowers unknown.

A. Nuttallii (Planch.), *Udora canadensis* (Nutt.), from New Jersey, closely resembles this, differing in the acute termination of its leaves, and apparently its less deeply divided sheath: its flowers are not in a state admitting of examination. *A. canadensis* (Planch.) has lanceolate-linear leaves and a much shorter sheath. The latter differs from the former by not having any inner divisions to the perianth of its male flowers. Our plant is clearly not *A. canadensis*, but it may be *A. Nuttallii*, the want of male flowers totally preventing its absolute determination. As the genus *Anacharis* is, as yet*, confined to the American continent, it has been thought better to give a distinctive name to our plant (derived from its resemblance to *Elatine Alsinastrum*), so as to prevent its being confounded with the American species, and thus extending their range far beyond what may prove to be their natural limits. Should either of them eventually be shown to be identical with our plant, one of the names will of course drop; and as that species to which ours is the most nearly allied is now for the first time distinguished from the *Elodea canadensis* of Michaux, it will then be for botanists to determine which name should be retained.

Shortly after receiving this plant from Mr. Bloxam, I was informed that similar ones had been found in Hampshire and near Dublin. I am indebted to my friend Mr. H. Collins for a specimen from the former locality, an ornamented pond, at Leigh Park, about eight miles from Chichester. He informs me that there is very great probability of its having been introduced there accidentally with the roots of *Nymphæa odorata*, received by the gardener a few years since from America. The plant had not been noticed in the pond previously to those roots being put into it, and it appeared shortly afterwards in small quantity, but soon rapidly increased. Mr. Scott, the intelligent gardener at Leigh Park, has sent three female flowers to Mr. Collins and Mr. Borrer, one of which I have examined carefully. It has three broad calycine segments; three narrower, shorter, perhaps spathulate, coralline segments; three broadly linear barren filaments; and two long, greatly recurved, possibly emarginate, stigmas. The upper part of the plant to which one of the flowers is attached is exactly like a similar portion of *A. Nuttallii* from New

* The *Udora pomeranica* and *U. lithuanica* of European authors have never been seen in flower, and have much more the look of *Hydrilla* than *Anacharis*, but their genus is at present undeterminable.

Jersey, for which I am indebted to Sir W. J. Hooker, and I have no doubt that they are the same species. It is a curious coincidence, that the only perfect flowers of the Market Harborough *A. Alsinastrum*, and also of the Leigh Park *A. Nuttallii* which I have been able to examine, have no trace of more than two stigmas.

Mr. Mackay accompanies specimens of the Dublin plant (found growing in a small pond in the garden of J. D'Olier, Esq., at Collignes near that city,) by the statement that it is in company with *Aponogeton* and other rare aquatic plants, and was in all probability introduced with them. Flowers have not been observed upon it, and its name must therefore remain doubtful—even its genus. In appearance it is almost exactly like *A. Nuttallii*, with which it agrees in having narrower and acuter leaves than *A. Alsinastrum*.

The question now arises, May not the *A. Alsinastrum* have been introduced? To this I answer in the words of the Rev. A. Bloxam, who kindly visited its place of growth and supplied me with numerous living and dried specimens. He says, in answer to an inquiry of mine, "I can find no reason to doubt the *Udora* being a true native. Numbers of other water-plants grow in the same locality, *Potamogetons* of various kinds, &c." He adds, that "although not observed until this year, I should suppose that it must have been a long period in the ponds from the great quantity of it."

Synopsis specierum Anacharidis *et* Apalanthes; *auctore* J. E. Planchon, Scien. Doc.

Anacharis, *Richard.*

1. *A. callitrichoides* (Rich.); foliis oppositis vel ternis linearibus acutis minute serrulatis, spatha pedicello (brevi) cylindrico continua sensim a basi ad apicem dilatata lineari-oblonga apice bifida, antheris (polline emisso) siccitate cærulescentibus, stigmatibus perianthii laciniis longioribus ad medium bifidis; cruribus linearibus.

Hab. in Brasilia australiori; Montevideo, *Commerson*; La Plata (absque loco proprio), *Tweedie* in Herb. Hooker.

A. callitrichoides, *Rich. in Mém. Inst.* 1811, ii. 7. t. 2.

Character e specimine Tweediano, quod floribus utriusque sexus gaudet, masculis, sicut folia, cum icone Richardiano plane congruentibus, femineo unico et pro investigatione nimis imperfecto.

2. *Anacharis Matthewsii* (Planch.); foliis 3–4-nis dense imbricatis, spatha mascula (ante dehiscentiam) breve pedunculata ellipsoidea, perianthii laciniis exterioribus oblongis interioribus linearibus et petaloideis subæquilongis, antheris (novem) subsessilibus polline emisso non cærulescentibus.

Hab. in Peruviæ ditione Ubuamantanga, prov. Canta, *Matthews*, No. 581. In aqua fluente rivulorum.

Folia 7–8 lin. longa, 1 lin. lata, haud acuminata sed apice subrotundato breviter acutata, patentia vel erecto-patentia internodiis pluries longiora. Antheræ lineari-oblongæ.

3. *A. Alsinastrum* (Bab.); foliis ternis ovali-oblongis obtusis subtilissime serrulatis, spatha floris masculi (ignota), floris feminei tubulosa ovarium sessilem pluries superante apice bifida, perianthii laciniis latis omnibus subæqualibus, stigmatibus ligulatis reflexis emarginatis.

Hab. in Anglia.

Folia 3–4 lin. longa, 1½–2 lata, in apice caulis ramulorumque confertis, in parte infima ramulorum parvis distantibus oppositis, sessilia, squarrosa, apice paululum reflexa.—*Babington.*

4. *A. Nuttallii* (Planch.); foliis 3–4-nis oblongo-linearibus subtiliter serrulatis interdum obtusis, petalis floris masculi ligulato-spathulatis, stigmatibus ligulatis reflexis bifidis.—*Nuttall.*

Hab. in America septentrionali, sed loci natales dum stirps cum duobus aliis hucdudum confusa sit, observationibus novis denuo notandi.

Udora canadensis, *Nutt. Gen. N. Amer. Pl.* ii. 242. *excl. syn. Michx.*

Huc fere absque dubitatione refero stirpem prope Novam Cæsaream a cl. Torreyo lectam cujus folia variant late vel anguste linearia, sed tamen sunt semper acutiora quam illa *A. Alsinastri*. Spatha floris feminei sessilis, tubulosa, ovario adpressa et super eum producta, apice acute bifida. Flores pauci et pro examine accurato nimis imperfecti.

5. *A. chilensis* (Planch.); foliis ternis lineari-oblongis obtusis subtilissime serrulatis, spatha floris feminei sessili tubulosa apice hinc fissa, stigmatibus tribus bipartitis perianthii laciniis exterioribus reflexis longioribus.

Hab. in Chili prope Valparaiso, *Cuming*, No. 636.

Folia illis *A. Alsinastri* plane similia, unguicularia, 2 lin. lata, in parte infima ramulorum opposita. Spatha in flore unico suppetente folii tertiam partem vix æquante. Tubus perigonii pollicaris; limbus reflexus, laciniis exterioribus circiter 1 lin. longis, interioribus . . . . . Styli tres, profunde bipartiti, laciniis linearibus.

6. *A. canadensis* (Planch.); foliis ternis lineari-oblongis vel anguste linearibus, apice interdum rotundatis breve acutatis, spatha floris masculi (breve pedunculata) ventricoso-obovata, floris feminei sessilis tubulosa ovarium sub 5-plo longiore apice bifida, perianthii floris masculi laciniis interioribus nullis.

Hab. in America septentrionali. Saskatchawan, *Drummond* (specimina mascula). Canada, *Cleghorn* (specimina feminea imperfecta).

Elodea canadensis, *Michx. Fl. Bor. Amer.* i. 20.?

Apalanthe, *Planchon.*

Elodeæ sp., Richard. *Udoræ sp.*, Endlicher (sed character genericum ex elementis heterogeneis infauste exstructum).

Flores hermaphroditi, cæterum femineis *Udoræ*, præter antherarum præsentiam, in omnibus conformes. Stamina in specie typica Guyanensi vidi interdum haud æquidistantia, nec cum stigmatibus regulariter alternantia, sed alterum liberum inter stigmata duo, altera duo inter se filamentis plus minus concreta et cum crure altero unius stigmatorum bifidorum semiconnata. Antheras vidi potius late ellipticas quam cordatas; pollinis granula lævia, 3–4-natim cohærentia. Dehiscentia antherarum mihi obscura. *Cl. Bonplandius*, in descriptione *Apal.* (*Elodeæ*) *granatensis*, stylum in collo longo calycis liberum adesse asserit; sed character illud, cum oculatissimum Richardum fugerit, in vivo rursus inquirendum est. Ipse nihil vidi ad confirmationem observationis istæ tendens.

1. *Apal. guyanensis* (Planch.); foliis 3–9-nis lanceolato-linearibus (vel anguste linearibus) a basi ad apicem sensim angustatis acutis haud recurvis, spatha sessili cylindracea "ovarium in ipsa sessile" superante; stigmatibus (sæpius) bifidis: cruribus apice dilatatis.
Hab. in Guyana, *Rich.* Demerara, *Parker*, in Herb. Hook.

Elodea guyanensis, *Rich. in Mém. Inst.* 1811. ii. 4. t. 1.

2. *Apal. granatensis* (Planch.); foliis 7–15-nis, anguste linearibus acutissimis, spatha sessili ovarium in ipsa sessile subæquante.
Hab. in aquis Novæ Granatæ prope Guaduas inter Honda et Cune. *Humboldt* et *Bonpland.*

Elodea granatensis, *Humb. et Bonpl. Pl. Æquin.* ii. 150. t. 128.

3. *Apal. Schweinitzii* (Planch.); foliis sæpius 3-nis (in parte infima ramorum oppositis) lanceolato-linearibus (vel subovalibus) acutis subtilissime serrulatis, spatha sessili cylindrica acute bifida florem demum longe pedicellatum exserente.
Hab. in Americæ septentrionalis provinciis confederatis (United States), loco proprio non indicato, *Schweinitz* in Herb. Hook.

Serpicula occidentalis, *Pursh? Fl. N. Amer.* i. 33 (ob flores hermaphroditos triandros, sed diagnosis manca imprimis quoad floris situm non sufficit).

Herba omnino facie *Anacharidis Nuttallii* vel *A. canadensis*. Folia in ramulorum parte inferiore opposita, abbreviata, subovalia, 2–2½ lin. longa, internodiis multo breviora; cætera linearia, patenti-erecta, internodiis multo longiora ideoque laxe imbricata, acuta nec tamen acuminata. Spatha 4–5 lin. longa. Pedicellus floris 6–8 lin. longus. Ovarium anguste ovatum in collum 1–1½ pollicarem sensim angustatum. Laciniæ perianthii exteriores latiuscule lineares, patentes, pellucidæ; interiores petaloideæ, tenerrimæ. Stamina tria; filamenta gracilia, antheris longiora; antheræ obovatæ, compressæ, loculis granulis pollinis inter se conglomeratis repletis, dehiscentia ignota. Stigmata tria, bipartita (?), cruribus recurvis perianthii laciniis exterioribus duplo longioribus.

Obs. Elodea canadensis (Michx.) a specie supra descripta differt, ob verba auctoris in delineatione characteris generici, " ovarium ad caulem sessile." Inde stirps ad *Anacharidem canadensem* (Planch.) verosimiliter recte referta.

EXPLANATION OF PLATE II.

Anacharis Alsinastrum, natural size, with a detached flower showing its very long tube.

Note.—The flower, the only one obtained, is doubtless imperfect, by wanting the third stigma.

- *a.* A whorl of leaves.
- *b.* Summit of the sheath.
- *c.* A female flower.
- *d.* Stigmatic fringe.

Magnified.

We are indebted to Mr. J. W. Salter for the beautiful drawing, made for the 'Supplement to English Botany,' from which our plate is engraved.

VIII. *On the Ovule of* Euphrasia officinalis. By G. Dickie, M.D., Lecturer on Botany in the University and King's College of Aberdeen.

Read 13th January 1848.

In a communication submitted to the Society two years ago, an attempt was made to prove that in certain plants, tubes observed in connexion with ovules are not really in every case derived from the pollen, as stated by some physiologists, but prolongations from some part or other of the ovules. This statement had reference only to a few plants, and the same restriction is still adhered to: it would be rash to generalise in the matter. It was argued in favour of this opinion, that the number and position of the ovules would present obstacles to the pollen-tubes entering their foramina. An argument, it may be said, of greater value was employed, viz. that the development of such a tube might be traced at an early stage projecting from the exostome in the form of a papilla, ending in a blind extremity, afterwards increasing in length and coming in contact with the placenta. The observations of the late Mr. Griffith on *Santalum* were quoted in favour of the idea in question, that acute observer having proved the true nature of the tube sent up to meet the pollen-tube, it being a prolongation of that part which is usually denominated embryo-sac. It was not in my power to speak so emphatically regarding the nature of the tubes in those plants in which they were seen; in *Narthecium, Bartsia* and *Euphrasia* I expressed however my belief that they might be prolongations of the apex of the nucleus. It was considered sufficient at that time to show that prolongations like pollen-tubes might be sent up from the ovule. I have repeatedly examined ovules of *Euphrasia* and have found them uniformly present. I had originally set out with the view of tracing pollen-tubes into the ovule, and if possible observing them in contact with the embryo-sac, and even in the act of causing introflexion of that part. When I say, if possible, the expression has reference to myself; observers of great experience and of high authority in points relating to vegetable physiology had made such statements, and implicit confidence was placed in them. Tubes were observed, but for the reasons alluded to I felt convinced that they had origin from the ovule itself.

Additional observations have led me to change the opinion formerly expressed respecting the part of the ovule from which these organs in *Euphrasia* are derived, and the present communication has reference to that point, and to a peculiarity in the structure of the ovule of that plant, which, so far as I am aware, has not been hitherto described.

The substance of the nucleus is very thin about the period of fecundation, the embryo-sac which lines it becoming highly developed. This sac is attenuated at the posterior extremity; its body tapers gradually upwards into a neck, which is bent at an obtuse angle, and near the apex it is bulbous; at this apex or anterior extremity there is the appearance of a fissure or cleft bounded by two or three rounded lobes. In the interior of the neck and bulb of the sac there is distinctly seen a tube which is narrow below, but somewhat dilated at the part corresponding to the bulb of the sac. This tube I have observed in several instances prolonged upwards, passing out at the terminal fissure and ending in a papilla closed at the extremity. I have traced it some way into the interior of the body of the sac, but the presence of the cellular contents has prevented me from being able clearly to see its relation to the very minute embryo, whose outline might be seen shining through. In one preparation in my possession there is an appearance which seems to indicate a connexion between the embryo and the tube, but I cannot decidedly assert that they are continuous. Lying parallel to the embryo-sac, and on the side next the short podosperm, there is another organ similar in structure; it may be compared to a Florence flask in shape; the necks of the two are quite continuous.

The nature of this remarkable appendage was not easily comprehended at first. I am inclined to believe that the arrangement of the parts in *Euphrasia* is somewhat similar to that in some species of *Veronica,* and which has been described and illustrated by M. Planchon, to the accuracy of whose descriptions and delineations I can bear testimony from my own observations. In the earlier stages of the ovule in *Veronica* the upper end of the sac is bulbous, below this it tapers into a neck, then becomes again somewhat dilated at the part in which the embryo afterwards appears, and which may be called the body of the sac; towards the posterior end it gradually becomes narrower and ends in a sharp point. At more advanced stages the neck of the sac presents several varicose appendages. The large appendage already described as lying parallel to the embryo-sac in *Euphrasia,* and continuous with its neck, is merely a process of that part. In *Euphrasia,* however, the embryo-sac does not appear externally, as in the advanced stages of that of *Veronica.*

The tube already described as traversing the bulb and neck of the sac, and passing some way into the interior of the body of the same organ, is certainly not the least remarkable part of the arrangement. The principal argument against its origin from the pollen has been already alluded to, viz. its closed papilliform end projecting from the fissure in the extremity of the bulb. It is certainly very difficult to pronounce a decision respecting the nature of the extremity of a transparent membranous tube less than a three-thousandth of an inch in diameter. I have come to the conclusion mentioned, after repeated careful examination under various powers of a microscope (by Brunner of Paris) varying from 250 to upwards of 600 diameters. Figure 1 represents a preparation in my possession, in which two tubes are lying beside each other; one of them is evidently broken across, the other is closed at the end; the latter may be traced to the exostome of an ovule, part of which only is represented. The ruptured tube belonged to another ovule which is not represented in the figure. But for the fact just mentioned, I should feel constrained at once to admit, that appearances are much in favour of Schleiden's opinion, excepting that part which has reference to the introflexion of the embryo-sac.

It will now be evident, therefore, that in *Euphrasia*, the ovule tubes are not prolongations of the apex of the nucleus, but proceed from the interior of the embryo-sac. As already mentioned, I am not at present prepared to state positively the relation between the tube and the embryo.

The majority of observers seem to agree respecting the presence of pollen-tubes in the tissue of the stigma and style; and they have been traced into the interior of the ovarium. That part of the subject which has reference to the presence of such tubes connected with the ovule, and their nature, has given rise to much difference of opinion.

Mirbel long ago pointed out the existence of tubular prolongations proceeding from some part of the ovule. Those observed by Mr. Brown in the *Orchideæ* were supposed to have their existence determined by the action of the pollen, but not to be directly derived from it. Schleiden spoke emphatically respecting the pollen-tubes reaching the embryo-sac, and the same was admitted by Meyen, though they differed respecting the subsequent relations of the two. Griffith demonstrated the presence of both pollen- and ovule-tubes. Hartig admitted the existence of three kinds in connexion with the ovules in different plants: first, true pollen-tubes, as in the *Coniferæ*; second, prolongations of the conducting tissue of the style, as in some *Cruciferæ*; lastly, tubes proceeding from some part of the ovule itself, as in certain *Cupuliferæ*. Gasparrini alludes to their presence in connexion with the ovule, but supposes them to be derived from the conducting tissue of the style; Hartig and he are therefore agreed in this, in regard to some plants at least. In *Orchideæ*, Amici, Mohl and Müller have all recently traced the pollen-tube through the foramina of the coats to the embryo-sac. Hoffmeister has made similar observations in the *Œnothereæ**. Tulasne says he has traced the pollen-tube into the interior of the embryo-sac. The opinions respecting them are therefore three: first, they are true pollen-tubes, an opinion supported by Schleiden, Meyen, Amici, Mohl, Müller, Gelesnow, Tulasne and others; second, they are derived from the conducting tissue of the ovarium, a view supported by Gasparrini, and also by Hartig, in reference at least to certain plants; third, they are derived from some part of the ovule itself, issuing from it, not directed towards it; this opinion derives support from the observations of Griffith and Hartig, and in the first part of this communication I have expressed the same in reference to *Euphrasia*.

Admitting that the pollen-tube reaches the embryo-sac†, the opinions respecting their subsequent relation to each other are the following. The view first promulgated by Schleiden was, that the pollen-tube pushed the summit of the embryo-sac before it and became invested by it. Hoffmeister admits that the tube in some instances where the embryo-sac is very delicate does push it inwards a little distance, but he also speaks of the tube becoming distorted by the resistance of the embryo-sac. Gelesnow, and subsequently Tulasne, state that the tube actually penetrates the embryo-sac and lies within it, and Schleiden has recently admitted the possibility of this in certain cases. Amici, Mohl, Müller and others state that it is merely applied to the sac at or near the apex; Meyen went a step farther, and supposed that their respective membranes were absorbed at the point of contact, thus permitting the direct mixture of the contents of both.

The action of the pollen in regard to the origin and subsequent development of the embryo may next be alluded to. It may however be observed, that the universality of a law having reference to the necessity for the action of the pollen is not now tenable, after the statement of Mr. Smith respecting the female plant of *Cœlebogyne*, and the still more recent observations of Gasparrini on the cultivated Fig. These statements will also diminish the tendency to call in question the observations on the Hemp long since recorded. Still, the action of the pollen, whatever be its nature, cannot generally be set aside.

It will be necessary to allude briefly to the stages through

* An account of the observations of Amici, Mohl, Müller and Hoffmeister, by Mr. Henfrey, is published in the 'Annals of Nat. Hist.' for Jan. 1848.

† Amici applies the term 'embryonal vesicle' to the earliest stage of this organ.

which the embryo passes. The first or earliest condition is that of a simple cell, the germinal vesicle of Amici and others; it may be compared to the reproductive cells of some of the Algæ, and might be denominated with propriety the *sporoid* stage. The appendage termed 'suspensor' is worthy of notice; it is usually very highly developed in the sporoid embryo, and more so in some plants than in others; in some of the *Cruciferæ*, for example, it attains considerable dimensions. I have seen an embryo of *Draba verna* $\frac{1}{440}$ of an inch long, with a suspensor three times that length. Mr. Griffith describes the embryo in *Gnetum* as being attached to an enormously long, tortuous, but irregularly twisted cellular suspensor, its length varying from $3\frac{1}{2}$ to 5 inches; the whole length of the seed being about 1 inch.

Different opinions are entertained respecting the true nature of this appendage. According to Schleiden's view it is part of the pollen-tube; in the *Orchideæ* it would seem from Amici's observations to be part of the embryo-sac; he states that the part of the sac which was in contact with the pollen-tube becomes elongated upwards, dividing likewise into cells, which are transparent and situated one above another, so as to form a large confervoid filament; thus traversing in the opposite direction the course followed by the pollen-tube, becoming enlarged and passing through the orifices of the tegmen and testa, and being prolonged even as far as the placenta. According to Mohl the suspensor is essentially connected with the embryo, both being produced by the growth and division of the germinal vesicle, the lowest cell, the embryo, growing faster than the others. In *Tropæolum*, however, the development of the suspensor seems to precede that of the embryo; such at least is the result of Mr. Wilson's observations upon that plant*. It has been already stated that the embryo in its first stage may be compared to the spore of an Alga; future observations may afford greater reason than at present for saying, that the sporoid embryo of some phænogamous plants germinates *in situ*, emitting a confervoid filament, and requiring no transference to a new nidus, but finding in the interior of the embryo-sac all the conditions necessary to its existence and future development as a spore up to a certain period. In such Algæ as *Vaucheria, Derbesia*, &c., the spores usually escape from the cell in which they are produced; being furnished with cilia they are enabled to disperse themselves abroad, after a time they become fixed, and produce a plant like the parent. We may suppose that such change of circumstances is necessary to their proper development; the very fact of number alone would in certain cases be an obstacle to their

* London Journal of Botany, vol. ii. p. 623.

growth in their original situation. In some instances however they do germinate *in situ*; these form the exception and not the rule. The sporoid embryo is usually solitary (*Citrus, Coniferæ,* &c. present exceptions); it does not require to change its place, but begins to germinate *in situ,* producing a confervoid filament, the embryo suspensor, which is usually directed towards the apex of the nucleus. But it may be objected to this idea, that spores do not germinate from any special fixed point; this however is not proved, for who has yet demonstrated that they have not a fixed point for the origin of the thread they produce? Sometimes however the suspensor is not directed towards the micropyle, but away from it; Gasparrini has observed this in *Citrus,* and Griffith observed that in *Osyris* the part corresponding to the suspensor has a direction quite opposed to the point reached by the pollen-tube. In the ovule of *Euphrasia,* the peculiarities of which have been already described, it is probable that the tubular filamentous appendage which protrudes from the apex of the embryo-sac is a prolongation of the terminal joint of the suspensor; at all events it cannot be derived from the pollen for reasons already given; at the same time it is not denied that the pollen-tube may reach and come in contact with the apex of the sac, though I have hitherto failed in detecting its presence. In a former communication an opinion was expressed that the jointed appendage of the embryo in the *Orchideæ* is no part of the pollen-tube, as supposed by Schleiden, but a process from the embryo itself; it was also added, that a tubular prolongation of its terminal joint might account for the presence of those tubes so abundant upon the placenta, and which had been by most observers considered to be derived from the pollen. From the observations of Mohl and others it would appear that the statement alluded to was only partially correct, their observations having confirmed the first part, but shown the second to be erroneous. For reasons already mentioned it would be premature to state that the production of the confervoid filament or suspensor, in other words, the germination of the sporoid embryo, forms the second stage of its development.

This stage appears to be quite independent of the action of the pollen. Mirbel and Spach in 1839* demonstrated that the first appearance of the embryo, the germinal vesicle, called by them primary utricle, precedes the application of the pollen. This early formation of the germinal vesicle, the first outline of the embryo, was proved by them in a large number of *Gramineæ*. Its independence of the pollen need scarcely be spoken of in *Cælebogyne* and *Citrus* already alluded to. The ob-

* Report by M. Giraud in 'Annals of Nat. Hist.' vol. v.

servations of Mohl on the *Orchideæ* lead to the same conclusion; those of Müller on the same family have a similar import. Mr. Henfrey in his report already quoted observes, "The whole question appears to be narrowed to the determination of the point, whether the germinal vesicle does actually exist before impregnation, since if that can be proved, all appearances yet observed may be reconciled by allowing for very slight errors in interpreting and delineating them."

The most careful and trustworthy observers speak with caution respecting the real nature of the action produced by the pollen-tube upon the ovule in impregnation. We have seen that at least one stage of embryo-life is independent of the contact of the pollen-tube with the embryo-sac; this I have ventured to denominate the sporoid stage. In some few cases, viz. *Cœlebogyne* and others, all the stages are equally so; generally however the future progress of the embryo is determined by the action of the pollen, whatever the nature of that action may be. The production of true radicle, cotyledons and plumule will constitute the last stage of embryo-development, and it is in reference to it that the best instruments cease to afford us any precise information. We can trace the progress of the organs in question, but we cannot state precisely in what way the action of the pollen influences their development. We do not derive any very clear information from such statements as those of Oken*, when he tells us that "the pollen electrifies, animates or inspirits the ovarium—that the male imparts nothing in impregnation but the solar ray or fluid nervous mass in its semen, which awakes, animates and inspirits the quiescent female—that the pollen is a most highly differenced electrical product; the seed-granule a wholly indifferent and tranquil mucous mass. The pollen falls upon the stigma of the pistil, and irradiation has taken place; the material fruit-capsule gains thereby so much polarity, that saps enough ascend, in order to develope the germless seed-vesicles."

The theory of Schleiden had the advantage over all others that it directly accounted for the presence of the embryo. Some observations of Mr. Griffith seemed to lead to a conclusion nearly similar, the difference being that the embryo is not developed directly from the end of the pollen-tube, but from cells produced by that part. It is presumed that no one has hitherto traced a tube through its whole length, connected with the pollen-grain at one end and with the embryo at the other.

* Oken's Philosophy of Nature, Ray Society, 1847.

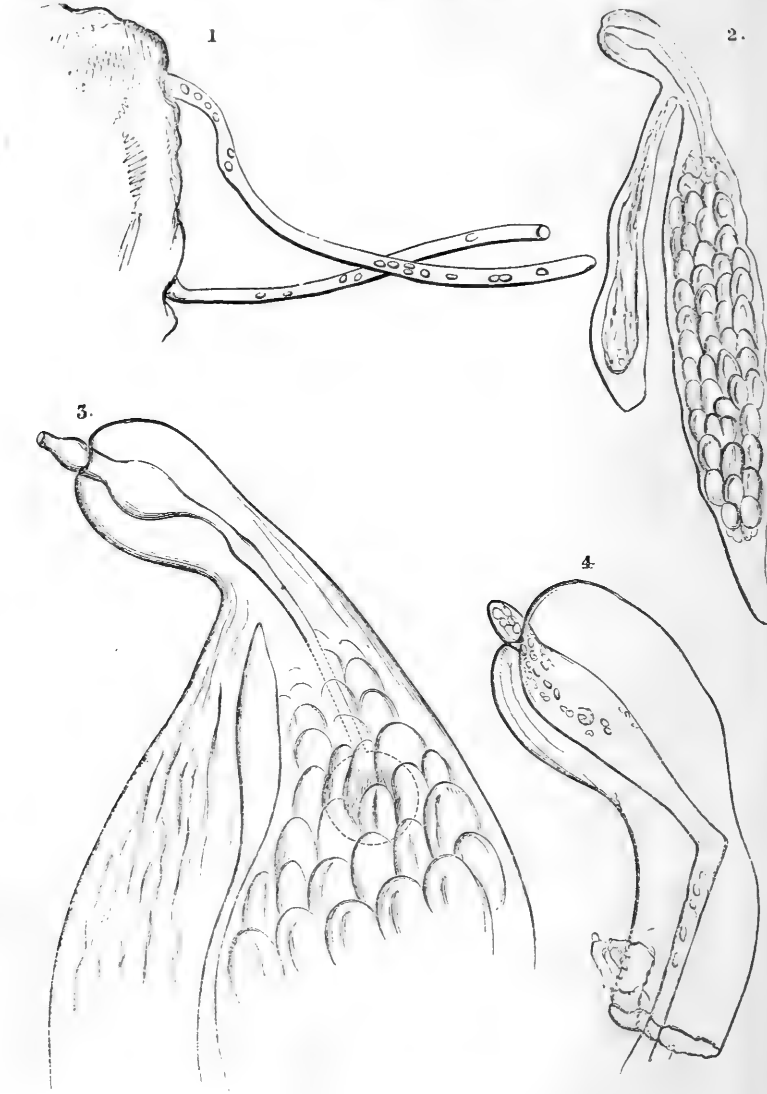


Fig. 1. Part of an ovule with a tube issuing from the foramen and terminating in a closed extremity.
Fig. 2. Embryo-sac and appendage.
Fig. 3. Part of another more highly magnified, showing the tube which traverses the sac.
Fig. 4. Neck and bulb of the sac with tube more highly magnified.

IX. *Notes of* Diatomaceæ *found in the stomachs of certain Mollusca.* By George Dickie, M.D., Lecturer on Botany in the University and King's College of Aberdeen.

Read 9th March 1848.

Professor E. Forbes has remarked that the stomachs of fishes are often zoological treasuries. The Haddock is a great conchologist; the Cod is more devoted to the Echinodermata, having a great taste for that tribe.

Certain Mollusca are equally indefatigable collectors of *Diatomaceæ*; they have been found in the stomachs of the Oyster, Clam, &c.; and Dr. Hooker in the 'Botany of the Antarctic Voyage' states, that the stomachs of *Salpæ* and other (especially of the naked) Mollusca invariably contain *Diatomaceæ*, sometimes several species. These *Salpæ* were washed up in masses on the pack ice, and in decay they left the snow covered with animal matter impregnated as it were with *Diatomaceæ*. He found that the contents of the stomach of every *Salpa*, between the latitudes of the North Tropic and 80° South, invariably contained the remains of these minute plants. *Dictyocha aculeata* was universally observed in the stomachs of those found off Victoria Barrier. Mr. Lee has found them abundant in the stomach of the common Barnacle.

The following notes of species detected in the stomachs of different species of *Ascidia* and of the freshwater Mussel (*Mya margaritifera*, L.) may be worthy of record. They do not appear to have the same discrimination as to their prey which the fishes would seem to exercise, every object, whatever be its nature, coming within the sphere of the currents produced by the cilia, is swallowed, provided its size be not too great. The *Ascidia* examined were from depths varying from twenty-five to thirty fathoms, and five to six miles from land.

A time was when there would have been some hesitation in offering to the Society such a communication as the present, owing to the conviction that some of the organisms to which it has reference really belonged to the animal kingdom. The very important discovery made by Mr. Thwaites, that they present examples of conjugation like *Zygnema*, &c., leaves their true nature no longer a doubtful question. There may still be some dispute respecting the position occupied by such forms as *Coscinodiscus, Actinoptychus,* &c.; but if it be admitted, and there seems no reason for hesitation, that such genera as *Meloseira* and its allies are true plants, it will not be difficult to understand also the nature of those just mentioned, the transition from the one to the other being obvious.

Diatomaceæ found in the stomachs of different species of *Ascidia*:—

Eunotieæ.

Epithemia Sorex, *Kg.?*

Fragilarieæ.

Fragilaria pectinalis, *Ehr.*
Diatoma flocculosum, *Ag.*

Meloseireæ.

Meloseira sulcata, *Kg.*
M. Jurgensii, *Ag.?*

Surirelleæ.

Surirella?
Synedra lævis, *Ehr.*

Cocconoideæ.

Cocconeis Pediculus, *Ehr.*
Doryphora amphiceros, *Kg.*

Achnantheæ.

Achnanthes longipes, *Ag.*

Cymbelleæ.

Cymbella maculata, *Kg.*

Gomphonemeæ.

Gomphonema pohliæforme, *Kg.*

Naviculeæ.

Navicula Hippocampus, *Ehr.*
Ceratoneis Closterium, *Ehr.*

Coscinodisceæ.

Coscinodiscus Patina, *Ehr.*
C. lineatus, *Ehr.*
C. eccentricus, *Ehr.*
Actinocyclus undulatus, *Bailey.*
Actinoptychus senarius, *Ehr.*

Actinisceæ.

Dictyocha gracilis, *Kg.*

This list will afford some idea of the nature of the deposits going on in the Aberdeen bay at the depth and distance from land already mentioned.

The following species were evidently in a living state:—*Meloseira sulcata, M. Jurgensii, Synedra lævis, Navicula Hippocampus, Surirella?, Coscinodiscus Patina, Actinoptychus senarius,* and they were also very common; in this latter respect, however, they were not superior to the *Dictyocha* and *Doryphora.*

Of those enumerated, the following are usually met with in fresh water: *Fragilaria pectinalis, Diatoma flocculosum, Cocconeis Pediculus, Cymbella maculata* and *Gomphonema pohliæforme*; they were also much less abundant than the others. Their presence is readily accounted for, when it is considered that two large rivers, the Dee and Don, besides numerous smaller streams, empty themselves into the bay. Mr. Thwaites informs me that he has found the *Meloseira sulcata* both in fresh and brackish water. Some of the species mentioned are not uncommon in the mud of our harbour.

Mixed up with the *Diatomaceæ* were numerous individuals belonging to two or three forms of Foraminifera, also spiculæ of a species of *Grantia* and fragments of *Ulvæ*, with particles of silex in a finely divided state.

Some of those enumerated have a very extensive distribution: *Meloseira sulcata* has been found at Melville Island, and by Dr. Hooker at Victoria Barrier, where *Coscinodiscus eccentricus* and *C. lineatus* also occur. These and others are abundant in guano from Africa and Peru, and are now in myriads mixed with the soil of our fields, and their presence may perhaps at a future time be a puzzle to some assiduous Philomikros who may be ignorant of the history of British agriculture.

Although temperature may exercise little influence over the distribution of *Diatomaceæ*, it may not be irrelevant to record here that of the sea in the Aberdeen bay, as ascertained by Mr. James Stratton, whose observations were made occasionally from March 1845 to September 1846 inclusive. The mean temperature at a mean depth of 24·5 fathoms, four miles from land, is 47°·7 F., being nearly one degree higher than that of the air as observed in the vicinity of Aberdeen. The minimum took place in March, being 39°·5 F., exactly the mean temperature of the ocean according to Sir J. C. Ross.

The freshwater Mussel (*Mya margaritifera*, L.) is abundant in both the Dee and Don. The specimens in whose intestines the following *Diatomaceæ* occurred, were from the former river eighteen miles inland.

Meridieæ.

Meridion circulare, *Ag.*

Fragilarieæ.

Fragilaria hyemalis, *Lyngb.*
Diatoma flocculosum, *Ag.*
D. tenue, *Ag.*

Meloseireæ.

Meloseira distans, *Kütz.*?

Surirelleæ.

Synedra capitata, *Ehr.*
S. tenuis, *Kütz.*

Cocconoideæ.

Cocconeis Pediculus, *Ehr.*

Achnantheæ.

Achnanthes minutissima, *Ehr.*

Cymbelleæ.

Cymbella flexella, *Kütz.*
C. leptoceras, *Kütz.*?
Cocconema cymbiforme, *Ehr.*

Gomphonemeæ.

Gomphonema geminatum, *Ag.*
G. pohliæforme, *Kütz.*
G. minutum, *Ag.*

Naviculeæ.

Navicula rhomboides, *Ehr.*?
N. cuspidata, *Kütz.*
N. viridis, *Kütz.*

Intermixed with these were spiculæ of *Spongilla*. Generally speaking the individuals of each species were of the minimum size, certainly far less than that usually attained. Of those brought within the sphere of the currents produced by the cilia, the smaller alone were swallowed. Of the species enumerated I have found the following on our mountains at heights varying from 2800 to 3800 feet: viz. *Meridion circulare*, *Diatoma floccu-*

losum, D. tenue, Meloseira distans ?, *Gomphonema pohliæforme, G. minutum, Navicula rhomboides* ? and *N. viridis*. The *Meloseira* I have found to constitute a considerable proportion of the fine black mud found beneath patches of snow on Ben-na-Muich Dhu.

X. *Notice of a new species of* Spiridens.

By R. K. Greville, LL.D., F.R.S.E., F.L.S. &c.

Read 9th March 1848.

The genus *Spiridens,* established by Nees von Esenbeck in the 11th volume of the 'Nova Acta Acad. Cæs. Leopold. Car. Naturæ Curiosorum,' has hitherto contained the single species it was constituted to receive, viz. *Spiridens Reinwardtii.* This most noble of all mosses, as it is justly designated by Sir W. J. Hooker, is a native of the Molucca Isles; twelve inches or more in height, with a robust, Bartramia-like habit. It is figured in the Transactions above-mentioned; but the British botanist will also find a figure and description in the first volume of Sir W. J. Hooker's 'Botanical Miscellany,' published in 1830.

In looking over a small collection of Cryptogamous plants recently gathered in the island of Tahiti by Dr. Sibbald and sent by him to Professor Balfour, I found two specimens (only two, alas!) of a moss which a single glance convinced me must belong to the genus *Spiridens*; and the capsules being in a perfect state enabled me to determine this at once in the most satisfactory manner. The resemblance which it bears in general character to *S. Reinwardtii* is so marked, that at first it seemed doubtful whether it might not be a mere variety, but a more careful inspection rendered the specific distinctions quite apparent. The new species is a smaller and more slender plant, six to nine inches long or more, the leaves scarcely more than half the size, the capsules more cylindrical and the subulate termination of the operculum considerably longer and finer. It is under the microscope, however, that the most characteristic features are perceived to exist in the leaves; the margin of which in *S. Reinwardtii* is distinguished by a broad flat border closely and sharply toothed; in the new species by a very narrow thickened border remotely toothed. Without entering into a minute description, uncalled for in so brief a notice, the following specific characters may be assigned to the two mosses:—

S. Reinwardtii (Nees); foliis late marginatis, acute dentatis; dentibus approximatis; capsulis ovato-oblongis.

S. Balfouriana (nob.); foliis anguste marginatis, remote dentatis; capsulis ovato-cylindraceis.

This beautiful species of one of the finest genera in the family I have sincere pleasure in naming after my highly esteemed friend Dr. Balfour, Professor of Botany in the University of Edinburgh.

EXPLANATION OF PLATE III.

Fig. 1. *S. Balfouriana*, nat. size.
Fig. 2. Leaf.
Fig. 3. Margin of the leaf of *S. Reinwardtii*.
Fig. 4. Ditto of that of *S. Balfouriana*.
Fig. 5. Perichætial leaves and capsule.
Fig. 6. Peristome.—Figs. 2–6 all magnified.

XI. *Notice of two new species of Ferns belonging to the genera* Oleandra *and* Grammitis. By R. K. GREVILLE, LL.D. &c.

READ 9TH MARCH 1848.

THE genus *Oleandra* of Cavanilles, adopted by Presl and now generally received for a section of the old genus *Aspidium*, is one of the most natural in habit of the family of Ferns, and not less beautiful than well-defined. It is at the same time so limited in extent that the addition of a new species becomes a subject of considerable interest. The recorded species are *Oleandra nodosa* (*Aspidium nodosum*, Willd.), native of the islands of the West Indies; *O. articulata* (*Aspidium articulatum*, Sw.), found in the Mauritius; *O. neriiformis* (*Aspidium neriiforme*, Sw.), growing in the Philippine Islands and the East Indies; *O. Wallichii* (*Aspidium Wallichii*, Hook.), confined to Nepal; and *O. pilosa*, Hook., brought by Sir Robert Schomburgk from British Guiana. The last-named species, which is figured by the author in his beautiful 'Genera Filicum,' tab. 45, is most allied to the fern I have now the pleasure of laying before the Botanical Society. The latter was recently communicated to Professor Balfour from Tahiti, where it was collected by Dr. Sibbald, a gentleman, who, under all the disadvantages arising from the confusion which existed in that unhappy island, during the time of his visit, made some botanical discoveries of great interest; and I feel no small satisfaction in dedicating to him this very fine fern.

The character of the Hookerian species with which it has to be contrasted is as follows:—

O. pilosa (Hook.); stipite ad basin articulato, fronde subtus pubescenti-hirsuta, indusiis longe ciliatis.—*Hook. l. c.*

Dr. Sibbald's fern may be thus defined:—

O. Sibbaldii (nob.); stipite ad medium articulato, fronde utrinque pubescenti-hirsuta, indusiis integerrimis.

The frond is about eighteen inches long, membranaceous, linear-lanceolate like all its congeners, but more or less gradually attenuated below, and in this respect differing much from *O. pilosa*; both surfaces are pubescent, the margin especially, fringed with hairs; beneath, the midrib is set with long chaffy scales.

The arrangement of the sori, although not so regular as in *O. neriiformis,* is much more so than in *O. pilosa,* forming a more or less undulating line on each side, at from two to four lines distance from the midrib. I could have wished that the indusium had been in a younger state, nevertheless the organ is quite entire, and there is not the slightest trace of ciliation.

Another fern in the same collection, discovered in Raiatea, of which there exists only one specimen, appears like the former to be undescribed, and to possess considerable interest from its ambiguous appearance. With a general form of frond bearing a close resemblance to *Blechnum Spicant,* it has the sori of a *Grammitis;* and totally unlike as it is in habit to any *Grammitis* with which I am acquainted, I do not see how it can be placed in any other genus.

Grammitis blechnoides (nob.); fronde coriacea, utrinque attenuata, profunde pinnatifida, soris lineari-oblongis, subobliquis, numerosis.

Fronds numerous, from a creeping rhizoma which is densely covered with pale reddish brown scales, lanceolate, coriaceous, glabrous, seven to nine inches high, attenuated at each extremity, pinnatifid almost if not quite to the rachis, the segments alternate, entire, linear, obtuse, about half an inch long in the widest part of the frond, diminishing gradually in size below until they disappear a few lines from the rhizoma. Veins simple, internal. Sori oblong or linear-oblong, slightly oblique, arranged in a line on each side between the midrib and the margin, somewhat sunk in the thick substance of the frond.

EXPLANATION OF PLATE IV.

Fig. 1. *Grammitis blechnoides,* natural size.
Fig. 2. One of the segments, a portion of its substance removed to show the venation.
Fig. 3. Sori.
Fig. 4. Capsules.
Fig. 5. Seeds.—Figs. 2–5 magnified.

XII. *A Supplement to "A Synopsis of the British Rubi."* No. II. By Charles C. Babington, M.A., F.L.S., F.G.S. &c.

Read 11th May 1848.

Some apology may be necessary for the publication of a second Supplement to my 'Synopsis of Rubi,' in which several new forms are proposed as varieties of recognized species, and one supposed new species is described. It probably will be said of these, as it has been of former descriptions of *Rubi*, that they are only portraits of individuals, not accounts of species or even varieties. In answer to this it may be stated, that several of the plants to which those remarks referred, although originally noticed in one spot (not as single plants, but a crowd of them), have since been found in other and distant parts of the kingdom. As an illustration—*R. Salteri* found originally in the Isle of Wight was noticed by me at Llanberis in North Wales, in the summer of 1847;—*R. Borreri* has occurred in several new localities;—*R. Babingtonii* grows in Shropshire and Caernarvonshire.

The only plant, amongst those now first published, which I have been unable to refer to any described species, exists as scattered but very numerous individuals throughout a district of several miles in extent.

I am far from claiming for those plants which I call species or varieties respectively an absolute right to that rank, and that only; but merely place them in such a position as the information at my command leads me to think their proper rank and position. The time will doubtless come when botanists will be in possession of sufficient knowledge of *Rubi* to group them into real, not supposed species; but it is only by the careful and long-continued study of forms that such knowledge can be obtained. The definition of forms is the first step, the combination will be the second. Cultivation from seed is one of the most valuable modes of obtaining a true knowledge of these plants. This has now been done to some extent by persons well-acquainted with the described plants, and several others are about to undertake it; such experiments conducted by others are of little value.

4*. *R. affinis* (W. & N.); caule suberecto arcuatove anguloso glabriusculo, aculeis validis paululum deflexis declinatisve, *foliis* quinatis utrinque viridibus subtus sericeo-pubescentibus *basi planis apicem versus subundulatis* grosse crenato-cuspidato-serratis, foliolo terminali cordato vel cordato-ovato cuspidato infimis petiolatis, *paniculæ* compositæ foliosæ superne *tomentosæ ramis* cymosis *erecto-patentibus* aculeis infra deflexis, sepalis a fructu reflexis longe acuminatis.

R. affinis, *Rub. Germ.* 18. t. 3; *Arrh. Rub. Suec.* 25; *Fries, Summa Veg. Scand.* 165; *Lees in Steele Handb. Bot.* 58?; *Leight. in Phytol.* iii. 73, not *Fl. Shrop.* 226.

Stems mostly suberect, sometimes elongated and arching, angular or even furrowed, purple, with or without a few hairs. Prickles confined to the angles of the stem, large, strong, a little deflexed or declining, from a dilated compressed purple base, tip yellow, or wholly yellow. Leaves digitate-quinate, thin, dull green and distantly pilose above, rather paler tomentose and with silky pubescence beneath; midrib beneath with a few short stout hooked prickles becoming longer and generally more hooked on the petioles. Terminal leaflet cordate, cordate-ovate, or cordate-orbicular. Lower pair of leaflets slightly overlapping the intermediate pair.

Flowering shoot surrounded at its base by scales which are white with silky pubescence. Branches of the panicle ascending and together with the summit of the rachis pilose and tomentose. Prickles large from a broad compressed base, numerous; the upper ones slender nearly straight and declining. Sepals densely tomentose hairy and white on both surfaces; strongly reflexed from the black fruit.

Shawbury Heath and other places in Shropshire, *Rev. W. A. Leighton.* Great Cowleigh Park near Malvern, *Rev. A. Bloxam.* The Torrents near Dolgelly; and the Wrekin, Salop, *Mr. Lees.* Glen Falloch and Loch Eil in Scotland; and Llanberis in North Wales.

Obs. 1. A form of this species is sometimes found with more slender nearly straight and declining prickles, leaves pubescent not tomentose beneath, panicle thyrsoid with simple or few flowered branches, and fewer smaller and more slender prickles. This is possibly the result of shade.

Obs. 2. This plant is allied to *R. cordifolius,* but in that species the leaves are flat and less coarsely serrate, the barren stems always arching and the prickles on the panicle and flowering shoot all straight and declining. It is often very like *R. plicatus,* but the panicle of that plant wants the under coating of tomentum, its barren stems have slender prickles, the scales at the base of the flowering shoot are fuscous; and, as well-observed by my friend Mr. Leighton, the sepals of *R. plicatus* are "scatteredly hairy on the outside, chiefly at the base and apex, the white tomentum with which the inside is entirely lined forming only a narrow white line on the margins." *R. nitidus* also resembles *R. affinis,* but is distinguished by its coarsely and doubly serrated leaves and the patent or divaricate branches of its panicle.

Obs. 3. Some difficulty attends the determination of the plant described as *R. affinis* by Mr. Lees. A specimen from Great Cowleigh, so named by him for the Rev. A. Bloxam to whom I am indebted for it; one from the Wrekin, and another from near Dolgelly, both named *R. vulgaris,* for which my thanks are due to Mr. Lees himself, are *R. affinis.* A specimen received from Mr. Lees as *R. affinis* and gathered between Dolgelly and Trawsfynydd, North Wales, seems to be a state of *R. macrophyllus.* When characterizing *R. affinis* for Steele's Handbook, he placed it amongst the species with stems "arching and rooting at the extremity," but my observations lead me to consider that the suberect section is its true place.

8. *R. corylifolius* (Sm.!); caule decurvato vel procumbente teretiusculo glabro, *aculeis subulatis rectis tenuibus,* foliis quinatis subtus mollibus pallidioribus marginem versus undulatis planis vel decurvatis, foliolo terminali rotundato-ovato cordatove, *infimis subsessilibus intermediis incumbentibus,* panicula subcorymbosa, *sepalis ovatis* a fructu reflexis, *stylis virescentibus, toro oblongo pedunculato.*

R. corylifolius, *Sm. Fl. Brit.* 542; *Eng. Bot.* 827; *Arrh. Rub. Suec.* 16; *Bab. Man.* ed. 1. 95, ed. 2. 98; *Syn. Rub.* 12; *Fries, Summa Veg. Scand.* 168.
R. affinis, *Bab. Man.* ed. 1. 93.
R. affinis γ, *Leight. Fl. Shrop.* 226.
R. sublustris, *Lees in Steele Handb.* 54.

Stems long, usually glabrous. Prickles moderate. Petioles deeply furrowed above with nearly straight prickles beneath. Panicle rather pyramidal than corymbose; branches corymbose, few-flowered, the lower ones often elongated and spreading; prickles long, straight, slender, declining, with a bulbous base; hairs ash-coloured. Primordial fruit oblong; torus manifestly stalked, leaving a clear space between the lowest drupe and the calyx. Base of the filaments and styles pink. Petals oblong, pinkish or white.

It is believed that the above will be found an improvement upon the character which I formerly gave for *R. corylifolius.*

Obs. Since this paper was communicated to the Society Mr. Leighton has published elaborate descriptions of what he considers as four varieties of *R. corylifolius* (Phytol. iii. 159), and has kindly informed me by letter to which of them several of the specimens in my collection belong. He also suggests that my *R. incurvatus,* described below, may be his *R. corylifolius* β, but with that opinion I cannot altogether agree, since his plant is characterized by a stem "green and slightly tinged with reddish purple," whilst the true *R. incurvatus* has the dark purple stem of his varieties γ. and δ.

I have no doubt that the figure published under the superintendence of Smith (Eng. Bot. t. 827) represents *R. corylifolius* α. *sublustris* (Leight.), not his γ. *Smithii*, and that he had the same plant in view when writing the 'Fl. Brit.,' but that the *R. corylifolius* of the 'Eng. Flora' is purposely so described as to include plants with much more angular stems. Two plants from near Bath, named *R. corylifolius* by my friend Mr. Borrer, than whom no higher authority exists, belong apparently to the variety δ. *intermedius* of Leighton.

The strongly angular stems of the plants included under Mr. Leighton's varieties γ. and δ. have always appeared to me to separate them from the true *R. corylifolius*, i. e. from his varieties α. and β, although the latter has slightly angular stems. They also have much less, or not at all, subulate prickles, but rather compressed ones. Arrhenius remarks of *R. corylifolius* (the plant of Smith), "caulis sterilis teres, versus apicem angulatus, ... viridis, sub sole rubescens."

Doubtless during the present summer Mr. Leighton will examine his plants with reference to the form of the primordial fruit, the torus, the styles, and the direction of the edges of the leaves, and determine by means of these (according to my views) highly important characters the rank of the four forms which he has described. A careful examination of the dried specimens of them to which I have access has not enabled me to form a confident opinion upon them; but it is my firm belief that *R. incurvatus* is quite distinct from *R. corylifolius*; neither do I suppose that it is synonymous with either of Mr. Leighton's varieties of that plant, although some of the individuals included by him under more than one of them will perhaps be found to belong to it.

8*. *R. incurvatus* (n. sp.); caule arcuato anguloso glabriusculo pilosove, *aculeis validis* rectiusculis horizontalibus declinatisve, *foliis* quinatis coriaceis subtus tomentosis viridi-albis *marginem versus incurvatis undulatisque*, foliolo terminali cordato-ovato acuminato, infimis breve petiolatis intermediis dissitis vel incumbentibus, paniculæ angustæ ramis brevibus corymbosis, *sepalis ovatis attenuatis* a fructu hemispherico reflexis, *stylis dilute carneis, toro ovato sessili.*

Stem arching, angular, slightly furrowed, purple, nearly glabrous or with scattered patent hairs. Prickles purple with a yellow tip, hairy, much-enlarged and compressed at the base.

Leaves shining above, soft and greenish white beneath; their doubly crenate-dentate-apiculate margins turned upwards in a remarkable manner and wavy; midrib and petioles with strong hooked prickles with yellow tips; lower pair of leaflets oblong, shortly stalked, either overlapping or distinct from the obovate intermediate pair; terminal leaflet cordate-ovate, acuminate, on rather a long stalk; all acute. Petioles flat above or very slightly furrowed. Stipules linear.

Flowering shoot rather long, surrounded at its base by short scales white with silky pubescence, purple, hairy with patent hairs. Prickles strong, deflexed, purple with yellow tips, hairy. Leaves ternate, pilose above, pale green and hairy beneath; leaflets nearly equal, obovate or oblong, lateral ones lobed on the lower edge; petioles and midribs with small hooked prickles. Stipules linear or linear-lanceolate. Panicle narrow, compound, tomentose and pilose, with yellow setæ shorter than the hairs; prickles long, declining or slightly deflexed, rather slender; branches short, corymbose, the two or three lowest axillary, distant, the upper ones approximate, all patent; the upper half or two-thirds of the panicle ultra-axillary; occasionally the lowest branch is prolonged and forms a subsidiary panicle as in *R. corylifolius*; bracts trifid, broad. Sepals ovate or lanceolate, attenuated into a rather long linear point, woolly on both sides, ashy within, greenish externally; reflexed from the fruit but their points turned upwards, at that time tinged with red at the base within. Petals broadly elliptical, clawed, pink. Styles flesh-coloured. Primordial fruit hardly more than hemispherical; torus quite sessile, the lowest drupe adpressed to the base of the calyx.

Common in the valley of Llanberis, Caernarvonshire.

Obs. 1. The position of this plant appears to be almost exactly intermediate between *R. corylifolius* and *R. cordifolius*, but, as it seems to me, is quite distinct from either of them. In look it greatly resembles the former, but in character is far more nearly allied to the latter. The almost terete stem, slender bulbous-based prickles, rugose leaves with flat or decurved edges, furrowed petioles, oblong primordial fruit remarkable for its stalked torus, and the greenish styles, distinguish *R. corylifolius*. The flat edges of the leaves, furrowed petioles, panicle with rather numerous setæ, oblong primordial fruit and pale green styles, are the chief distinctions of *R. cordifolius*.

Obs. 2. It is probable that some of the plants referred to in Obs. 3, under *R. corylifolius* in my 'Synopsis of Rubi,' belong to the present species, but the great difficulty of determining several of the characters from the dried and pressed plant prevents me from noticing them any further in this place. I strongly suspect that some of the bushes named *R. rhamnifolius* (second form) by Mr. Leighton will prove to be *R. incurvatus*: indeed it can scarcely be doubted that a specimen from "the Flash near Shrewsbury" so named by him and marked as "*R. rhamnifolius* forme ordinaire" by Esenbeck, is *R. incurvatus*, although it has the pale reddish purple stem of *R. corylifolius* β (Leight.). A plant gathered at "Lyth Hill near Shrewsbury" by Mr. Bodenham, and named *R. leucostachys* by Mr. Lees, to whom I am indebted for it, seems also to be *R. incurvatus*.

Obs. 3. It is not without much hesitation that I now describe a supposed new species of *Rubi*, as I cannot but suspect that it is already named and described by some of the botanists who have published upon this genus. After a careful study of the descriptions of *Rubi* contained in British, and more especially continental works, I have been quite unable to detect this plant, and am therefore reduced to the necessity of imposing a new name upon it. Had there been only two or three bushes of it, I should have passed it over as an anomalous form of one or other of its allies; but when I find it occupying by its number a prominent place amongst the brambles in the valley of Llanberis, throughout a distance of five or six miles, I am led to the conclusion that it is really a distinct form constituting what, in this genus, we consider as a species. The characters of the living plant are so conspicuous as to distinguish it at a glance from the other brambles amongst which it grows. It will probably soon be found in other places.

11. *R. leucostachys* β. *vestitus*.
R. villicaulis α. et δ, *Bab. Man.* ed. 1. 95.
R. Leightonianus, *Bab. Ann. Nat. Hist.* xvii. 240, *Man.* ed. 2. 101.

The following observations quoted from a letter (dated Oct. 26, 1847) addressed to me by my friend Mr. Leighton, appear to prove indisputably that my *R. Leightonianus* is only an extreme state of *R. leucostachys*. He deserves credit for the pains which he has taken to elucidate this subject, but I must deplore that his acuteness has been so successful in this particular case, for he has thereby frustrated a proposed commemoration of himself and his labours. This is a remarkable instance of the advantage of carefully distinguishing and describing forms, as thereby attention is drawn to them and a better knowledge of the limits of species attained. If typical specimens of *R. leucostachys* and *R. Leightonianus* were alone seen, probably no botanist would doubt their distinctness; but when we trace *R. leucostachys* changing, in shady places, into *R. vestitus*, and that in denser shade acquiring the very thin large remarkably dentate and pale leaf of *R. Leightonianus*, we become convinced that only one variable species is before us. This conclusion is additionally enforced by the concurrent variation in the prickles. In the autumn of 1847 I was led to suspect that *R. Leightonianus* would be proved to be only an extreme state of *R. leucostachys,* from a difficulty which occurred to me when endeavouring to distinguish it from *R. vestitus* in a dense wood in Herefordshire. Shortly afterwards I received Mr. Leighton's remarks, accompanied by a series of specimens, and my suspicions were converted into certainty.

Mr. Leighton remarks as follows:—"If you examine the barren stem of *R. leucostachys β. vestitus,* growing in rather exposed situations, you will find the prickles on the middle and upper portions large, equal, fully developed, and confined to the angles or nearly so; but on the base of the stem the prickles are much more numerous, smaller, and scattered on all sides. The leaves have dense white tomentum on their under surface; and the prickles on the petioles are hooked and strong.

"On young plants, or those growing in shady woods, especially if moist, the barren stem presents throughout much the appearance of the base of the same part in exposed plants in its greener colour, and the inequality, slenderness and scattered position of the prickles. The leaves also are thinner and green on both sides, and the whole plant is destitute of that tawny colour which is peculiar to it when exposed. The prickles on the petioles are straight or nearly so.

"If you examine similar plants on higher and drier but still shady spots, the barren stem is found to have the same appearance as in the plant of moist places, but with a manifest tendency to more equality and regularity in the prickles. The under surface of the lower leaves is green, that of the upper ones has a whiter appearance. The prickles on the petioles are slightly curved or hooked, but a few are straight."

I am indebted to Mr. Leighton for a specimen from near Shrewsbury, in which the barren stems from the same bush have the small scattered slender prickles of *R. Leightonianus* in one part, the strong, equal and regularly distributed ones of *R. leucostachys* on another, and also several intermediate states. It may be safely added, in the words of Mr. Leighton, that the above "fully proves *R. Leightonianus* to be only a state of *R. leucostachys β. vestitus* growing in shade."

24. ***R. hirtus,*** W. et N.

α. hirtus; caule subtereti, foliis magnis quinatis inæqualiter mucronato-serratis, foliolo terminali ovali cuspidato, panicula tomentosa, sepalis vix aciculatis.

R. hirtus, *Rub. Germ.* 95. t. 43.

β. *Menkii*; caule subanguloso; foliis mediocribus quinatis vel ternatis inæqualiter et grosse mucronato-serratis, foliolo terminali ovali-lanceolato, panicula hirta, sepalis aciculatis.

R. Menkii, *Rub. Germ.* 66. t. 22.

γ. *foliosus*; caule anguloso sparsim piloso, foliis mediocribus quinatis inæqualiter mucronato-dentatis, foliolo terminali cordato acuminato, panicula hirta ad apicem foliosa, sepalis paululum aciculatis.

R. foliosus, *Rub. Germ.* 74. t. 28.

I have nothing to add concerning *var. α.* and *β*; *var. γ.* is now published for the first time. It grows in Hartshill Wood, Warwickshire, where it was discovered by the Rev. A. Bloxam, and to whom is also due the credit of determining its identity with the *R. foliosus*, Weihe. It does not quite agree with that plant, for in the 'Rubi Germanici' the stem is stated to be hairy, the terminal leaflet ovate cuspidate and finely serrate (but scarcely so represented on the plate), the panicle almost without setæ at the summit (according to the description, but many are shown in the figure), and the calyx without setæ or aciculi. In other respects the English plant agrees well with the description and figure of that found in Germany.

Obs. I am now convinced that the variety of *R. Radula* formerly referred by Dr. Bell Salter and myself to *R. foliosus* (Weihe) is not the plant intended by that author, which (whatever may be thought of the claims of my *R. hirtus γ. foliosus*) seems to be very closely allied to *R. Menkii* (Weihe).

25. *R. glandulosus*, Bell.

ε. *rotundifolius*; caule subanguloso piloso setoso, aculeis parvis multis, *foliolo terminali rotundo* cuspidato basi subcordato inæqualiter *duplicato-cuspidato-dentato*, prope basin mucronato-serrato, paniculæ hirtæ aculeis multis tenuibus rectis declinatis setis brevibus multis ramis paucis brevibus ascendentibus apiceque paucifloris.

Barren shoot rather angular with small numerous yellow prickles; hairs and setæ abundant, the latter very short. Leaves mostly ternate, thin, opake, with scattered hairs above, ashy and pilose beneath; terminal leaflet nearly round but slightly narrowed below, in one of my specimens it is considerably narrowed below; lateral leaflets unequally bilobed (or rarely divided into separate leaflets); all wavy at the margin; petioles armed like the stem. Hairs on the flowering shoot and panicle long, setæ mostly short and sunken amongst the hairs, prickles rather long and very slender; leaves ternate; branches very few, very short; sepals lanceolate with an attenuated point, setose, acicular, reflexed (?) from the fruit.

In small quantity in the same plantation with *R. glandulosus* γ. *rosaceus* and δ. *dentatus,* near Twycross, Leicestershire, *Rev. A. Bloxam.*

25*. *R. Güntheri,* Weihe.

β. *pyramidalis*; caule procumbente, *foliis* supra subglabris opacis : *marginibus deflexis, paniculæ pyramidalis* apice et ramis racemosis rachide recta rigida.

Stem quite prostrate, conforming itself to the inequalities of the ground, angular, not furrowed, greenish purple; prickles rather numerous, short, strongly declining or slightly deflexed, their base thick; hairs few; aciculi and short setæ rather numerous. Leaves ternate, or very rarely quinate-pedate, the edges bent downwards, green on both sides, opake with strongly impressed veins and scattered hairs above, paler and with yellowish hairy veins beneath; leaflets nearly equal, terminal one obovate-cuspidate with a subcordate base, lateral leaflets similar but narrower and unequal or lobed on the lower margin; all irregularly strongly dentate-serrate-apiculate; general and partial petioles and midribs armed beneath similarly but less strongly than the stem; stipules linear, hairy, setose.

Flowering shoot surrounded at its base by brown scales clothed with ash-coloured silky pubescence, long, very hairy, with rather numerous short and a few longer declining prickles; aciculi and setæ short, few, except at the upper part of the shoot and amongst the flowers. Leaves ternate; leaflets nearly equal, obovate-cuspidate, green and hairy on both sides with paler veins beneath; general and partial petioles armed like the shoot but with more numerous aciculi and setæ; the one or two uppermost leaves occasionally simple, ovate or cordate or lobed. Panicle very long, with several axillary racemose ascending branches and a long ultra-axillary pyramidal summit with patent or divaricate branches which are few-flowered and racemose below and one-flowered above; the whole remarkably pyramidal and very stiff; general and partial rachis and peduncles nearly or quite straight, very hairy, with slender straight yellow prickles and numerous purple setæ. Petals obovate-lanceolate, narrow, greenish white, widely separated. Styles pale green, pinkish below. Sepals lanceolate with a long setaceous point, ashy, downy, prickly, setose, green within, lying close to the fruit and either patent or forced back by it. Primordial fruit oblong, others shorter.

Valley of Llanberis, N. Wales, in great plenty. August.

Obs. This beautiful and conspicuous plant agrees so nearly with *R. Güntheri* that I think it best to consider it as a form of that species, but have thought it advisable to describe it at some length. Its chief differences consist in its very rigid and straight, not wavy, rachis; the divaricate rather than ascending upper divisions of the panicle; greenish white, not pink (?), petals; and more prickly and not truly reflexed sepals. It also much resembles *R. thyrsiflorus,* but has a different appearance owing to the almost constantly single-flowered and spreading upper divisions of its panicle and its narrower petals. Its examination has confirmed me in the opinion formerly expressed that *R. Güntheri* and *R. thyrsiflorus* of the 'Rubi Germ.' are forms of one species. When representing the plants in that work the artist seems to have been provided with a rather weak panicle of the former and a very strong one of the latter, thus causing them to appear more than naturally different.

In our plant the panicle is often several feet long, and its lower axillary branches are exactly like the smaller panicles of less vigorous shoots; the uppermost compound branches resembling the small panicles produced by weak plants.

25**. *R. scaber* (Weihe); caule arcuato subanguloso aspero, *aculeis* subæqualibus *validis brevibus declinatis deflexisve,* aciculis setis pilisque paucis brevissimis, foliis ternatis quinatisve supra pilosis subtus pallide viridibus pilosis inæqualiter apiculato-dentatis, foliolo terminali obovato-cuspidato, *paniculæ* tomentosæ superne ultra-axillaris *ramis divaricatis* subcorymbosis paucifloris, sepalis lanceolatis aciculatis setosis a fructu laxe reflexis.

R. scaber, *Rub. Germ.* 80. t. 32.

Prickles rather numerous on the barren stem, remarkably declining but scarcely deflexed on our plant, short with a thick base, yellow; aciculi, setæ, and hairs rather few, very short, with thick rigid bases, which remaining on the old stems give the file-like roughness to them for which this and the plants allied to *R. Radula* are remarkable. Leaves ternate or "quinate-pedate," opake and deep green with scattered hairs above, much paler but green with more numerous hairs beneath; lateral leaflets very strongly lobed, each lobe oval and cuspidate, upon a short ascending stalk; terminal leaflet obovate and cuspidate with a cordate base; all irregularly and rather doubly apiculate-dentate; general and partial petioles and midribs (both primary and also those of the lobes of the lateral leaflets) armed beneath with short thick yellow hooked prickles, the petioles also having rather numerous but extremely short aciculi setæ and hairs, the midribs with longer hairs but apparently without setæ or aciculi; stipules linear setose and hairy.

Flowering shoot surrounded by silvery scales, hairy, setose, with prickles like those of the barren shoot but smaller; upper part of the peduncles more setose (setæ purple), with a few aciculi, more hairs, an under coating of ash-coloured wool, and more slender and less deflexed prickles. Lowest and uppermost leaves simple, broad, rather cordate, deeply lobed; the others ternate with unequally oval or ovate lateral leaflets, the terminal leaflet obovate-acuminate and considerably narrowed below; all apiculate dentate, pilose and green on both sides, paler beneath. Panicle broad and relatively short, somewhat pyramidal; lower branches axillary, ascending, long, racemose-corymbose, few-flowered; upper ones ultra-axillary, divaricate, nearly corymbose, only three-flowered on my specimens (as they are also represented in the 'Rubi Germ.,' but not racemose as on that plate). Sepals lanceolate, woolly, aciculate, setose, greenish externally, loosely reflexed from the fruit. Petals oblong.

In Hartshill Wood, Warwickshire, in a dense thicket of brambles and briars, *Rev. A. Bloxam*. August.

Obs. It is very difficult to determine in which section of the genus this plant should be placed; indeed, its structure shows that the sections characterized from the barren stems are not so absolutely distinct as has been supposed by some writers. The armature of those stems would place it in the scabrous division with *R. Radula*, to the varieties *pygmæus* and *foliosus* of which the peculiar arms of its petioles show some similarity. In other respects it is very different from *R. Radula* and its allies. It seems far more correctly placed in close connection with *R. Güntheri* and *R. glandulosus*. In the 'Compend. Fl. Germ.' (ed. 2) it stands between *R. Güntheri* and *R. Menkii*. Its scabrous stem and very different panicle distinguish it from the former, and the very different prickles of the stem from the latter. From *R. glandulosus*, to the variety *Lejeunii* of which Mr. Bloxam thinks it is allied, the remarkable armature of the stem and the broad pyramidal divaricate panicle appear to separate it.

XIII. *Notice of a new species of* Antrophyum. By R. K. Greville, LL.D., F.R.S.E., F.L.S., &c.

Read 11th May 1848.

In addition to the two new species of ferns (*Oleandra Sibbaldii* and *Grammitis blechnoides*) recently communicated to Professor Balfour by Dr. Sibbald from the island of Tahiti, I have now to submit the description of a third to the Botanical Society. The discovery of this plant is an additional proof how much remains to be done in an island where numerous collections have been made, but which is evidently still rich in undescribed productions. It is to be hoped that Dr. Sibbald will have an opportunity of revisiting Tahiti under more favourable circumstances, and that he will add largely to his collections, especially of ferns and mosses.

The interesting fern which forms the subject of this short notice belongs to *Antrophyum,* a genus having undivided, more or less lanceolate fronds, in which the sori form continuous grooved lines on the simply reticulate venation. *Antrophyum* is thus nearly allied to *Hemionitis,* from which, it must be confessed, it scarcely differs, except in the simplicity of the frond, for the grooved sorus is a somewhat variable character.

There is however another genus, *Polytanium* of Desvaux, which has been separated on, as it appears to me, more slender grounds. In that genus the sori are not reticulated, but form uninterrupted parallel lines, connected however by non-soriferous veins.

The plant I am about to describe seems to do away with such a distinction; for in it the sori are parallel, uninterrupted, and might be described as remotely forked rather than reticulated, and so seldom does *any* division in the sorus take place, that it is sometimes simply continuous for two or three inches together.

Antrophyum Grevillii (Balfour in herb.); fronde sessili, late lineari-lanceolata, inferne præcipue attenuata, soris approximatis, parallelis, longissimis, villosis, remote furcatis.

I cannot find any described species of *Antrophyum* which at all corresponds with Dr. Sibbald's specimens. The fronds are tufted, ten to eighteen inches in length, fully an inch broad in the widest part, from whence they become insensibly narrower towards the base, which however never passes into a true stipes, although there is for the space of two or three inches an obscure midrib. The sori, which constitute the most remarkable feature, are so approximated as to be not more than a line apart, forming twelve or more uninterrupted lines, which sometimes divide at very remote intervals, but scarcely ever anastomose. The capsules, which are similar to those of the other species of the genus, are almost quite concealed by the mass of ferruginous hairs which arise along with themselves from the soriferous vein.

EXPLANATION OF PLATE V.

Fig. 1. *Antrophyum Grevillii*, nat. size.
— 2. A portion of the frond, showing the groove and soriferous vein.
— 3. A capsule with some of the ferruginous hairs.
— 4. Seeds.

XIV. *Notice of a deposit of Fossil* Diatomaceæ *in Aberdeenshire.* By George Dickie, M.D., Lecturer on Botany, King's College, Aberdeen.

Read 8th June 1848.

It is unnecessary to insist here upon the very general occurrence of silex in fresh and salt water, or the means by which it is dissolved and retained in solution; the very general distribution of Diatomaceous plants is a sufficient proof, if any such need be brought forward. It may be, that by some process like that called electrotype, the organisms in question are enabled to perpetuate their own beautiful forms, the impressions being taken in the purest transparent silex. The rapidity with which they are multiplied will account for the large deposits of fossil earth found in different parts of the world, and the indestructible nature of the mineral which they have the power of depositing in or upon their tissue enables us to recognize them long subsequently to the time when their vitality ceased.

In the month of March last, two different substances were sent to me for examination; they were described as having been found under a bed of clay at Premnay in the interior of Aberdeenshire. One of them consisted of small solid fragments of a dull white, the other had the form of a fine powder of a pure white. On examination it was found that the former consisted of decomposed felspar forming a kind of porcelain earth, the other had no small resemblance to some fossil earths with whose physical characters I was not unacquainted; accordingly, on submitting it to examination under the microscope, I found it to be entirely composed of *Diatomaceæ*. Being desirous of procuring additional information respecting the probable circumstances under which such a deposit might have taken place, I requested some particulars respecting it; my disappointment was considerable when informed that the decomposed felspar alone had been found under a bed of clay, but that the white powder was in reality the residue left after the use of peat as fuel, a quantity of which had been preserved, its peculiar appearance having attracted notice. The fact, however, is not less interesting when viewed in connection with a true fossil earth to be presently described, which was found by Mr. Murray, at Blackhouse near Peterhead, under a bed of peat, for specimens of which I am indebted to my friend Professor MacGillivray. The residue of the Premnay peat was found to consist of the following *Diatomaceæ* :—

Eunotieæ *.

Eunotia ocellata.
E. tetraodon.
E. turgida.
Himantidium Arcus.

Meridieæ.

Meridion circulare.

Fragilarieæ.

Fragilaria rhabdosoma.

Meloseireæ.

†Meloseira Italica.

Surirelleæ.

†Surirella bifrons.
Synedra Ulna.

Cymbelleæ.

Cymbella Ehrenbergii.
Cocconema lanceolatum.
Gomphonema lanceolatum ?

Naviculeæ.

†Navicula acrosphæria.
N. binodis.
N. dicephala.
†N. major.
N. nodosa β. striata.
†N. viridis.
Stauroneis lanceolata.
S. linearis.
S. Microstauron.
†S. Phœnicenteron.

Tabellarieæ.

Tabellaria ventricosa.

Coscinodisceæ.

Coscinodiscus minor.

This last was detected by Mr. Thwaites, to whose assistance I am indebted in naming the species. Those marked † were in greatest quantity, and the *Meloseira Italica* was more abundant than the others ; this species had not, so far as I am aware, been hitherto included in the list of British species, and I have found it in a living state very abundantly in several localities near Aberdeen ; it generally occurs at the sources of cold springs.

The residue so rich in *Diatomaceæ*, remaining after burning peat from the Premnay bogs, renders it exceedingly probable that separate deposits of fossil *Diatomaceæ* may yet be detected there.

The specimen from Peterhead, in possession of Dr. MacGillivray, is a mass of small specific gravity having a laminated structure with remains of vegetable fibre interspersed through it. It was found to contain nearly forty species of *Diatomaceæ*, viz.—

Eunotieæ.

Epithemia alpestris.
†E. gibba.
E. ocellata.
E. proboscidea.
E. turgida.
E. Zebra.
†Eunotia Monodon.
Himantidium Arcus.

Fragilarieæ.

Fragilaria rhabdosoma.

Meloseireæ.

Meloseira Italica.
M. subflexilis ?

Surirelleæ.

Campylodiscus Clypeus.

* The names are adopted from Kützing's work on the *Diatomaceæ*.

Surirella elliptica.
S. Solea.
Synedra capitata.

Cocconeideæ.

Cocconeis Pediculus.

Cymbelleæ.

†Cymbella Ehrenbergii.
C. cuspidata.
†C. helvetica.
†C. maculata.
†Cocconema cymbiforme.
Gomphonema minutum.
G. pohliæforme.

Naviculeæ.

Navicula attenuata.
†N. binodis.
N. dicephala.
†N. inflata.
N. major.
†N. oblonga.
N. radiosa.
N. rhomboides.
N. viridis.
Stauroneis lanceolata.
Amphora ovalis.
A. elliptica.

Tabellarieæ.

Tabellaria fenestrata.

Those marked † were most abundant.

XV. *On the form of the Capsule and Seeds as affording a specific character in* Primula vulgaris (*Huds.*), P. veris (*Linn.*), *and* P. elatior (*Jacq.*). By the Rev. W. A. Leighton, B.A., F.B.S.

Read 13th July 1848.

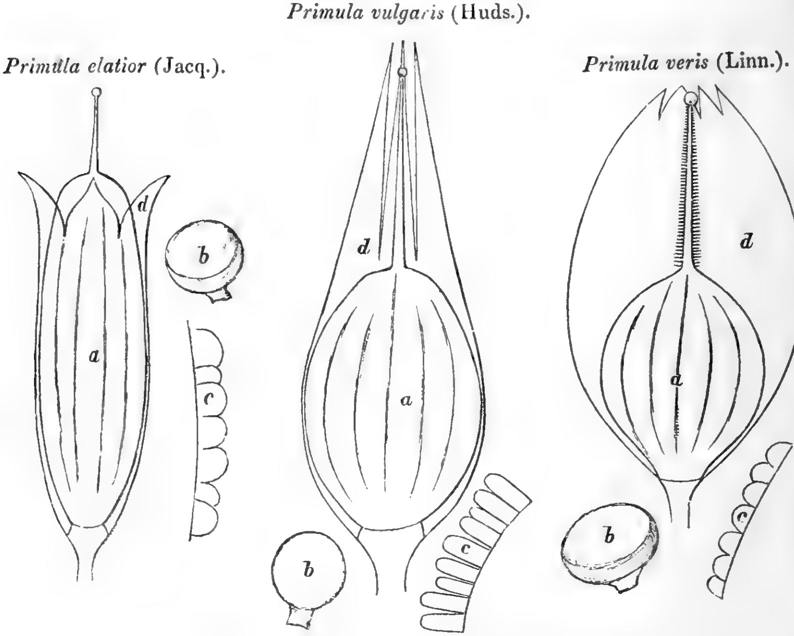
Very much has been written from time to time on the Cowslip, Primrose and Oxlip, both to prove their specific identity and the contrary; and many experiments have been undertaken with similar views, but as it appears to me without having arrived at any certainty. The question seems still an open one. Most of these writers, whose papers I have had the means of consulting, whilst they duly describe the forms and peculiarities of the leaves, flowers, scape and other parts of the above plants, never take any notice of the capsule and seeds. The same may be said of both English and continental botanists, whose works I have referred to.

It occurred to me that possibly good specific characters might exist in the form of the capsule and seeds. Accordingly, having a plant of the Bardfield Oxlip (*P. elatior,* Jacq.) in my garden, given to me in 1842 by my friend Mr. C. C. Babington of St. John's College, Cambridge,—and also Cowslips (*P. veris,* Linn.) and Primroses (*P. vulgaris,* Huds.), transplanted thither from the neighbouring fields, I determined to examine and compare the three plants in these particulars; and I was agreeably surprised to find my conjectures realized. The result of this comparison will be best exhibited by the accompanying drawings of these parts in the three plants, in which the relative proportions of each to the other have been carefully preserved.

The capsule of *P. vulgaris* is ovate, half the length of the calyx, the seeds globose, their surface elongato-papillose, the style glabrous, the subulate teeth of the calyx straight and meeting together at their apices.

In *P. veris* the capsule is elliptical, scarcely half the length of the calyx, the seeds forming round flattened discs, their surface rotundo-papillose, the style hairy, the short triangular teeth of the calyx incurved and converging, but not meeting together at their apices.

In *P. elatior* (Jacq.) the capsule is linear-oblong, as long as, or even slightly longer than, the calyx, the seeds forming round flattened discs, their surface rotundo-papillose, the style glabrous, the ovato-lanceolate teeth of the calyx curved outwards.



a. Capsule. *b*. Seed. *c*. Surface of seed. *d*. Calyx.

Luciefelde, Shrewsbury, June 6th, 1848.

XVI. *Stirpes Cryptogamæ Sarnienses; or Contributions towards the Cryptogamic Flora of Guernsey.* By the Rev. T. Salwey, M.A.

Read 9th November 1848.

So much has been done by Mr. Babington in his 'Primitiæ Floræ Sarnicæ' for the illustration of the phænogamous flora of the Channel Islands, that perhaps a brief notice of the cryptogamic botany of one of the islands of this group may be acceptable to some of the Members of the Botanical Society. Guernsey does not appear to be very prolific in cryptogamic plants—a variety of causes tend to produce this result—the open nature of the country; the great paucity of wood; the general dryness of the soil from the circumstance of all the rocks being of the primitive formation; and the very great proportion of the land being under the cultivation either of the spade or plough; all these circumstances are inimical to the growth and perfect development of cryptogamic plants. There are no woods in the island, and the soil even of the orchards is in general under the culture of the spade. It is at once evident therefore that the great variety of Agarics, Boleti, and the innumerable other Fungi which are found so abundantly in the extensive woods and rich pastures of England, have no corresponding habitats here in which to grow. The same reason limits the number of Musci, Hepaticæ and Jungermanniæ, whilst from the few brooks and ponds which are found in the island it is equally hopeless to expect a great number of freshwater Algæ. Even the lichens do not exhibit that luxuriance of growth which we find in the deep woods and glens of the Cambrian mountains. Thus the common *Parmelia saxatilis* is seldom found here in fruit, and the few meagre specimens of *Sticta pulmonaria* are also without apothecia. The abundance of their orchards led me to expect that I should discover here the *Parmelia chrysophthalma* which is found in the south of England; but my researches failed in discovering more than a single specimen of this plant in an orchard in Sark. My friend Mr. Lukis some years ago once found also a single specimen of the same plant in the northern part of

Guernsey. This island however possesses much to interest the lichenist from more northern regions. He will find here abundance of the *Roccella tinctoria,* and will also meet with *Lecanora milvina, Lecidea Salveii, Parmelia leucomelas, Sticta aurata,* and *Porina pustulata* of Ach.,—a plant hitherto a stranger to our British flora.

In the minute epiphyllous fungi the island is more prolific than I have found any locality of the same extent in England—some few species are in extreme abundance and very fine, as the *Puccinia Cotyledonis* and *Æcidium Bunii*—the *Dothidea rubra* also is much more highly developed than I ever found it in England, thus showing the influence of a southern climate on this class of plants. There was one circumstance however with respect to this tribe of plants which much struck me. In Shropshire and Herefordshire, as well as in Wales, it is perhaps not possible to find a sycamore-tree of which the leaves are not blackened with numerous specimens of the *Rhytisma acerinum;* whilst in Guernsey I could not even detect a single specimen, although I examined every tree I met with after my attention was attracted by this circumstance. The leaves of every sycamore-tree in the island are as perfectly free from this discolouring epiphyte as those of the plane-tree. One or two of the Uredines which I have sent to Mr. Berkeley he thinks may prove to be new species. Amongst this tribe of plants he has already named as new the *Depazea Caricæ* on the leaves of the common fig-tree, and the *Ustilago Salveii* on young plants of *Dactylon glomeratus.*

The richest part of the cryptogamic flora of Guernsey will doubtless be found in the marine Algæ. Were any one well-acquainted with this department of botany to be long resident here, I feel little doubt that some interesting discoveries might be made. The few opportunities I have had of studying them from short and occasional visits to the sea-coast, and this in only one or two localities, have given me little opportunity of becoming much acquainted with this branch of botany; whilst during the time of my residence in this island, the state of my health confined me so much to the house, that my botanical researches in every branch were greatly interrupted. The list therefore which I have sent you is only to be considered as "contributions" towards the cryptogamic flora of Guernsey, of which it is hoped that some native of the island will be induced to give us a more complete account, for what a stranger is enabled to discover in a brief visit can only be a small portion of the botanical treasures of the island.

I feel that I cannot conclude this short notice without expressing my best thanks to my friends Messrs. Borrer, Berkeley, Ralfs and Wilson for kindly naming such specimens as I was in doubt about.

List of Guernsey Cryptogamic Plants, with a few notices upon some of them.

Musci.

Phascum crispum ; β. rostellatum.
subulatum.
Pottia Heimii. Rocks in the parish of St. Peter du Bois on the coast.
Gymnostomum fasciculare, *Hook.* and *Tay.* in part (*Wilson*).
Physcomitrium ericetorum, *Bruch* and *Schimper*, var. (*Wilson*).
Gymnostomum pyriforme.
microstomum.
Weissia fugax. In a cave at Petit Bo.
controversa.
Grimmia pulvinata.
maritima.
Ceratodon purpureus.
Trichostomum canescens.
Dicranum bryoides.
adiantoides.
taxifolium.
squarrosum.
flexuosum.
scoparium.
heteromallum.
Campelopus densus. Jerbourg.
Tortula muralis.
ruralis ; β. lævipila.
aloides.
Polytrichum commune.
juniperinum.
aloides.
Entosthodon Templetoni. Road leading down to Petit Bo from the east.
Funaria hygrometrica.
Orthotrichum diaphanum. Catêl churchyard and upon elm-trees at the bottom of the Rohais road.
Orthotrichum tenellum. Do. do.
Bryum argenteum.
capillare.
cæspititium.
erythrocarpon. Walls about St. Peter's Port.
ligulatum.
hornum.
cuspidatum.
Bartramia pomiformis.
Pterigonium filiforme.
gracile.
Hypnum serpens.
purum.
plumosum.
sericeum.
alopecurum.
myosuroides.
proliferum.
prælongum.
rutabulum.
ruscifolium.
striatum.
cuspidatum.
triquetrum.
squarrosum.
filicinum.
scorpioides.
cupressiforme.
pumilum.
Teesdalii. Cave in Petit Bo.
resupinatum. Jerbourg.

Hepaticæ.

Riccia crystallina.
lamellosa.
Anthoceros punctatus.
Marchantia polymorpha.
hemisphærica.
Jungermannia bicuspidata.
pusilla.
albicans.
complanata.
polyanthos.
Jungermannia viticulosa.
bidentata.
heterophylla.
serpyllifolia.
dilatata.
tamarisci.
β. monilensis.
epiphylla.
furcata.

Lichenes.

Usnea plicata.
Evernia flavicans.
Ramalina calicaris.
  α. fraxinea.
  β. fastigiata.
Ramalina pollinaria.
  polymorpha.
  scopulorum.
Roccella tinctoria.
  fuciformis.

I cannot agree with the authors who unite these two plants. If intermediate states are to be considered as a sufficient ground for uniting what have hitherto been considered distinct species, then must a great many more of the *Cladoniæ* be united than is now done, for between the greater part of the different species in this genus there are so many intermediate states, that it is extremely difficult to know to what species to refer many specimens. Manufacturers have noticed that the *tinctoria* is very superior as a dye to the *fuciformis,* and my friend Mr. Lukis has pointed out to me a distinction between these two plants which I was not before aware of, but which the examination of a great number of specimens enabled me to confirm; viz. that the *sap* of *tinctoria* is of a deep yellow, staining the fingers when gathered, whereas that of the *fuciformis* is not so. It is perhaps to be regretted that chemical tests have not been resorted to in endeavouring to distinguish between nearly allied plants.

Cetraria sepincola.
Peltigera resupinata.
  β. parilis.
  canina.
  β. pusilla; spuria, *Ach.*
  rufescens.
  polydactyla.
Sticta aurata. Jerbourg, *Mr. Lukis*; on the rocks N. of the Eperquerie, Sark, *T. S.*
Sticta fuliginosa.
  limbata.
  scrobiculata.
  pulmonaria.
  glomulifera.
  herbacea.
Parmelia perforata.
  perlata.
  tiliacea.
  Borreri.
  saxatilis.
  β. omphalodes.
  γ. sulcata, *Fl. Hib.*
  physodes.
Parmelia olivacea.
  caperata.
  rugosa, *Fl. Hib.*
  conspersa.
  parietina.
  i. concolor; candelaria, *Ach.*
  lævigata, *Ach.* & *E. B.*
  scortea, *do.*
  chrysophthalma. In an orchard at Sark.
  leucomela. Jerbourg and S.W. point of Rocquaine Bay, *Mr. Lukis.*
  ciliaris.
  aquila.
  pulverulenta.
  speciosa.
  stellaris.
  β. hispida; Lichen tenellus, *E. B.*
  erosa, *Suppl. to E. Bot.* 2807.

There are two varieties (unless indeed they are distinct species) of this plant in Guernsey. In the one the thallus exhibits the same loose mode of growth that it does with us in England and Wales, but has no sorediæ; but in the other it adheres so closely either to the rock or tree on which it grows that it is very difficult to detach the specimen. The *surface* too of this latter var.?, and not the edges, is copiously sprinkled with sorediæ. In the description given of the *erosa* in the 'Suppl. to E. B.' it is observed, "that sometimes the edges are raised, and producing mealy granules on the *under* side, assume, although not hollow, an appearance approaching to that common in *P. tenella*." The sorediæ however of the Guernsey var. of this plant are on the *upper* surface of the thallus. The hue of the thallus too, which is of a very pale whitish green, and its being more frequently found investing the dark crevices of rocks than growing on trees, seems to point out a difference of species. The shields also of the former variety are decidedly black, whilst those of the latter, though very minute in my specimens, are of a brown colour. The former variety I have not found in fruit in Guernsey.

Parmelia obscura.
  α. cycloselis.
  β. ulothrix.
plumbea.
lanuginosa.
brunnea.
pezizoides, *Suppl. to E. B.*
Parmelia crassa.
coarctata.
saxicola.
elegans.
murorum.
  β. miniata.

There is a very beautiful variety of this plant forming extremely thin extensive patches on the rocks of a bright orange colour. The thallus is almost wholly minutely granular, and without apothecia. To the naked eye it looks only like an orange stain upon the rock.

Parmelia fulgens. Downs near the sea on the N. of the island, *Miss Lukis.*
Parmelia circinata.
cervina.
  β. squamulosa.
tartarea.
carneo-lutea. On an elm-tree in the village above Saint's Bay.
subfusca.
atra.
cinerea.
badia; β. milvina. Jerbourg.
sophodes.
——— ? exigua?
Crust cartilaginous, of a dark green colour, having somewhat of a leaden hue towards the edges, when dry. Apothecia hemispherical, dark brown, with a raised somewhat crenulate border of a lighter hue than the thallus. On the rocks at Dixcart Bay, Sark.
Parmelia hæmatomma.
varia, and
  δ. polytropa.
vitellina.
ferruginea.
sordida; α. glaucoma.
  β. sulphurea.
impolita; Arthonia pruinosa, *Ach.*
scruposa.
Gyalecta cupularis; Lichen marmoreus, *E. B.*
Cladonia endiviæfolia.

Cladonia alcicornis.
pyxidata.
fimbriata.
furcata.
rangiferina.
gracilis; *b.* hybrida; cervicornis, *E. B.*
Bæomyces rufus, *E. B.*
anomalus, *Fl. Hib.*
Biatora atrorufa.
vernalis; *a.* luteola.
A very beautiful state of this with reddish shields which are often proliferous, and with a waved border, grows on decaying tufts of thrift in Sark.
Biatora rivulosa; *a.* saxicola.
β. corticola.
——— ?
Between *uliginosa* and *synothea*, E.B. Crust dark green, consisting of innumerable very minute granules or scales, forming a spongy crust. Apothecium black, globular, finally flat, and with a pale border usually sprinkled over with the minute scales of the crust. On walls.
Biatora quernea. Barren.
lucida.
Salveii; Lecidea, *Suppl. to E. B.*
Lecidea canescens.
vesicularis.
albocærulescens; Lecid. cæsia, *Ach.*
contigua; *a.* disciformis.
lapicida.
atro-alba; *ε.* subconcentrica; Lichen concentricus, *E. B.*
fusco-atra.
confluens.
geographica.
premnea.
enteroleuca; elæochroma.
Lecidea albo-atra; *a.* corticola.
c. saxicola; epipolius, *E. B.*
sabuletorum; *γ.* coniops.
citrinella; scabrosus, *E. B.*
Umbilicaria pustulata. Near Petit Bo, *Mr. Lukis.*
Opegrapha saxatilis.
scripta.
dendritica.
Coniocarpon cinnabarinum.
Sphærophoron compressum.
Endocarpon miniatum.
pulchellum, *E. B. Suppl.* 2602. On some elm-trees in the lane leading from Havilland to Fermain Bay.
Sagedia fuscella.
Pertusaria communis.
fallax.
pustulata, *Ach.* On an ash-tree by the side of the road at Rousaitre.
Verrucaria epigæa.
muralis.
umbrina.
maura.
nitida.
epidermidis.
punctiformis.
leucocephala.
viridula.
olivacea.
acrotella, *Fl. Hib.*
Collema nigrum.
crispum.
cristatum.
lacerum.
subtile.
muscicolum.
plicatile.
nigrescens.
ceranoides.

Characeæ.

Chara vulgaris.
Chara pulchella. Sark.

Algæ.

Cystoseira granulata.
fibrosa.
Halidrys siliquosa.
Fucus vesiculosus.
serratus.
nodosus.
canaliculatus.
Himanthalia lorea.
Lichina pygmæa.
Alaria esculenta.
Laminaria digitata.
saccharina.
Chordaria flagelliformis.
Chorda filum; *β.* thrix.
Dictyota dichotoma.
Furcellaria fastigiata.

Delesseria ruscifolia.
Rhodomenia bifida.
laciniata.
jubata.
palmata; β. sarniensis.
Plocamium coccineum.
Rhodomela subfusca.
Laurencia tenuissima.
Chylocladia ovalis.
articulata.
Gigartina purpurascens.
Chondrus crispus.
Gelidium corneum.
Dumontia filiformis.
Porphyra vulgaris.
Ulva lactuca.
linza.
crispa.
Enteromorpha intestinalis.
Bangia fuscopurpurea. Scarce.
Codium tomentosum.
Vaucheria velutina.
sessilis.
Cladostephus verticillatus.
spongiosus.
Sphacelaria scoparia.
olivacea. In a cave near the gentlemen's bathing-place.
Ectocarpus littoralis.
siliculosus.
tomentosus. Grand Cobo.
Polysiphonia fastigiata.
thuyoides.
urceolata.
byssoides.
fruticulosa.
Dasya coccinea.
Ceramium rubrum.
ciliatum.
Griffithsia equisetifolia.
Griffithsia setacea. Fermain Bay.
corallina. Bay under the Artillery Barracks.
Calithamnion polyspermum.
tetragonum.
Rothii.
Conferva Linum. St. Sampson's.
ærea.
fucicola.
rupestris.
glaucescens.
arcta.
flexuosa.
Zygnema nitidum.
quininum.
Scytonema myochrus. This forms a velvety stratum upon a bank near the sea at Jerbourg. It is of a deep indigo colour.
Lingbya muralis.
Oscillatoria nigra.
Chroolepus aureus.
Iolithus.
Trentepohlia purpurea. In a cave beyond the bathing-place.
Corynephora marina.
Palmella botryoides.
cruenta.
Nostoc commune.
verrucosum. In a small rivulet in Saint's Bay.
Rivularia atra. Grand Havre.
Meloseira nummuloides. Brook in the N. of the island.
Fragilaria pectinalis. In a well at St. Andrew's.
Diatoma fenestratum. Ditto.
flocculosum. Ditches near Ivy Castle.
Gomphonema ampullaceum. In a well at St. Andrew's.

Fungi.

Agaricus procerus.
muscarius.
coccineus.
campestris.
Georgii. St. Martin's: sold in the market.
orcades.
Rotula.
caulicinalis.
Polyporus vulgaris.
Ribis.
ulmarius. In an elm-tree in the village at Saint's Bay.
Thelephora hirsuta.
Peziza cacaliæ. On pods of *Mathiola sinuata.* Portinfer.
Cryptomyces versicolor; *c.* viridis. St. Sampson's.
Dacrymyces stillatus.
Sphæria typhina.
graminis.
loniceræ.
hedericola.
confluens. On the decaying trunk of an ash-tree in St. Andrew's parish.
lata.

Sphæria concentrica.
Myriangium Duriæi, *Berk. & Mont.* On ash-trees in Sark.
Phoma asteriscus. On *Heracleum* in Moulin Huet Bay.
Dothidea ulmi.
    rubra.
Lycoperdon gemmatum; ε. furfuraceum.
Scleroderma vulgare.
Erysiphe communis.
Oidium moniloides.
Aregma bulbosum.
Puccinia graminis.
    polygonorum.
    lychnidearum.
    Cotyledonis.
    violarum.
    Fabæ.
    prunorum.
Æcidium Bunii.
    laceratum.
    primulæ.
    rubellum.
    ranunculacearum.
    Periclymeni. FermainBay.
Depazea Caricæ. On the leaves of the common fig-tree. *Berk. MSS.*
Ustilago Salveii, *Berk. MSS.* On young plants of *Dactylon glomeratus.* St. Martin's.
Uredo compransor.
    Petroselini. On *Sium latifolium.*
    caricina. On *Cyperus longus.*
    bifrons. On *Rumex obtusifolius.*
    ranunculacearum.
    rubigo.
    cylindrospora.
    polygonorum.
    Rosæ.
    caprearum.
    leguminosarum.
    candida. On *Lepidium latifolium.* Grand Cobo.
    primulæ.
    hypericorum.
    trifolii, *Dec.* apiculosa, *Lk.* On *Medicago denticulata.*
    ——. On *Lotus hispidus.*
    ——. On pea leaves—not *appendiculosa*—a very handsome species.
    Scillarum.

XVII. *Note on the Colour of a Freshwater Loch.* By George Dickie, M.D., Lecturer on Zoology and Botany in the University and King's College of Aberdeen.

Read 9th November 1848.

Various vegetable productions have on different occasions been recorded as having appeared in such profusion that they communicated a colour of greater or less intensity to bodies of fresh water in which they naturally live. The plants in question belong to the *Oscillatorieæ* and *Nostochineæ*; among the former, *Oscillatoria ærugescens* has been recorded by Dr. Drummond (Ann. Nat. Hist. vol. i. 1st Series) as giving a tinge to the water of Glaslough in Ireland*; I have found the same species at Aberdeen, and particularly abundant in a small and shallow artificial lake, in sheets of great extent at the bottom. I have not observed it, as stated by Dr. Drummond, "broken into innumerable fragments, and suspended like cloudy flocculi in the water;" it sometimes however becomes detached from the bottom and forms large masses on the surface. The following plants belonging to the *Nostochineæ* have been described by Mr. Thompson of Belfast as producing the same effect: the *Anabaina spiralis* (*Spirillum Thompsoni,* Hass.) was observed to colour Ballydrain Lake in the county of Antrim; *Anabaina Flos-aquæ,* Bory, he saw "tinging with its delicate green hue the margin of the smallest of the Lochs Maben in Dumfries-shire," and *Aphanizomenon incurvum,* Morren, was "observed on the surface of sheltered creeks in Ballydrain Lake."

Professor Allman has more recently described (Annals of Natural History, vol. xi.) a new plant, *Trichormus incurvus,* All., as "colouring the water of the Grand Canal Docks near Dublin, a pea-green."

The present brief notice is for the purpose of recording the occurrence of a species of *Rivularia* near Aberdeen, under circumstances similar to those of the plants alluded to and producing a like effect. For some years back excursions have been

* *Oscillatoria rubescens* has been observed to communicate a red tint to Lake Morat in Switzerland.

made with the students of my botanical class to a loch on the estate of Parkhill, about four miles north-west from Aberdeen. The sheet of water in question is about a quarter of a mile in its greatest length; on almost all sides it is surrounded by extensive deposits of peat, with the soluble matter of which a great proportion of the water passing into the loch is impregnated. The loch abounds in *Scirpus lacustris, Arundo Phragmites, Nuphar lutea, Nymphæa alba,* and various species of *Potamogeton,* &c. The locality was generally visited in the beginning of July; nothing peculiar had ever been observed till the summer of 1846, when my attention was arrested by a peculiar appearance of the water, especially near the edge, but extending also some distance into the loch. Numerous minute bodies with a spherical outline, and varying in size from $\frac{1}{24}$th to $\frac{1}{12}$th of an inch in diameter, were seen floating at different depths, and giving the water a peculiar appearance. In some places they were very densely congregated, especially in small creeks at the edge of the loch. A quantity was collected by filtration through a piece of cloth, and on examination by the microscope, there could be no doubt that the production was of a vegetable nature and a species of *Rivularia*; one however unknown to me, and not agreeing with the description of any species described in works to which I had access. Specimens were sent to the Rev. M. J. Berkeley; he informed me that the plant belonged to the genus mentioned, and stated it to be *Rivularia echinulata,* E. B. Along with it, but in very small quantity, I also found another plant, the *Anabaina Flos-aquæ,* Bory.

In the first week of July 1847, the same species were observed similarly associated, but the *Anabaina* was now more plentiful, without however any apparent corresponding diminution in the quantity of the *Rivularia.*

In July last (1848) it was observed that the *Rivularia* was as rare as the *Anabaina* had been in 1846; to the latter consequently the water of the loch now owed its colour, which was a very dull green; the colour however becomes brighter when the plant is dried. In neither of the seasons mentioned was it in my power to make any observations on the colour of the loch earlier or later than the date above-mentioned, consequently nothing can be added respecting the comparative development and progress of the two plants at other seasons.

Two other smaller lochs in the same vicinity were not observed to present any appearance of the productions in question.

In connection with the subject of this short notice, it may be stated, that during a visit to Ben Muich Dhu in 1846, the appearance presented by a patch of snow at 3500 feet of elevation, attracted attention. It seemed as if sprinkled over with soot; a quantity of the black matter was collected, and found to consist in part of the following *Diatomaceæ*: *Eunotia triodon*, *Navicula viridula* ?, *N. curvula* ?, and *Meridion circulare*, and along with them *Protococcus nivalis* in very small proportion; the remainder consisted of inorganic matter, the nature of which was not ascertained.

XVIII. *On the mode of growth in* Oscillatoria *and allied genera.* By JOHN RALFS, M.R.C.S.

READ 14TH DECEMBER 1848.

THE growth of the lower Algæ by repeated transverse division of their cells is now a well-established fact. In the *Desmidieæ* and the *Palmelleæ* this division is usually complete and gives rise to distinct individuals. In the latter family the common gelatinous matrix mostly retains them in such close connection that the entire mass is regarded as a frond, of which the cells are only portions. The case is essentially similar in the *Desmidieæ*; but in them the common matrix is so exceedingly thin that it can scarcely be detected, whilst the slightest touch scatters the cells, rendering their independence apparent, and hence each individual is considered a frond.

In *Tiresias* and many other simple, filamentous Algæ, the divided cells remain closely united, and form a jointed filament which continues to elongate until the cells cease to divide.

I believe that in *Oscillatoria* we may trace a mode of growth of an intermediate kind and connecting these extremes. In many species of this genus the stratum spreads with great rapidity. This rapid growth cannot be caused by zoospores or granules vegetating in constant succession, because, although the filaments vary in length, their breadth is uniform. It does not depend on the simple elongation of the filaments, because, in many species, the filaments always remain short, notwithstanding the great increase of the mass.

The difficulty of tracing the growth in *Oscillatoria* is enhanced by its cells being frequently confluent, or having their divisions marked merely by faint transverse striæ. Still that the cells divide as in the other simple Algæ will scarcely be contested, if indeed the fact be not sufficiently proved in those species which have some of the striæ about twice the ordinary distance apart, as is always the case when cells are dividing.

In general the cells are indicated, as I have just stated, by more or less evident transverse, straight striæ; but at certain intervals the junction margins become rounded during division and the filament separates into distinct portions. All the *Oscil-*

latorieæ have the filaments inclosed in sheaths. When the sheath divides together with the cell, the original filament at once forms two; and as this process is continually going on, we can easily conceive the rapid extension of the stratum consequent upon the progressive increase in the number of filaments.

It may be necessary to mention, that it is easy to distinguish between a natural separation and a fracture. In the latter case the ends formed by violence are abrupt; in the former they are usually rounded.

When, as in some species, there is a complete separation of the internal filament unaccompanied by simultaneous division of its sheath, the latter retains the portions in connection. *Lyngbya ferruginea* affords a good example of this kind, and as its filaments are stouter than those of most species of *Oscillatoria,* no better plant can be selected for observation. If a portion of the stratum be examined, filaments of various lengths may be seen mingled together; but they are all of the same breadth, although some of them are not longer than broad.

When separated portions are thus held together by the sheath, there is generally a short interval between them. Whether this results from an elongation of the sheath or the mutual repulsion of the inclosed portions is doubtful. The latter I consider as the more likely cause. May it not be produced by an electric current developed at the instant of partition? Perhaps the radiation of the filaments from the stratum, in some species of *Oscillatoria,* may be similarly accounted for.

Microcoleus is known by its numerous, short, simple *Oscillatoria*-like filaments being contained within either a simple or a slightly branched, inflated sheath or frond. The presence indeed of this common covering is the character which separates *Microcoleus* from *Oscillatoria*; for the filaments and their manner of division are alike in both.

In *Oscillatoria* the parted filaments are retained together merely by the common mucus which permits a comparatively wider range, and allows them to diverge in various directions. In *Microcoleus,* on the contrary, their freedom is restricted; the frond by its form and size keeps them parallel and binds them in bundles. At first the frond contains only one or two filaments (as correctly stated by Mr. Hassall in his 'British Freshwater Algæ'); but these dividing as in *Oscillatoria,* the inflated frond becomes completely filled and at length ruptured, when the filaments escape from it to form new plants.

I intend in a future communication to offer some evidence in proof that the appositional branches in *Rivularia, Calothrix* and other genera are merely modifications of the mode of growth here described.

XIX. *Algæ Orientales:—Descriptions of new Species belonging to the genus* Sargassum. By R. K. Greville, LL.D. &c.

Read 13th July, 9th November, 14th December 1848, 11th January and 8th February 1849.

Many of the species which I now propose to describe from time to time were communicated to me some years ago by my excellent friend Dr. Robert Wight, Surgeon on the Madras Establishment; a gentleman well-known by his valuable 'Illustrations of Indian Botany,' and for his untiring investigations into the vegetable productions of our Indian possessions. These Algæ were to have been published in the 'Prodromus Floræ Peninsulæ Indiæ Orientalis,' a work undertaken by him in conjunction with Dr. Walker-Arnott, and calculated to add largely to the well-founded reputation of both parties. The second volume, however, having been unfortunately suspended, I have been induced in the mean time to give them to the botanical world in the present form, through the medium of the Botanical Society.

Vachellianæ.

1. *Sargassum Henslowii* (nob.); caule compresso, ramosissimo; foliis cartilagineis, ecostatis, cuneatis, subdentatis, superioribus versus apicem oblique excavatis, acute dentatis; vesiculis oblongo-ellipticis, apiculatis; receptaculis minutis, cylindraceis, subpaniculatis.

Hab. in mari Chinensi, legit G. H. Vachell.

Whole plant three or four feet long, slender, but at the same time bushy from the numerous secondary branches. *Root* unknown. *Stem* not thicker than a crow-quill, compressed, giving off branches at intervals of 1–2 inches, some of which are a foot or more in length; secondary branches 1–3 inches long, thickly clothed with very short tufted ramuli, bearing the fructification. *Leaves*; on the main stem an inch or more long, of a thickish and somewhat opake substance, spathulate or cuneate, much attenuated towards the base, with one or two teeth towards the apex, which is more or less obtuse and oblique; on the branches the leaves are much smaller, more or less broadly lanceolate and acute, with generally a large tooth on one side above the middle, and the substance obliquely excavated as it were from the tooth to the apex. *Vesicles* 2–3 lines long, elliptical-oblong, with a slender foliaceous mucro, and supported on peduncles less than a line in length. Sometimes the vesicles are slightly margined, and they are, as well as the leaves, sparingly furnished with pores. Those intermixed with the receptacles are scarcely more than a line or a line and a half long. *Receptacles* not a line long, linear, cylindraceous, rarely single or once divided, but generally forming minute panicles or racemes composed of 3–5 receptacles, with one or two vesicles, and often with minute linear-lanceolate leaves. *Colour* in the dried state dark reddish brown.

This species was kindly communicated to me by my friend Professor Henslow in 1831, and had been transmitted to him by the Rev. G. H. Vachell, along with other interesting plants from Macao and the adjacent islands.

2. *Sargassum Vachellianum* (nob.); caule brevissimo, teretiusculo, muricato; ramis elongatis, planis; foliis lineari-lanceolatis, submembranaceis, repando-dentatis; vesiculis sphæricis, petiolatis, petiolis compressis dilatatis; receptaculis cylindraceis, subdichotome racemosis.

Hab. in mari Chinensi, legit G. H. Vachell.

Plant two to three feet long, of a slender and graceful habit. *Root* a cartilaginous disc, from which arise several stems about an inch in length, cylindrical, as thick as a crow-quill, rough with the conical bases of former branches. From the summit of the stem are produced one or more main *branches*, flat, about a line broad, giving off a second series of branches at intervals of 1–2 inches, 2–6 inches long, and bearing a numerous series of very short ones with the fructification. *Leaves* more or less linear-lanceolate, repando-denticulate, sometimes almost spinuloso-denticulate, distinctly petiolate; those arising from the lower part of the primary branches two to near three inches long and nearly half an inch broad, of a firmer and thicker substance than the rest; those on the secondary branches smaller, seldom exceeding two inches in length, and becoming gradually narrower till on the upper parts they are strictly linear and acuminate, being often not more than a line or even less in breadth. Midrib narrow, disappearing below the apex; pores small and scattered. *Vesicles* nearly spherical, rarely mucronate, on petioles 2–3 lines long, which are sometimes dilated and foliaceous; those on the main branches nearly as large as a small garden-pea; those on the ramuli considerably smaller and subpyriform. *Receptacles* cylindraceous, forming a subdichotomously divided axillary raceme of an inch or more in length, on the lower part of which are generally found several vesicles and minute leaves, the latter preserving all the characters of the larger ones; the divisions of the raceme are conspicuously divaricate, and even the extreme apices often terminate in a minute wide-spreading fork, as in some species of *Cladonia*. *Substance* of the whole plant between cartilaginous and membranaceous, somewhat translucent. *Colour* in the dried specimens pale olivaceous brown.

This beautiful species is probably very variable in its secondary characters, and a larger series than I have seen would be required before it could be satisfactorily described. Young plants before the fructification is fully developed might almost be taken for another species.

This was also communicated by Professor Henslow.

3. *Sargassum ornatum* (nob.); ramis teretiusculis; foliis oblongo-obovatis, costatis, repando-dentatis, membranaceis, petiolatis; vesiculis subsphæricis; receptaculis cylindraceis, obtusis, racemosis.

Hab. in mari Chinensi?

Root unknown. The whole plant is probably upwards of two feet in length, but the only specimen I have seen is sixteen inches long, slender, producing branches towards the base, four or five inches in length, at intervals of about an inch, and becoming gradually shorter upwards. On these branches are situated the very short ramuli, which, besides the accompanying leaf, consist of nothing more in general than a vesicle or two and the raceme of fructification. *Leaves* one to near two inches long, the larger ones above half an inch broad, oblong-obovate, rounded at the extremity, attenuated at the base into a slender stalk, irregularly and unequally repando-denticulate, thin and translucent, the midrib slender, disappearing beneath the apex, the pores minute and scattered. *Vesicles* nearly spherical, the largest about the size of a small garden-pea, rarely mucronate or marginate, the stalk filiform, about two lines long; those which often form a part of the raceme, somewhat pyriform. *Receptacles* axillary, cylindraceous, obtuse, forming an irregularly divided raceme 3–5 lines in length. *Substance* thin and membranaceous, and on being remoistened, very flaccid. *Colour* pale yellowish or olivaceous brown.

A very elegant species, native I believe of the Chinese Seas; but I regret that my note regarding it has been mislaid.

Wightianæ.

4. *Sargassum echinocarpum* (nob.); caule cylindraceo, ramosissimo; foliis oblongo-lanceolatis, dentatis, uninerviis; vesiculis plus minusve ovalibus, petiolatis, petiolis latioribus, foliaceis; recep-

taculis axillaribus, racemosis, planis, lineari-cuneatis, acute et grosse denticulatis.

Wight in herb. no. 18.

Hab. in mari Indico, ubi detexit Wight.

Root unknown. *Plant* of a bushy habit, about two feet long. *Stem* cylindraceous, about as thick as a crow-quill, giving off branches 6–8 inches long at intervals of less than an inch apart; these branches are clothed with a second series 1–2 inches in length, on which the short fruit-bearing ramuli are thickly set. *Leaves* cartilaginous, fully an inch long, shortly petiolate, oblong-lanceolate, very irregularly repando-dentate, obtuse, the nerve extending almost to the apex, punctate, the pore visible to the naked eye. *Vesicles* between oval and spherical, about the size of hemp-seed, very numerous, intermixed with the receptacles, on broad foliaceous stalks, often winged and apiculate, frequently developed in the leaves themselves. *Receptacles* axillary, varying in length from little more than 1, to 2 or even 3 lines, racemose, more or less linear, flat, so largely and sharply toothed as to be sometimes almost pinnatifid. *Colour* a rich dark reddish brown. *Substance* cartilaginous.

In habit this species is allied to *S. vulgare*, but differs entirely in the fructification and other leading characters. The sportive disposition of the vesicle is very remarkable, showing every transition from the leaf to that organ. On one occasion I observed two vesicles imbedded in the same leaf, as represented at fig. 3. The leaves occasionally assume a broadly linear character, and if I am correct in referring one imperfect specimen in my possession to this species, they become sometimes more elongated and at the same time less toothed.

Campbellianæ.

5. *Sargassum Campbellianum* (nob.); caule filiformi; foliis membranaceis, linearibus, dentato-serratis, obtusis, uninerviis; vesiculis paucis, sphæricis, breviter petiolatis; receptaculis racemosis, elliptico-cylindraceis ad apicem denticulatis.

Hab. in mari Indico. Specimina communicavit J. Campbell.

Root unknown. Entire plant probably three feet long or more, of a very slender and graceful habit. *Stem* filiform, cylindrical, elongated, in my imperfect specimens nearly two feet in length, producing horizontal branches at remote intervals 6–9 inches long or more, which bear numerous ramuli 1–3 inches long; these ramuli are clothed with leaves and receptacles at intervals of often not more than the eighth of an inch. *Leaves* petiolate (those on the primary branches $1\frac{1}{2}$ inch, those on the ramuli less than an inch long), linear or nearly linear-lanceolate, irregularly dentato-serrate, either acute or quite obtuse at the apex, thin, membranaceous and translucent, the nerve slender, disappearing beneath the apex; pores not visible to the naked eye, scattered over a space nearer to the nerve than to the margin, which latter is destitute of them. Petioles short, with often a single sharp tooth at the base of the leaf. *Vesicles* solitary, subspherical, on short compressed stalks, generally situated at the base of the ramuli, but not unfrequently produced on the racemes also, scarcely so large as hemp-seed. *Receptacles* axillary, linear-oblong or fusiform, either undivided or forming lax racemes 2–3 lines long or more. They are generally entire at the lower part, but sharply toothed towards the apex. *Colour* a dull, very pale olivaceous green. *Substance* extremely thin, delicate and membranaceous.

This is a very interesting species, not contained in Dr. Wight's collections, but kindly communicated to me at his special request by its discoverer, James Campbell, Esq. of Madras. It is conspicuous by its very slender and delicate habit and pale olivaceous yellow colour. The receptacles are sometimes solitary, sometimes once-divided, but more generally form little clusters or racemes, the parts of which are much disposed to pass into foliaceous expansions. I have indeed seen receptacles on one raceme passing in a proliferous manner into both vesicles and minute leaves.

VACHELLIANÆ.

6. *Sargassum debile* (nob.); caule elongato, subcompresso, ramis laxis, longissimis, simpliciusculis; foliis membranaceis, lineari-oblongis, obtusis, dentatis, uninerviis; vesiculis sphæricis axillaribus. *Hab.* in mari Chinensi prope Macao; Vachell.

Root unknown. Specimen in my possession 34 inches long, and the character of the lower leaves indicates that they grew near the base; so that the whole plant may be from 3 to 4 feet long. Habit extremely slender and weak. *Stem* somewhat compressed, scarcely thicker than a sparrow's quill, giving off at irregular intervals, for some inches above the base, a few filiform branches 2–3 feet long, of nearly the same thickness throughout, sometimes more or less subdivided, but frequently simple, and along their whole length bearing leaves and vesicles at intervals of from half to three-quarters of an inch. *Leaves* thin, membranaceous, translucent, linear-oblong, obtuse, waved at the margin, sparingly and irregularly toothed, attenuated below into the stipes, the nerve conspicuous, very slender, disappearing below the apex; pores minute, but visible to the naked eye. *Vesicles* axillary, stalked, spherical, rather larger than the seeds of *Lathyrus odoratus*, the stalks scarcely a line long, filiform. *Substance* membranaceous and somewhat flaccid. *Colour* pale yellow-olivaceous green.

The only specimen which I have seen is not in fructification, but is otherwise in a very perfect and satisfactory state. In general appearance, especially when placed in water, it might be compared to some kinds of *Potamogeton,* and probably vegetates in quiet and shallow bays. The vesicles, as may be seen in the plate, form an axillary raceme, and no doubt indicate the position of the fructification, which, in more advanced individuals, would be probably found towards the extremity of the branches. In my specimen I observe no trace of it, although the vesicles are present on every part.

Wightianæ.

7. *Sargassum lanceolatum* (nob.); caule angulato, ramosissimo; foliis lanceolatis, acutiusculis, minute dentatis; vesiculis sphæricis, petiolatis, petiolis brevibus, planis, dilatatis; receptaculis compressis, subcuneatis, racemosis, ad apicem late denticulatis.

Hab. in mari Peninsulæ Indiæ Orientalis; Wight.

Root I have not seen. *Stem* probably 1–2 feet long, angular, and nearly as thick as a crow-quill; in the portion which I possess, giving off branches at intervals of half an inch; these branches towards the base are 4–6 inches long, spreading, becoming gradually shorter upwards, so as to render the general outline pyramidal; all of them thickly clothed with ramuli about an inch in length, and bushy with leaves, vesicles and receptacles. *Leaves* shortly petiolate, about an inch long, very numerous, lanceolate or linear-lanceolate, somewhat acute, repando-denticulate, furnished with scattered pores and a strong nerve which disappears below the apex. *Vesicles* intermixed with the receptacles, about the size of hemp-seed, spherical, often slightly margined, supported on dilated foliaceous stalks seldom much more than a line in length, but occasionally on stalks a quarter of an inch long, more broadly foliaceous and nerved. *Receptacles* axillary, a line or a line and a half long, forming minute more or less divided clusters; they are linear-cuneate, subcylindrical at the base, compressed upwards, and furnished with broad, sharp teeth at the sides and apex. *Colour* very dark red-brown. *Substance* when dry somewhat firm, cartilaginous and opake.

This species has so great a resemblance at first sight to another, which I received from Dr. Wight, and which stands in the herbarium as my No. 7, that they were mixed together, and it was not until I examined them critically that they were perceived to be essentially distinct. Of the present species I only possess a solitary specimen, and that not an entire one, there being only about twelve inches of the upper extremity; at the same time it is in so satisfactory a state, that I venture with some confidence to regard it as undescribed.

8. *Sargassum acanthicarpum* (nob.); caule elongato, filiformi, subangulato, ramosissimo; foliis lineari-lanceolatis, uninervibus, profunde dentato-serratis; vesiculis subsphæricis, petiolatis, planis, dilatatis; receptaculis axillaribus, racemosis, compressis, lineari-cuneatis, grosse et acute dentatis.

Wight in herb. no. 4 & 6.

Hab. in mari Peninsulæ Indiæ Orientalis; Wight.

Entire plant near 2 feet long, with a slender graceful appearance. *Root* a small callous disc, from which arise one or more undivided somewhat angular stems, not thicker than a sparrow's quill. The branches begin to be given off in a horizontal manner immediately above the root, where they are 2 or 3 inches long, soon extending to 5 or 6 inches, and then gradually diminishing to the end, thus giving the whole a more or less oblong-acuminate outline. Towards the base, the branches appear to be frequently in pairs; two being given off near together, then after a longer space two more and so on, but this character is gradually lost, and the upper branches become irregularly alternate, at intervals of half an inch or more. These branches produce the fruit-bearing ramuli at intervals of a few lines; they are an inch or more in length next the stem, and diminish insensibly to the extremity of the branch. *Leaves*: those arising from the stem close to the root, ovate-oblong, subsessile; those on the branches about an inch in length, linear-lanceolate, becoming gradually shorter and narrower towards the extremity, deeply and irregularly dentato-serrate, furnished with minute pores and a narrow nerve which is very faint towards the apex. *Vesicles* numerous, from the size of a large pin's head to that of hemp-seed, subglobose, often slightly elliptical, on stalks a line or more in length; but these stalks have a frequent tendency to pass into leaves; in some specimens nearly all are foliaceous, and several lines long, the vesicles themselves being then more or less elliptical, winged, and often apiculate. *Receptacles* 1 or 2 lines long, linear-cuneate, compressed, sometimes subtriquetrous, bristling at the lateral and terminal margin with large, very acute teeth. Generally the raceme is composed of but few simple receptacles, but occasionally they are proliferous, as shown in the plate. The terminal receptacle is often large and the lateral or lower ones very small. *Colour* a dark reddish brown when dry; a rich yellow-brown in transmitted light. *Substance* somewhat membranaceous and translucent, but rigid in the dry state.

This species, to which I at one time attached the provisional name of *erinaceum*, is distinguished for its beautiful foliage and the very slender branches, which indeed are scarcely thicker than a hog's bristle. The light and graceful character of the whole plant is increased by the dentation of the leaves, which is sometimes so marked even to the naked eye, as to give them a laciniate character.

9. *Sargassum dumosum* (nob.); caule subplano,, distiche ramoso; foliis lineari-lanceolatis, uninerviis, inferne præcipue attenuatis, superne plus minusve dentatis; vesiculis ellipticis, petiolatis, petiolis elongatis, dilatatis, foliaceis; receptaculis axillaribus, clavatis, subcompressis, dentatis, racemosis.
Hab. in mari Peninsulæ Indiæ Orientalis; Wight.

Root I have not seen, the only specimen in my possession being about a foot of the upper portion of the plant. In this, the *stem* (?) is about a line broad, flat or nearly so, and giving off branches 5 or 6 inches in length in a distichous manner, at intervals of half an inch to an inch. These branches produce others, which are more or less subdivided in their turn, so as to give the ramification generally a bushy fasciculate character. *Leaves* an inch long, somewhat more than a line broad, linear-lanceolate, acute, gradually attenuated from the middle to the petiole, very irregularly toothed, and that almost exclusively in the upper part, rarely subentire, furnished with pores and a slender nerve which disappears below the apex. *Vesicles* larger than the seed of *Lathyrus odoratus*, accompanying the receptacles, elliptical, often mucronate, supported on flat stalks nearly half an inch long, sometimes becoming even longer and decidedly foliaceous. *Receptacles* axillary, 1–2 lines long, club-, or linear-wedge-shaped, somewhat compressed, often incurved, toothed, especially at the outer margin and apex, and forming a rather lax sparingly divided raceme. *Colour* blackish brown in the dry state. *Substance* rigid.

The solitary specimen from which I have drawn up the above description was mixed with *Sargassum pyriforme*, Ag., to which it bears no inconsiderable resemblance in general habit, and especially in the form of the vesicles. Both the leaves and fructification, however, at once separate it from that plant. With *Sargassum Swartzii*, Ag., it has a nearer affinity, but is readily distinguished by the much shorter leaves and elongated, toothed receptacles.

10. *Sargassum porosum* (nob.); caule cylindraceo, brevissimo, muricato, ramis planis; foliis ovato-oblongis, subundulatis, inciso-dentatis, uninerviis; vesiculis sphæricis breviter petiolatis; receptaculis minutis, axillaribus, cylindraceis, oblongis, inermibus, subracemosis.
Hab. in mari Peninsulæ Indiæ Orientalis; Shuter (1827), Wight.

Root an expanded cartilaginous disc. *Stem* cylindrical, very short (in the only specimen I possess scarcely half an inch), about the thickness of a blackbird's quill, muricate. *Primary branches* few, 12–18 inches or more long, simple or sparingly divided, flat, a line or more broad, giving off the secondary branches in a distichous manner at intervals of about half an inch; these are from 3 to 6 inches long, and closely set with fruit-bearing ramuli likewise distichously arranged, and from half an inch to an inch in length. *Leaves*; those of the young primary branches, especially near the base, an inch long, ovate-oblong, sometimes ovate-lanceolate, somewhat undulate, deeply, and very irregularly inciso-dentate; those on the secondary branches half the size above-mentioned, and those accompanying the fructification minute and somewhat cuneate; all furnished with a slender nerve becoming faint and disappearing before reaching the apex, and with abundance of oval pores. *Vesicles* spherical, on stalks scarcely a line long; those accompanying the leaves on the young primary branches considerably larger than the seed of *Lathyrus odoratus*; those on the smaller branches and those intermixed with the receptacles much less. *Receptacles* axillary, about a line long, cylindraceous, linear-oblong, obtuse, unarmed, forming irregularly divided clusters. *Colour* a rich red-brown, the younger leaves paler and somewhat translucent. *Substance* membranaceous, slightly rigid when dry.

This species is allied to *Sargassum incisifolium*, Ag., found at the Cape of Good Hope, but differs in the entire receptacles besides other characters. In an old state the branches lose their leaves and seem covered with the little tufted racemes.

The specimen which I possess from Dr. Shuter was kindly communicated by Sir W. J. Hooker.

11. *Sargassum elegans* (nob.); caule filiformi, teretiusculo, ramosissimo; foliis lineari-oblongis, obtusis, laciniato-dentatis, inferne oblique attenuatis; vesiculis parvulis, sphæricis; receptaculis lineari-oblongis, subcompressis, apicem versus dentatis, racemosis.

Wight in herb. no. 15.

Hab. in mari Peninsulæ Indiæ Orientalis; Wight.

Plant probably between 1 and 2 feet long; the specimen before me being fully 12 inches of the upper extremity, the whole of which bears evidence of having been covered with branches. *Root* I have not seen. *Stem,* or probably more correctly *primary branch,* filiform, about double the thickness of a hog's bristle, giving off spreading branches 3–4 inches long, at intervals of half an inch, which become gradually shorter upwards, thickly covered with leaves, vesicles and receptacles. *Leaves* linear-oblong, or, sometimes, oblong-lanceolate, nearly three-quarters of an inch in length, 2–3 lines broad, obliquely attenuated at the base into a very slender petiole, sharply inciso-dentate, or even laciniate, furnished with a delicate nerve and oval pores. *Vesicles* numerous, spherical, the largest not half the size of the seed of *Lathyrus odoratus*, most of them as small as an ordinary pin's head, often apiculate, and the apiculus excentric, furnished with a few papilliform pores, and supported on a little compressed stalk not a line in length. *Receptacles* axillary, cylindraceous or subcompressed, oblong or somewhat club-shaped, sharply toothed, and forming little racemose tufts about a line and a half long. *Colour* dull reddish brown. *Substance* somewhat membranaceous and slightly diaphanous.

A very beautiful species. When dry, the laciniate teeth of the leaves give them quite a fringed appearance.

12. *Sargassum brevifolium* (nob.); caule teretiusculo, muricato; foliis parvulis, obovatis, dentatis, uninerviis; vesiculis minutis, sphæricis; receptaculis filiformibus, elongatis, racemosis.
Wight in herb. no. 20.

Var. β; foliis laciniato-dentatis, in petiolo longiore attenuato. An species distincta?
Wight in herb. no. 10.
Hab. in mari Peninsulæ Indiæ Orientalis; Wight.

Root I have not seen. *Stem* (or *primary branch*?) probably 2 feet long or more; but only fragments are in my possession; cylindraceous, somewhat muricate. *Branches* 4 or 5 inches long, thickly clothed with the fructiferous ramuli, which are not more than half an inch in length. *Leaves*; those on the main branches I have not seen; those on the secondary branches, from the axils of which the clusters of receptacles and vesicles arise, are about a third of an inch long, more or less obovate, remotely dentate, rounded at the end, furnished with pores and a nerve which soon becomes rather faint and disappears below the summit. *Vesicles* spherical, numerous, the size of a large pin's head, having prominent pores, supported on filiform stalks half a line in length, and arising from the lower ramifications of the raceme. *Receptacles* numerous, filiform, elongated, forming much-divided racemes from a quarter to half an inch long. The receptacles are not unfrequently foliaceous towards their upper extremity, in which case they resemble linear leaves toothed at the margin, and are furnished with a nerve and pores. *Colour* reddish black when dry. *Substance* cartilaginous.

In variety β. the stem is more muricate. The leaves are smaller, and besides being inciso- or laciniato-dentate, they are attenuated more gradually into a longer and more slender stalk. The receptacles are smaller, but present no other perceptible difference.

In the absence of more perfect specimens, and indeed of a larger series, the present description must necessarily be imperfect. The plant I have considered as a doubtful variety bears a great resemblance to the other, yet I might perhaps with some reason have raised it to the rank of a species; the striking similarity of the fructification alone deterred me. Should it prove distinct, it may bear the name of *S. pergracile*.

13. *Sargassum obovatum* (nob.); caule subcompresso; foliis caulinis obovatis, obtusissimis, subintegris vel obscure dentatis; aliis racemis intermixtis lanceolatis, serratis; vesiculis subellipticis; receptaculis minutis, oblongis, cylindraceis, in racemis densis, rotundatis, pedunculatis, aggregatis.

Hab. in mari Peninsulæ Indiæ Orientalis; Wight.

Root unknown. *Plant* probably 1–2 feet long, judging from the fragment in my possession, which is apparently a portion of one of the primary branches or divisions of the *stem*; this is somewhat compressed, as thick as a blackbird's quill, beset with numerous branches 2–3 inches long, which are bushy with ramuli less than an inch in length on which are found the racemes of fructification. *Leaves*: those on the stem above an inch long, obovate, quite rounded at the extremity, almost entire or obscurely repando-dentate, furnished with a nerve which disappears at some distance from the end; those on the smaller branches often more or less serrated, while those which accompany the fructification are much smaller, linear-lanceolate, and sharply serrate. *Vesicles* attaining the size of a small garden pea, varying in shape from elliptical to spherical, sometimes apiculate, supported on a compressed stalk generally little more than a line in length. Sometimes, however, one of the little lanceolate leaves becomes converted into a vesicle, and the stalk is then proportionally long. *Receptacles* cylindraceous, oblong, much-divided and lobed, forming a dense, roundish, very shortly pedicellated cluster a line or more in length. *Colour* very dark red-brown. *Substance* thick and cartilaginous.

The only specimen—and it is a mere fragment—which I have seen of this Alga was disentangled from some other species. There appears to be a disposition in the leaves towards the ends of the branches to become incurved, but this may not be a permanent character.

14. *Sargassum Wightii* (nob.); caule compresso, distiche ramoso; foliis anguste lanceolatis, integerrimis; vesiculis ellipticis, apiculatis, longe petiolatis, petiolis planis, dilatatis; receptaculis linearibus, compressis, ramosissimis, in racemo amplo subtruncato aggregatis.

Wight in herb. no. 12 & 13.

Hab. in mari Peninsulæ Indiæ Orientalis; Wight.

Root an expanded disc, throwing up several mostly undivided stems from 1 to 2 feet in length, or probably more, giving off branches in a distichous manner, at intervals of half an inch or more; the lower ones are several inches long, becoming gradually shorter, and more remote as they approach the summit: the fruit-bearing ramuli are very short, and, like the rest, distichously arranged. *Leaves* from 1 to near 2 inches in length, narrow-lanceolate, sometimes almost linear-lanceolate, nearly equally attenuated at each extremity, acute, quite entire or obscurely repando-dentate, furnished with a somewhat faint nerve and a few scattered pores. *Vesicles* about the size of the seed of *Lathyrus odoratus*, elliptical, apiculate, on long dilated foliaceous stalks, in young plants arising from the axils of the cauline leaves; afterwards accompanying the fructification but sparingly, and generally taking the place of a leaf. *Receptacles* axillary, filiform, compressed, very much divided, the exterior branches the longest, so that the racemes have a cymose or tassel-like appearance. The racemes vary much in size, being dense, and not more than 2 or 3 lines long in some plants; in others half an inch and much more lax. *Colour* dark, olivaceous, the receptacles black when dry. *Substance* slightly cartilaginous.

In some specimens, the branches, besides producing axillary racemes, have the appearance of terminating in a larger raceme, an effect which seems to be produced by the ultimate leaves being converted into receptacles, the whole preserving the truncate and tassel-like outline of the axillary racemes.

For this fine and very striking Alga I have reserved the name of the excellent and indefatigable naturalist from whom I received it. It is quite unlike any other species with which I am acquainted.

15. *Sargassum cervicorne* (nob.); caule compresso, distiche ramoso; foliis late lineari-lanceolatis subintegerrimis, superioribus atque in ramis fertilibus brevioribus, lanceolatis, plus minusve dentatis; vesiculis elliptico-sphæricis petiolatis, petiolis foliaceis, dilatatis; receptaculis compressis, valde dentatis, in racemo composito aggregatis.

Wight in herb. no. 17.

Hab. in mari Peninsulæ Indiæ Orientalis; Wight.

Root a callous disc, throwing up a number of *stems* nearly two feet long, compressed, a line or more broad, undivided, giving off *branches* in a distichous manner, at intervals of from half an inch to an inch or more, 3–6 inches long, spreading, the whole forming a more or less oblong outline. Fruit-bearing *ramuli* numerous, an inch long or more at the base of the branches, and diminishing gradually to the extremity. *Leaves*: those produced from the main stem and especially on young plants often 2 to near 3 inches long, and from a quarter to half an inch in breadth, somewhat obtuse at the apex, either quite entire or obscurely repando-dentate, rarely furnished with a few sharp teeth towards the base. On the branches they are about an inch long, more or less lanceolate, more acute, often sharply toothed; all furnished with a nerve and pores. *Vesicles* somewhat elliptical, on young plants nearly as large as a small garden pea, supported on foliaceous, dilated stalks 2–3 lines long. Sometimes the vesicle is winged and apiculate. *Receptacles* 1–1½ line long, axillary, forming pedunculate, more or less divided racemes, the segments very irregular in shape, compressed, and toothed so as frequently to resemble a deer's horn.

The most remarkable feature in this Alga is the occasional length of the leaves which arise at the base of the primary branches, and which cause them to resemble the fronds of some of the Lycopodoid *Polypodia.* This is most conspicuous in a rather early stage of growth. The species however is liable, I suspect, to considerable variation; and even on the same individual leaves may be seen almost, if not quite entire, while others are decidedly and sharply toothed. The latter occur *chiefly* in the upper part of the plant, and towards the ends of the branches. The description and figure I have given must be regarded as provisional, for if my apprehensions be well-founded, a more extensive series of specimens will be required before a complete character can be drawn up.

16. *Sargassum squarrosum* (nob.); caule filiformi, angulato; foliis (parvis) anguste obovatis, obtusis, plus minusve repando-dentatis; vesiculis subsphæricis, brevissime petiolatis; receptaculis obovatis vel lineari-oblongis, plano-compressis, acute lateque dentatis.
Hab. in mari Peninsulæ Indiæ Orientalis; Wight.

Root I have not seen. *Stem* filiform, angular, a foot to, probably, a foot and a half long, bushy with numerous branches which appear to be generally 2 or 3 inches long. *Leaves* small, half an inch or, rarely, three-fourths of an inch in length, narrow-obovate, rounded at the apex, attenuated at the base into a slender and rather long footstalk, often nearly entire, but more generally repando- or even serrato-dentate, furnished with pores, and a nerve which disappears before reaching the summit. *Vesicles* nearly the size of hempseed, subspherical, supported on stalks scarcely a line long. *Receptacles* a line or more in length, axillary, obovate, or oblong, compressed, the margin and apex furnished with broad sharp teeth; frequently the receptacles are proliferous, the whole forming a very irregularly divided raceme, which is sometimes so twisted and curled as to give it the appearance of a cluster of minute proliferous leaves.

From the two imperfect specimens which I possess of this plant, I suspect that it is subject to considerable variation, and my figure and description are given chiefly with a view of affording algologists a memorandum for its more accurate investigation. On one of my specimens several of the leaves are converted into vesicles, which are supported on stalks 2 lines long resembling the lower part of the leaf; these are also winged and apiculate.

17. *Sargassum divaricatum* (nob.); caule angulato; foliis linearibus, acuminatis, breviter petiolatis, uninervibus, subintegerrimis; vesiculis numerosis, sphæricis, petiolatis, petiolis planis, dilatatis; receptaculis cylindraceis, filiformibus, divaricato-dichotomis.

Wight in herb. no. 7.

Hab. in mari Peninsulæ Indiæ Orientalis; Wight.

Root I have not seen. Entire plant probably a foot or more in length. *Stem* nearly as thick as a crow-quill, giving off spreading branches at short intervals 4 to 6 inches long, which are clothed with numerous short ramuli and leaves, so as to give the whole plant a bushy appearance. *Leaves* somewhat more than an inch in length, a line or more broad, more or less acuminate, entire, or rarely obscurely subdentate, shortly petiolate, furnished with a nerve and pores. *Vesicles* spherical, smaller than hempseed, on little flat dilated petioles about a line long; sometimes they are margined, and occasionally on longer stalks resembling an abbreviated leaf, and apiculate. *Receptacles* filiform, cylindraceous, subdichotomously divided, the segments spreading, the whole forming axillary tufts, often 3 or 4 lines in length. *Colour* reddish brown, that of the receptacles black. *Substance* cartilaginous.

A well-marked species, the receptacles separating it at once from its congeners. When luxuriant the three or four tufts on a ramulus seem to form one mass, and to the naked eye suggest the idea of a little parasitic *Gigartina,* and is by no means unlike dwarf specimens of *Gymnogongrus Griffithsiæ,* Mart. Sometimes the receptacles are less abundant and conspicuous, having fewer divisions, the segments however being often nearly 2 lines long. The leaves bear a considerable resemblance to those of *Sargassum bacciferum,* but are much more numerous.

18. *Sargassum acutifolium* (nob.); caule plano-compresso, distiche ramoso; foliis linearibus utrinque attenuatis, acutissimis, integerrimis, uninervibus, ad ramulos filiformibus; vesiculis sparsis, subellipticis, petiolatis, petiolis planis; receptaculis compressis, lineari-oblongis, ad apicem dentatis.

Sargassum acinaria, Ag. Sp. Alg. vol. i. p. 22 ? ?

Hab. in mari Peninsulæ Indiæ Orientalis; Wight.

Root I have not seen. Plant probably 2 or 3 feet long.

Stem (or probably primary branch) plano-compressed, a line or more broad, distichously branched; branches about an inch apart, 8–12 inches long, flat like the stem, bearing ramuli 2–3 inches long, at intervals of $\frac{1}{2}$ to $\frac{1}{3}$ of an inch, which in their turn bear a smaller series upon which the fructification is placed. *Leaves,* the larger ones at the base of the branches, 2 inches in length, linear, acuminated at each extremity, entire, furnished with a nerve and a few scattered pores: the rest much smaller, almost filiform, those accompanying the fructification sometimes so slender as to be capillary. *Vesicles* scarcely half the size of hemp-seed, very sparingly developed, somewhat elliptical, on flat slender stalks, 2 lines or more long, mostly produced at the base of the racemes of receptacles. Sometimes a vesicle occurs at the extremity of a leaf. *Receptacles* minute, axillary, oblong or linear-oblong, compressed, generally toothed at the apex, forming more or less divided racemes. *Colour* reddish black. *Substance* cartilaginous.

It is not without considerable hesitation that I separate this plant from *Sargassum acinaria* of Agardh. There are however differences, judging from his description, (and in the absence of authenticated specimens,) which seem to be sufficiently decisive. The stem in *S. acinaria* is said to be angular. In the specimens before me both it and the branches are clearly plano-compressed, and give off the ramifications in a distichous manner. This character alone would remove my plant from the species above mentioned. The receptacles, described simply as cylindraceous in *S. acinaria,* are in the present plant, when fully developed, more or less compressed, and toothed at the apex. The cauline leaves are not "lanceolate," being too narrow to be termed even linear-lanceolate; but this is a character so liable to variation that much stress cannot be laid upon it. The racemes of fructification are truly axillary. The vesicles (in the specimens under examination) very few. *Sargassum acutifolium* is, from the abundance of the narrow leaves (which spread at a considerable angle), and also of the closely approximated tufts of receptacles, very bushy in appearance. My specimens are not more than 14 inches long, but evidently indicate a plant 2 or 3 feet in length.

EXPLANATION OF PLATES VI.—XI.

Plate VI.

Sargassum Henslowii.

Fig. 1. A leaf from the main stem.
— 2. Ditto from the branches.
— 3. Vesicles.
— 4. One of the little tufted ramuli composed of leaves and receptacles.
— 5. Ditto with vesicles. 4 and 5 magnified.

Sargassum Vachellianum.

Fig. 1. One of the ultimate ramuli.
— 2. A vesicle from one of the main branches.
— 3. Vesicles from the racemes of fructification.
— 4. Leaf.
— 5. Part of a raceme. 4 and 5 magnified.

Sargassum ornatum.

Fig. 1. Part of a branch.
— 2. Leaf from the stem.
— 3. Vesicles.
— 4. Raceme of fructification ; the last magnified.

PLATE VII.

Sargassum echinocarpum.

Fig. 1. Portion of a branch.
— 2. Leaf with a vesicle at its apex.
— 3. Leaves producing vesicles.
— 4. Vesicle with foliaceous expansion of the stalk.
— 5. Vesicle in its simplest form.
— 6. Receptacles, with a leaf passing into a vesicle.
— 7. Portion of a raceme. 5—7 magnified.

Sargassum Campbellianum.

Fig. 1. One of the smaller branches.
— 2. A leaf with raceme of fructification.
— 3. Vesicle.
— 4. Receptacles passing into leaves and vesicles. 2—4 magnified.

Sargassum debile.

Fig. 1. Portion of a branch.
— 2. Leaf and vesicles; the last magnified.

PLATE VIII.

Sargassum lanceolatum.

Fig. 1. Termination of a branch.
— 2. Leaf, vesicles and raceme, slightly magnified.
— 3. Vesicles.
— 4 & 5. Racemes, magnified ; one of the receptacles terminating in a foliaceous expansion and vesicle.

Sargassum acanthicarpum.

Fig. 1. Termination of a branch.
— 2. A portion with receptacles, one of the leaves being converted into a vesicle.
— 3. Leaves from the base of the stem close to the root.
— 4. Vesicles.
— 5. Leaf and raceme.
— 6. Portion of a raceme, showing the proliferous state in which it is not unfrequently found. The two last magnified.

Sargassum dumosum.

Fig. 1. Portion of a branch.
— 2. Leaf and raceme.
— 3. Vesicles; one of them being supported on an abortive receptacle.
— 4. Raceme. 2—4 magnified.

Plate IX.

Sargassum porosum.

Fig. 1. Leaves and vesicles on the young plant.
— 2. One of the lower leaves.
— 3. Leaves and vesicles on the fertile branches.
— 4. Leaves of the ramuli with receptacle.
— 5. Portion of a branch with old racemes, after the leaves and vesicles have disappeared. The two last magnified.

Sargassum elegans.

Fig. 1. A branch.
— 2. Leaf from ditto.
— 3. Raceme.
— 4 & 5. Raceme.
— 6. Vesicles. 2, 4, 5 and 6 magnified.

Sargassum brevifolium.

Fig. 1. Lower portion of a branch.
— 2. Raceme of fructification, with vesicles.
— 3. Raceme, vesicles and leaf.
— 4. Vesicle.
— 5. Portion of var. β.
— 6. Leaves of ditto. 3, 4 and 6 magnified.

Plate X.

Sargassum obovatum.

Fig. 1. Termination of a branch.
— 2. Cauline leaf.
— 3. Leaves accompanying the receptacles.
— 4. A raceme and leaf from the end of a branch.
— 5. Vesicles. 4 magnified.

Sargassum Wightii.

Fig. 1. Portion of a branch.
— 2, 2. Leaves and vesicles from a young specimen.
— 3. Raceme of fructification as sometimes seen terminating the branches.
— 4. Portion of a raceme in its more compact form.
— 5. Portion of do. as seen in fig. 3.
— 6. Vesicle. 4 & 5 magnified.

Sargassum cervicorne.

Fig. 1. One of the fertile ramuli, and leaf given off at the base of a branch.
— 2. Leaf from a young plant with vesicles.
— 3. Do. from towards the upper part of same plant.
— 4. Vesicles.
— 5. Receptacles as they are developed on one specimen.
— 6. Do. The last magnified.

Plate XI.

Sargassum squarrosum.

Fig. 1. A branch.
— 2. Leaves.
— 3. Vesicles.
— 4. Receptacles. The last magnified.

Sargassum divaricatum.

Fig. 1. One of the ramuli.
— 2. Vesicles.
— 3. Do.
— 4. Receptacles. 3 & 4 magnified.

Sargassum acutifolium.

Fig. 1. A small branch.
— 2. Do. from a young plant.
— 3. Vesicles.
— 4. Do. produced at the end of leaves.
— 5. A raceme.
— 6. A single receptacle. 5 & 6 magnified.

XX. *The Musci and Hepaticæ of the Pyrenees.* By Richard Spruce.

Read 11th January 1849.

Before entering upon an enumeration of the Musci and Hepaticæ of the Pyrenees, it will be proper to indicate the sources from which it has been derived. I have not been able to find any trustworthy record of mosses gathered in the Pyrenees previous to the time of Bridel, who in 1803 visited the Pyrénées Orientales and the northern part of Catalonia, where he discovered his *Bartramia stricta, Barbula chloronotos* and some others. Of Bridel's mosses I have seen only a very few, communicated by Professor Arnott from the herbarium of M. Requien. In the 3rd edition of the 'Flore Française' (1815) several Pyrenean stations of mosses are recorded, on the authority of DeCandolle, Ramond, Dufour and Grateloup. The two botanists last-named have since that period continued to pay occasional botanical visits to the Pyrenees, almost up to the present time, and to their liberality I owe specimens of such mosses as they collected. In 1825 the eastern and central Pyrenees were visited by our distinguished countrymen, Messrs. G. Bentham and G. A. Walker-Arnott, and the latter gentleman has kindly communicated to me specimens of nearly all his Pyrenean mosses, a few only of which he has noticed in "A Tour to the South of France and the Pyrenees," inserted in the 'Edinburgh New Philosophical Journal' for April 1826. Still later, from 1828 to 1830, the eastern Pyrenees were at various times partially explored by Dr. C. Montagne, whose knowledge of general Cryptogamy is unrivalled, and his discoveries, including numerous lichens and not a few mosses, were announced by himself in the 'Archives de Botanique,' tom. i. (1833), under the title of "Notice sur les Plantes Cryptogames récemment découvertes en France," &c. Most of these I have had the opportunity of examining. In 1835, Dr. Grateloup began to publish in the 'Actes de la Société Linnéenne de Bordeaux,' tom. vii., a "Cryptogamie Tarbellienne, ou Description succincte des Plantes cryptogames qui croissent aux environs de *Dax,* dans le Dépt. des *Landes,"* in which were to be comprised all the Cryptogamia growing within 25 leagues of Dax, a district which would include the extreme Western Pyrenees; but it proceeded no farther than the publication of the Characeæ, Filices and Hepaticæ, for specimens of most of which I am under obligation to Dr. Grateloup. About the year 1843, MM. Philippe and de Lugo, two botanists residing at Bagnères-de-Bigorre, began to collect the mosses and Hepaticæ of the neighbouring mountains, and on the occasion of my visit to that city, two years afterwards, they put into my hands, without reserve, specimens of all they had succeeded in finding. A few mosses have also at different times been gathered in the Pyrenees by MM. des Moulins, Durieu, Gaston-Sacaze, and probably by others of whom I have not heard, and of whose labours I cannot therefore make that honourable mention which is their due. In 1845 came my own visit to the Pyrenees, undertaken principally (though not solely) for the purpose of studying the Musci and Hepaticæ, and extending through a period of nearly eleven months. It will not be without use if I here briefly retrace my steps, as some repetition will be thereby avoided, and an opportunity will be afforded of indicating the position of certain localities, the names of which are of frequent recurrence in my catalogue, though too obscure to be found in an ordinary map*.

I arrived at Pau, the *chef-lieu* of the Dept. of the *Basses-Pyrénées,* and the ancient capital of Béarn, in the early part of May 1845, and my first herborization in the Pyrenees was made on the 13th of the same month. My excursions comprised, besides the woods, &c. adjoining the town of Pau, the villages of Jurançon, Gélos, Rontignon and Narcastet, lying on the southern bank of the Gave de Pau, with the valleys running up from them to the southward, among what may be called the skirts of the Pyrenees; and the village of Bilhères, lying south of the same river. From the 29th to the 31st were devoted to a visit to Oloron, at the entrance of the Vallée d'Aspe, along which runs one of the most frequented roads into Spain. On the 11th of June I again left Pau for St. Sever, in the Landes, on a visit to Dr. Léon Dufour, the eminent naturalist, where eight days were usefully spent in exploring the neighbouring *landes,* especially those of Mugriet (Commune of Souprosse) a few miles distant from St. Sever, and on the opposite side of the Adour. Returning thence to Pau, I again started on the 25th for Laruns, a little town lying about 26 miles to the southward, near the up-

* For a fuller account of my tour consult the 'London Journal of Botany,' vol. v. p. 134.

per extremity of the Vallée d'Ossau, and midway between the Eaux Bonnes and the Eaux Chaudes. Here commenced my acquaintance with the *real* Pyrenees. My excursions included the Pic de Ger and the Montagne Verte, the former overlooking the Eaux Bonnes from the south and the latter from the north; the Gorge de Hourat, conducting to the Eaux Chaudes, and watered by the Gave de Gabas; the Gave de Valentin, which uniting at Laruns with the Gave de Gabas, forms the Gave d'Ossau; the village of Béost and the hameau of Bagès (celebrated as the residence of Gaston-Sacaze, the shepherd-botanist). Descending the Vallée d'Ossau and again taking Pau in my way, I proceeded on the 8th of July to Argélez, in the Dept. of the *Hautes Pyrénées.* The following day was given to the herborization of Pierrefitte, on the south side of the valley (or rather *plain*) of Argélez, and at the confluence of the gorges of Luz and Cauterets. On the 11th I ascended to Cauterets, where I remained until the end of the month. My excursions from it were to the Pont d'Espagne and Lac de Gaube, ascending the Val de Jéret along the banks of the Gave de Marcadaou; to the valleys of Lutour and Combascou, and to Mont Lizé. On the 2nd of August, accompanied by Dr. Southby, a compatriot enthusiastic in the pursuit of natural history, I crossed the central chain by the Port de Cauterets to the baths of Penticosa in Aragon. In this excursion, which occupied four days, numerous interesting flowers, but scarcely any mosses, were added to my collection. Returning to Cauterets, and descending from thence to Argélez, on the 8th I again ascended to Luz, at the entrance of the valley of Barèges. From Luz I visited the celebrated Chaos and Cirque de Gavarnie, the Vallée d'Estaubé, &c., but my bryological collections were not much swelled thereby. On the 20th I crossed the Tourmalet to Bagnères-de-Bigorre, in the valley of the Adour. My stay was but short, for the present, and my only excursion of importance was to the flowery Mont Lhieris. The 27th and 28th of the same month were taken up in walking through the mountains, by way of the Hourquette d'Aspin, the Vallée d'Aure and the Port de Peyresourde, to Bagnères-de-Luchon, in the Dept. of the *Haute Garonne.* During my stay here of five weeks, I explored the whole of the magnificent Vallée du Lys (lateral to the valley of Luchon) with its four lakes and twenty-four cascades, and I ascended the lofty mountain of Crabioules (mountain of *crabes* or *izards*) which bounds it on the west, as far as the snow-line on the 1st and 2nd of October. Before this time I had visited the mountain of Superbagnères, which rises from the back of the town, the gorge of Esquierry ("le jardin des Pyrénées"); the Lacs d'Oo (Lac de Séculéjo and Lac d'Espingo) lying between

Mont Crabioules and the Vallée d'Aure; the Vallée de Burbe (in which is the Bois de Gouerdère), and, passing through the Port de Portillon at its extremity, the upper part of the Vallée d'Aran in Catalonia; and on the 10th, 11th and 12th of September, passing through the Bois de Sajust and the Port de Bénasque (in the central chain), I had ascended the Maladetta in Aragon. Leaving Bagnères-de-Luchon and the Haute Garonne on the 4th of October, I returned to Bagnères-de-Bigorre, and occupied myself until nearly the end of the month in exploring its environs, by which my collection of pleurocarpous mosses was much enriched. The localities examined were the rocks of Bédat and Salut, close by the town; Mont Lhieris and the woods of Gerde and Asté at its base; the Gorge de Labassère; the Vallée de Lesponne with Lac Léhou (otherwise Lac Bleu), and a tributary valley (Ardalos) extending to the base of the terminal cone of the Pic du Midi. The autumn being unusually prolonged, and the summits still clear of snow, I undertook another expedition to the Basses Pyrénées, and on the 1st of November proceeded again to Laruns, where I remained until fairly driven away by the coming of winter. Besides the localities visited in summer from this station, I now examined the Vallée de Béost, which leads across the Col de Louvie to the Vallée d'Argélez; the upper part of the Gave de Valentin towards the Col de Tortes; the mountain (Goursi) which shades Laruns on the south; and Gabas, near the base of the Pic du Midi. Driven from the mountains, my next destination was, by way of Pau, to Dax (*Aquæ Augustæ Tarbellicæ*) in the Landes (*Ager Syrticus*), where I arrived on the 18th of November. In the midst of almost unceasing rain I visited in this rich district the ophitic rocks of St. Pandelon on the banks of the Luy (a tributary of the Adour), the chalk rocks of Tercis, and the woods of Saubagnac and La Torte. Having devoted a fortnight to a re-examination of the neighbourhood of Pau, I returned early in December to Bagnères to winter. In the Pyrenees, as throughout nearly all the rest of Europe, the winter of 1845–6 was remarkably mild, and by the month of February the lower mountains were quite clear of snow. I availed myself of this circumstance to explore the district almost completely, and in one instance to make, in company with M. Philippe, an excursion of four days (from the 5th to the 8th of February) into the heart of the mountains, for the purpose of examining the back of the Pic de Mont-Aigu and the Vallée de Castelloubon (otherwise V. de Gazos), which is separated by only a narrow ridge from the valleys of Luz and Argélez. Even at that season we were able to reach an altitude of 7000 feet, and might easily have gone higher, but the ground at that height, though almost clear of snow, was frozen to the depth of several inches, and the waterfalls were changed into sheets of ice. The chief localities examined near Bagnères, and not previously named, are the forests of Transoubât and of L'Escaladieu (the latter on the road to Toulouse); the valleys of Campan, Serris and Trébons; the Bois de Lagaillaste and the Camp de César, both near the village of Pouzac; the *Côtes schisteux* of Loucrup and the Bois de Montgaillard, on the road to Lourdes. These examinations enabled me to add extensively to the list of mosses previously observed by MM. Philippe and de Lugo. Finally quitting Bagnères early in March, a last visit to Pau rendered my collection of the mosses of the Western Pyrenees still more complete; and in proceeding thence to Paris, two days spent at St. Sever with the excellent Dufour, afforded me rarities unobserved the preceding year.

In this *résumé* of my wanderings I have avoided alluding to the species collected, but it will be seen, by tracing my track on the map, that I executed a network of journeys sufficient to explore pretty fully the tract of mountains traversed, extending from the Vallée d'Aspe on the west to the Vallée d'Aran on the east, and to enable me to state with considerable confidence the amount and distribution of species within these limits.

Since my return from the Pyrenees I have had a few additional species and habitats from my friend Philippe, and also from M. Schimper, who passed through part of the Pyrenees in 1847 on his way into Spain.

It must in conclusion be acknowledged, that it is only botanists resident in the Pyrenees who have it in their power to present to the world a complete flora, whether Phanerogamic or Cryptogamic, of these mountains. Botanical geography is a subject that can be but very imperfectly studied in the cabinet, and in sitting down to arrange the materials collected on a distant expedition, one always finds some deficiency, some essential observation omitted, which, to a person on the spot, might be supplied by travelling possibly only a few paces.

General considerations on the structure, &c. of the Pyrenees.—The Pyrenees may be aptly compared to an immense barrier, raised by nature's hand for the separation of two nations, and extending from sea to sea. The transversal ridges which spring here and there from the central chain may be considered as the buttresses, or as the outworks of this great fortification. The area occupied by these mountains lies between 3° 20′ E. and 2° 0′ W. long. (from Greenwich), and from a little north of the 43rd parallel nearly to the 42nd. Their direction, from the Mediterranean to the Bay of Biscay, is nearly W. by N.; and their length, from Cape Creux to the Port des Passages, is about 270 English miles. It is well known that the Pyrenees have at the latter limit reached but half their length, and that their continuation constitutes the elevated ridges of Bizcaya, Asturias and Gallicia, up to their real termination at Cape Finisterre; at present, however, we have only to do with that portion which separates France from Spain, and to which the name "Pyrenees" is popularly limited.

When attentively considered, the Pyrenees will be found to consist of *two* chains: the *western*, which increases in altitude from the ocean to the Maladetta (10,722 ft.*), its highest point, whence it rapidly sinks to the opposite sea; the *eastern* commencing north of the Maladetta, with hills of slight elevation, increases in height as it approaches the Mediterranean, not far from which is Mont Canigou (8652 ft.), one of its loftiest summits. From the point of dislocation is thrown off to the northward a remarkable embranchment, which separates the basin of the Garonne from that of the Adour, giving birth to the latter river, and stretches through the Dept. of the Hautes Pyrénées a little way into that of Gers: its highest point is the Pic du Midi de Bigorre (9000 ft.). Some geologists (as M. Reboul) have traced several distinct axes of elevation in the Pyrenees; and M. Elie de Beaumont supposes that they have been upheaved at four distinct epochs, though the great mass owes its elevation to only the third of these, which was posterior to the chalk formation. The fourth epoch of elevation is perceivable only in the localities where serpentine (*ophite*) appears.

The loftiest summits of the Pyrenees are nearly all out of the central chain; the Maladetta, the culminating point of the whole range, is to the southward of it; as is also Mont Perdu, the next in altitude. The depressions (called "Ports" in the medial ridge, and usually "Cols" in the transversal ones) are all of considerable elevation, often from 7000 to 9000 feet, and there are only two passes practicable for carriages, one at each extremity of the chain. On the southern or Spanish side the ascent is more abrupt than on the northern side, where two ridges (at least) parallel to the medial ridge, and yielding to it very little in height, are usually distinctly traceable. The Spanish Pyrenees are also watered by fewer streams, have fewer lakes, and are less clad with forests than the French. On both sides the valleys are in most cases steep; the *basins* we successively encounter in

* The altitudes are all in French measures, and I have given very few, for besides that I had not the opportunity of determining any myself, the altitude of the same mountain, as stated by different observers, often varies considerably.

ascending them are usually small, and occupied either by lakes, or by alluvium deposited by the descending streams. In only two cases have I seen hollows filled with peat, one on Mont Goursi in the Basses Pyrénées, and the other at the head of a small valley, lateral to the Vallée de Lesponne in the Hautes Pyrénées.

The line of perpetual congelation in the Pyrenees, I assume from my own observations to be at an average height of nearly 9000 feet, or more than 1000 feet higher than in the Alps. One authority, now before me, fixes it at 8718 feet, and Ramond estimated it at from 8100 to 8400 feet, which I do not hesitate to say is much too low. It varies however considerably with the degree of exposure and even with the form of a mountain, and the snow is uniformly found to melt less, and consequently to descend lower in an eastern exposure than elsewhere. Hence, even on the highest mountains, the band of perpetual snow is not more than from one to two thousand feet broad.

The streams which take their rise on the *southern* slopes of the Pyrenees flow nearly all into the Ebro. On the *northern* slopes, the space lying opposite the western half of this drainage of the Ebro is occupied by the Adour and its tributaries, while the space corresponding to the eastern half, extending from the source of the Adour to that of the Arriège, is occupied by the upper part of the basin of the Garonne. In the extreme eastern angle, on both the northern and southern side, are various small streams which run directly into the Mediterranean. This drainage of the rivers would seem to afford us the basis of a division of the Pyrenees, for the purpose of estimating the distribution of plants on their surface; but on trial such a division will be found intractable, and I prefer another which separates the plants into more distinct groups, and corresponds very nearly with that adopted by the *botanistes sédentaires* of the Pyrenees. I divide the Pyrenees into *three districts*, the *Western*, the *Central*, and the *Eastern*, the limits of which I proceed to define.

The *Central Pyrenees* are comprised between the upper part of the Gave de Pau, from its source at the Cirque de Gavarnie as far as to the bridge of Lourdes, on the *west*; and Mont Maladetta and the Vallée d'Aran, watered by the infant Garonne, on the *east*; or from the meridian of Greenwich* to about 50 minutes of east longitude. This district includes, in France, the upper part of the Dept. of the Haute Garonne and most of the upper part of the Hautes Pyrénées; in Spain, part of Aragon and a very small angle of Catalonia. It is watered by the upper

* The village of Luz, in the valley of Barèges, is exactly in the longitude of Greenwich.

branches of the Adour and Garonne, and contains the highest mountains and the deepest valleys in the Pyrenees, as well as the most extensive forests. Glaciers of great extent are found in this district only; the principal are those which occupy the northern slopes of the Maladetta and Crabioules.

The *Western Pyrenees* extend from the Central to the ocean at Bayonne and St. Jean de Luz. They include, in France, the Dept. of the Basses Pyrénées and part of the Landes, stretching as far as the Adour at St. Sever and Dax, besides a small portion of the Hautes Pyrénées; in Spain, a small part of Navarre and most of the northern part of Aragon. This district extends farther to the north than either of the others; it is consequently colder at the same altitude, and in the sandy plains bordering on the Adour and the ocean the climate is much more humid.

The *Eastern Pyrenees* are comprised between the Central and the Mediterranean. In France they occupy the whole length of the Depts. of Arriège and Pyrénées Orientales; in Spain, nearly all the northern part of Catalonia. This district is the most southern, the warmest and driest, and the most denuded of forests of the whole three*.

A rough sketch of the mineralogy of the Pyrenees, so far as it is connected with the distribution of plants, will conduce to a more complete idea of the peculiarities of these divisions. The igneous rocks of the Pyrenees do not, as in the Alps, constitute some of the loftiest mountains, and the highest point at which I am aware of the existence of granite is on the summit of the Pic du Midi d'Ossau (9186 ft.), unless it attains the summit of Néouvielle (9696 ft.), as some maintain. In the eastern part of the Western Pyrenees it constitutes the mass of the mountains above Cauterets, especially those which include the valleys of Combascou, Lutour and Jéret, and the Lac de Gaube; from whence it passes (by the Vallée d'Azun, &c.) into the upper part of the Vallée d'Ossau, where I have observed it from below the Eaux Chaudes to the Pic du Midi, and on the circumjacent mountains, in which it is the predominant rock. From the Vallée d'Ossau it dips at once so profoundly as not to be observed in the deepest parts of the Vallée d'Aspe, or in any of the valleys to the westward, until it reappears near Bayonne, in the *massif* of Cambo. In the Central Pyrenees it appears in the valley of Barèges (continued from the valley of Cauterets) and about the base of the Pic du Midi de Bigorre; but, with this latter excep-

* I should add, that great part of the Arriège is still a *terra incognita* to me, and I especially commend its exploration to resident cryptogamists. Probably, from its containing some very lofty summits, as the Pics of Montcalm and Estats, both its character and its vegetable products would require the western part of it to be annexed to our Central district.

tion, it rarely attains the surface in the neighbourhood of Bagnères-de-Bigorre. Near Bagnères-de-Luchon it appears in most of the valleys and at the base of the mountains. From the Central Pyrenees it passes into the Eastern, where, especially in the Dept. of Pyr. Orientales, it constitutes a very large proportion of the surface. In the granite I include gneiss, and possibly some other rocks whose internal structure is of nearly the same character.

Mica-slate (*schiste-micacé*) I have observed in the Western Pyrenees only in the valley of Cauterets, especially at the base of the Monné and on Mont Lizé. Thence it passes into the Central district, where it constitutes the terminal cone of the Pic du Midi, the Pic de Mont-Aigu, and all the adjacent mountains. The wall of rock which supports the waters of Lac Lehou is of mica-schist, and in general the embankments of all the lakes in the Pyrenees are of this rock or of granite. In the Eastern Pyrenees the mountains on the western side of the river Aude are of mica-schist, and I am not aware of its occurrence elsewhere.

Slate (*schiste-argileux*) may be regarded as the most important rock in the Pyrenees, appearing as it does in every part of them. In the W. Pyrenees I have observed it in the Vallée d'Ossau; also near Argélez, where it is the predominant rock, extending from thence along the gorge of Luz to the valley of Barèges, where it meets the mica-schist and other primary rocks. Ascending from Argélez by the valley of Cauterets, it extends (though not uninterruptedly) to the very summit of the central chain. The Port de Cauterets and all the other passes which have fallen under my notice are (as in the Alps) excavated in slate-rock, which is often very siliceous, and cleaves with difficulty in at least two directions. From Cauterets the slate passes into the Central Pyrenees, descending almost to their bases, and attaining the ridge of the central chain, as at the Port de Bénasque, &c. In the Eastern Pyrenees it would seem to occur chiefly about the base of the mountains, skirting the granitic nucleus. The lower mountains in the Pyrenees, whose chief constituent is clay-slate or grauwacke, have commonly rounded summits, and are covered with herbage; but the loftier ones, and especially those of the medial ridge, have a bolder aspect; their sides are furrowed by deep ravines, and their summits are serrated and peaked. When closely examined they are found to be in a state of continual decomposition and degradation, probably from the dissemination of iron pyrites in these rocks.

Transition-limestone (*calcaire de transition*) constitutes also its proportion of the surface of the Pyrenees. In the W. Pyrenees it forms the principal part of the ridge of the central chain, lying to the south of the Pic du Midi d'Ossau. From the valley of Cauterets it would seem to be entirely absent, but it reappears in the Central Pyrenees in the great valley of Barèges, where it extends from the bottom of the valley of Gèdre to a little beyond the lake of Gavarnie, and plunges under the immense mass of alpine limestone of the Marboré. The lower hills near B.-de-Bigorre, especially the Pic de Lhieris, are formed almost entirely of it, and here it often presents itself in thin beds, alternating with clay-slate. In the upper part of the valley of Luchon, and in all the surrounding mountains, I do not recollect to have observed any calcareous rock. In the E. Pyrenees, transition-limestone would seem to occur amongst the granitic formations in detached masses (accompanied however by slate) chiefly in the neighbourhood of Villefranche and Prats de Mollo, and in the Corbières. The ascents of mountains of transition-limestone are interrupted by escarpments, which are rarely of great elevation.

Of secondary rocks, the only one which I shall have occasion to mention is oolitic limestone (*calcaire alpin*). To this rock the Pyrenees owe some of their grandest features, as it forms escarpments in some instances considerably exceeding a thousand feet in altitude, as at the Cirque de Gavarnie, the termination of the Vallée d'Estaubé, &c.; but wherever it attains the alpine region (as in the instances just cited) I have found it quite destitute of mosses, probably from its exposed position, above the region of forests. It is only in the lower hills of the Western Pyrenees, especially near Pau, where it occurs as a conglomerate, that the alpine limestone has afforded me any cryptogamia. Some of Dr. Arnott's mosses from the Pyr. Orientales, judging from the fragments attached to the specimens, have been gathered on alpine limestone.

Trap-rocks I have remarked in the Pyrenees in small detached masses, but I have gathered cryptogamia only on a rapidly decomposing ophite at Labassère near B.-de-Bigorre, and at St. Pandelon near Dax.

This brief sketch of the chief rocks of the Pyrenees is confessedly very imperfect; it is also designedly *superficial*, for it is only by the surface-rock that plants whose roots rarely penetrate to the depth of an inch can possibly be influenced. The position, too, of any rock in the geological series cannot be said to have anything to do with the distribution of plants, though the presence of a certain mineral is in many cases essential to their existence. From my observations in the Pyrenees and elsewhere, I have ascertained pretty accurately what mosses require a matrix containing *carbonate of lime*; these will be specified as they occur. They have obviously no preference for primitive, transition, or secondary limestone, but they are always most abundant and luxuriant on limestones of which the surface rapidly decomposes; hence the older limestones, which in the Pyrenees are often transformed into marble, are never in that state prolific in mosses. Of those species which absolutely *refuse* to vegetate on limestone (and they are not very numerous), some are found on a great variety of rocks; but probably when carefully examined these rocks would be found to contain some one element, essential to all the species making choice of them. *Silex,* for example, seems necessary to certain *Grimmiæ*; and there are a few mosses rarely found except on rocks containing a large proportion of iron. It is scarcely necessary to mention that many mosses are never found on rocks at all, but by exception, some preferring the bark of living trees (*cortical*) and others decayed trunks or logs (*lignal*).

Distribution of Musci and Hepaticæ in the Pyrenees, according to latitude and longitude.—The distribution of plants on any given portion of the earth's surface requires to be estimated both *horizontally* and *vertically,* and if the surface to be considered extend through several degrees of latitude, the two modes will require to be exhibited both separately and in combination. It is obvious that a comparison of the vegetation of any portion of the earth with that of any other portion, or of the whole, must always be incomplete, until the whole of the earth's surface shall have been examined. Hence the following account of the distribution of Musci and Hepaticæ in the Pyrenees can only be regarded as approximatively correct. I enumerate 390 Musci and 91 Hepaticæ in the Pyrenees. Taking the whole number of Musci known in the world to be 2400 (which is rather over than under the limit), and of Hepaticæ to be 1200, this would show the Pyrenees to possess nearly one-sixth of the entire family of Musci and but one-thirteenth of the Hepaticæ, or twice as great a proportion of the former as of the latter. But this proportion is very nearly what we should arrive at in comparing the Musci and Hepaticæ of Europe with those of the rest of the world, so much more numerous are Hepaticæ in the southern than in the northern hemisphere.

The species which attain absolutely their northern limit in the Pyrenees seem to be only the four following:—

Hypnum aureum.	Tortula cæspitosa.
Bryum platyloma.	Southbya tophacea.

Those which attain their southern limit are apparently much more numerous; but when the mountains of Spain come to be fully explored, the list will probably be somewhat lessened; and I ought to acknowledge that, possessing no complete list of the Cryptogamia of Italy, I may have assigned the Pyrenees as the southern limit for a few species which in reality extend farther south in Italy. So far however as I can ascertain, the following species have their southern limit in the Pyrenees:—

Hypnum umbratum.
Pyrenaicum.
plicatum.
flagellare.
striatulum.
cæspitosum.
crassinervium.
Vaucheri.
pumilum.
campestre.
Starkii.
Mühlenbeckii.
pratense.
Haldanianum.
heteropterum.
catenulatum.
Sprucii.
trichophorum.
planifolium.
Isothecium rufescens.
chryseum.
Leskea rostrata.
longifolia.
Anacamptodon splachnoides.
Mielichoferia nitida.
Catoscopium nigritum.
Bartramia marchica.
Bryum acuminatum.
polymorphum.
Zierii.
concinnatum.
Ludwigii.
obconicum.
julaceum.
Mnium spinosum.
Mnium spinulosum.
medium.
Aulacomnion androgynum.
Physcomitrium acuminatum.
Tortula alpina.
latifolia.
aciphylla.
papillosa.
Dicranum fulvum.
longifolium.
Sauteri.
Arctoa fulvella.
Anodus Donnianus.
Orthotrichum Bruchii.
rivulare.
urnigerum.
Hedwigia imberbis.
Grimmia anodon.
curvula.
sulcata.
atrata.
Encalypta commutata.
rhabdocarpa.
Polytrichum sexangulare.
Fissidens grandifrons.
Sarcoscyphus adustus.
Alicularia compressa.
Jungermannia sphærocarpa.
Genthiana.
cordifolia.
Lyoni.
Francisci.
Lejeunia ovata.
Frullania fragilifolia.
Dumortiera irrigua.

Few species can be expected to attain their eastern limit in the Pyrenees (lying as they do on the *western* side of Europe), and I can find only these six, of which all but one (*Fissidens grandifrons*) had been previously supposed to be confined to our own islands:—

Hypnum cæspitosum.
Tortula papillosa.
Fissidens grandifrons.
Lejeunia ovata.
Frullania fragilifolia.
Dumortiera irrigua.

The number of Musci and Hepaticæ which are not found anywhere to the westward of Europe, either on the continent of America or in the intermediate islands, is considerable, and they mostly attain their western limit in the British Isles. Some species which reach their western *European* limit in the Pyrenees (not being found in the British Isles) reappear in N. America, under nearly the same latitude: such are *Hypnum Haldanianum*, *Leskea rostrata* and *attenuata, Physcomitrium acuminatum, Tortula cæspitosa, Dicranum fulvum, Fissidens grandifrons,* &c. *Tortula chloronotos* reappears in the isle of Teneriffe. There are only the following species whose occurrence westward of the Pyrenees has not yet been recorded :—

Hypnum Pyrenaicum.	Tortula inclinata.
Vaucheri.	Encalypta ligulata.
Isothecium Philippianum.	Buxbaumia indusiata.
Bryum polymorphum.	Plagiochila Pyrenaica.
Mnium medium.	Scapania apiculata.

Of the few mosses which grow on the southern slope of the Pyrenees, only one species (*Tortula cæspitosa*) was not found at all on the northern. The Spanish Pyrenees have in fact a peculiarly arid aspect (to the eye of a cryptogamist), and correspond well with the distant view I have had of the dry and naked sierras of Spain*.

If we now compare the three districts of the Pyrenees, above defined, one with another, we find a considerable number of species peculiar to each. The following mosses, gathered in the *Western Pyrenees,* were none of them observed in the Central and Eastern Pyrenees. [Those species marked with a (†) are peculiar to the sandy plains of the Landes.]

Hypnum strigosum.	Physcomitrium ericetorum.
megapolitanum †.	acuminatum.
cæspitosum †.	Tortula ambigua †.
trichophorum.	papillosa.
Catoscopium nigritum.	latifolia.
Bryum Tozeri.	cæspitosa.
cæspiticium.	Trichostomum luridum.
erythrocarpon.	subulatum †.
torquescens.	Dicranum spurium.
platyloma.	Weisia cirrhata †.
Muelleri †.	Wimmeriana.
Mnium spinosum.	Gymnostomum calcareum.
Funaria convexa †.	Ptychomitrium pusillum.
Entosthodon Templetoni †.	Orthotrichum crispulum.

* Cavanilles, in his 'Observaciones sobre la Historia Natural, &c. del Reyno de Valencia (Madrid, 1795),' amongst all the localities which he so minutely describes, mentions but one of bryological promise, where he observed the *solitary moss* which enters into his catalogue of the plants. In speaking of the mountains of Valldigna (p. 218) he says, "Los montes por donde están expuestos al mediodia son secos, y que no hay fuentes en sus raices : al contrario las faldas septentrionales de todos ellos están sembradas de sitios húmedos y frondosos, y en las raices nacen fuentes abundantes. . . . . En el valle de Barig son innumerables las fuentes que nacen desde Aldaya hasta Puigmola. . . . . En estos sitios húmedos y sombríos está siempre viva la naturaleza, cubierto el suelo de vegetales, y casi siembre de flores : allí se disputan las plantas el terreno. La doradilla (*Ceterach*), el polipodio comun, el pteris (*Pt. aquilina*) y la jungermania allanada (*Jg. complanata*) occupan las hendeduras de las peñas."

Orthotrichum patens.
urnigerum.
Conomitrium Julianum †.
Buxbaumia aphylla †.
Sphagnum cuspidatum †.
compactum †.
Alicularia compressa.
Southbya tophacea.
Jungermannia curvula.
minuta.
dentata †.
Lejeunia ovata.
calcarea.
Frullania fragilifolia.

The whole of the following were observed only in the *Central Pyrenees* :—

Hypnum Pyrenaicum.
flagellare.
aureum.
falcatum.
Haldanianum.
heteropterum.
planifolium.
depressum.
Neckera pumila.
Entodon cladorrhizans.
insidiosus.
Isothecium Philippianum.
striatum.
Leskea rostrata.
longifolia.
Hookeria lucens.
Anacamptodon splachnoides.
Bartramia marchica.
Bryum pyriforme.
longicollum.
Ludwigii.
julaceum.
concinnatum.
cirrhatum.
Mnium lycopodioides.
medium.
Dissodon Frœlichianus.
Anacalypta latifolia.
Tortula vinealis.
Ceratodon cylindricus.
Distichium inclinatum.
Dicranum fulvum.
majus.
falcatum.
Arctoa fulvella.
Campylostelium saxicola.
Brachyodus trichodes.
Anodus Donnianus.
Seligeria recurvata.
Anœctangium compactum.
Zygodon conoideus.
Orthotrichum rivulare.
Grimmia anodon.
funalis.
sulcata.
Fissidens osmundioides.
Tetrodontium Brownianum.
Sphagnum acutifolium.
squarrosum.
Sarcoscyphus adustus.
Jungermannia Schraderi.
Genthiana.
pumila.
cordifolia.
divaricata.
connivens.
Lophocolea minor.
heterophylla.
Harpanthus scutatus.
Chiloscyphus polyanthos.
pallescens.
Dumortiera irrigua.

The following species are peculiar to the *Eastern Pyrenees*, and when the Hepaticæ of that district come to be ascertained, the list will undoubtedly be extended :—

Hypnum fluitans.
recognitum.
Fabronia pusilla.
Bartramia stricta.
Bryum bimum.
Tortula mucronifolia.
alpina.
Tortula subulata, var. inermis.
gracilis.
Orthotrichum Sturmii.
Grimmia plagiopoda.
trichophylla.
Polytrichum sexangulare.

In glancing over the above lists, we cannot fail to be struck with the great number of species, especially of pleurocarpous mosses, peculiar to the central district. The obvious and true explanation of this is to be found in what is above remarked respecting the depth of the valleys and the extent and density of the forests; pleurocarpous mosses demanding in the latitude of the Pyrenees a great deal of shade.

A few species, occurring in both the Central and Eastern Pyrenees, were not observed in the Western. They are:—

Hypnum reflexum.
Mielichoferia nitida.
Bryum polymorphum var. curvisetum.
Timmia megapolitana.
Trichostomum tophaceum.
Desmatodon nervosus.
Dicranum longifolium.
virens.
Grimmia atrata.
Cinclidotus aquaticus.

The list of species wanting to the Eastern Pyrenees, but observed in both the Western and Central, is so very large that I forbear to insert it, feeling assured that when the former district comes to be explored as the two latter have been, it will be found much less deficient than this list would show it. Three mosses, *Amblyodon dealbatus, Tortula marginata* and *cuneifolia,* growing in both the Eastern and Western Pyrenees, have not hitherto been observed in the intermediate district.

Were I now asked to name *a moss characteristic of the whole Pyrenees,* I should say at once *Fissidens grandifrons,* Brid. (the *Dicranum palmiforme* of Ramond), which is a conspicuous ornament wherever moist calcareous rocks are found, but is scarcely met with out of the Pyrenees*. Amongst the Hepaticæ, *Jungermannia acuta* is scarcely less abundant, growing on the same sort of rock. The following species may also be considered respectively characteristic of our three districts, viz. *Southbya tophacea* of the *Western, Isothecium Philippianum* of the *Central,* and *Bartramia stricta* of the *Eastern.*

Distribution of Musci and Hepaticæ in the Pyrenees, according to altitude.—We come next to treat of the *vertical* distribution of plants, the most interesting branch of *Phytostatics.* In attempting to define our zones of altitude by natural boundaries,

* It will not be out of place to mention here a curious circumstance relating to this moss. Its *fruit* has never yet been found, and even its *flowers* were unknown when it was figured in the 'Bryologia Europæa.' A few years ago, Mr. Sullivant discovered female plants at the Falls of Niagara, and in 1846 he published the specimens in his beautiful 'Musci Alleghanienses' (no. 186). In Jan. 1846, a single tuft of male plants was found by myself and M. Philippe on a dripping limestone rock near Bagnères, and the inflorescence will be described in the proper place. These are all the flowers that have ever been found, and it will be a remarkable circumstance if it be ascertained (as this would seem to show) that *only the male plant exists in Europe, and only the female in America!* The obvious conclusion would be that the plant never had fruited, and without artificial aid never would fruit. It has, however, ample means of maintaining and spreading itself without the aid of seeds.

that is, by certain plants which constitute a marked feature in them, it would seem at first sight a great advantage could we select in every country the same species for this purpose; but a little research will suffice to show us the impracticability of this. To go no farther than the Alps; near as they are to the Pyrenees, and similar as their vegetation is in many respects, there are yet important differences. While, for instance, there is no tree in the Alps above the region of the spruce-fir (*Pinus Abies*, L.), in the Pyrenees there is above this a broad and well-marked belt of Scotch fir (*Pinus sylvestris*, L.). Again, there is in the Alps, above the limit to which the oak ascends, a zone in which the birch (*Betula alba*, L.) is the predominant tree; but in the Pyrenees the birch is excessively rare; indeed I do not at this moment recollect having anywhere seen it where I could be certain it had not been planted, and I perceive Mr. Bentham includes it in his catalogue with a mark of doubt. It would also be quite impossible to define any of our climatal zones in the Pyrenees by the distribution of the *heaths*, as has been done for the British Isles by Mr. Watson in his 'Cybele Britannica.' The only "heath-clad hills" I have seen in the Pyrenees, reminding me of our English and Scottish hills, are some of the lower mountains around Bagnères-de-Bigorre, and here the prevailing species is *Erica vagans*, though *Calluna vulgaris* occurs also, sparingly. The latter species seems never to penetrate far into the mountains. Again, *Erica tetralix* is not found at all in the Central or Eastern Pyrenees, but only in the Western. The only heath I have remarked near Bagnères-de-Luchon is *Erica cinerea*. *E. arborea* is abundant in the valley of Argélez and its tributary valleys (Castelloubon, &c.), but is absent from the Central Pyrenees, while it reappears in several parts of the Eastern. It has been shown by M. des Moulins ("État de la Végétation sur le Pic du Midi de Bigorre, &c.;" 'Recueil des Actes de l'Académie Royale de Bordeaux,' 1844), that several species of *thistles* occupy zones of altitude in the Pyrenees which are easily ascertained, and he has actually constructed a scale of the distribution of fourteen species in the Pyrénées Centrales, showing the altitudes at which they appear and disappear. But were this scale taken as the basis of a climatal arrangement (which M. des Moulins by no means proposes), how would it assist us in comparing the flora of the Pyrenees with that of Lapland, where according to Wahlenberg, "Cardui in sylvis admodum rari, omnesque fere inermes sunt. De cætero quoque plantæ vel frutices *aculeati* in Lapponia non crescunt, &c."?

In comparing two distant portions of the earth's surface with each other, in both of which the same plant is extensively distributed, we are not hence to conclude that the zone which it occupies has in both countries the same *average annual temperature.* Were this the case, such discrepancies as the following would be inexplicable. On Mount Etna, the beech, the birch and the Scotch fir are said to occupy the same zone. In the Pyrenees the beech ceases before the Scotch fir begins, and in the Alps the birch is said to fail even below the spruce-fir. But in Lapland the birch extends far above the Scotch fir, and in fact ascends higher on the mountains than any other tree. Assuming the correctness of these observations (which for Lapland and the Alps cannot be questioned), we are bound to conclude that there are peculiarities of constitution in certain species which enable them to ascend proportionally higher in one latitude than in another*. In other words, an *alpine* flora is not necessarily an *arctic* flora, in its character. Hence the saying of Linnæus, "Plantæ diversæ indicant altitudinem perpendicularem terræ," must be regarded not as an *axiom* but as a *problem*, the complete solution of which still remains to be effected.

It will readily be admitted that all our artificial arrangements,

* The discussion of this *idiosyncrasy* would demand an entire volume, but Wahlenberg's explanation of it (Flora Lapponica, Introd.) is worth quoting, and should be borne in mind in comparing the flora of the Pyrenees or of the Alps with that of Lapland. "Valde probabile mihi videtur *a calore meridiano* vegetationis gradum præcipue pendere" (p. xlix, l. c.)—"*Temperies* tantum illa *æstivalis* in vegetatione producenda efficax, constituit *clima*, ejusque gradus determinat." (p. lii.)—"Aliæ plantæ *longam magis, quam calidam æstatem* sibi exposcunt: ubi temperatura æstivalis media *per tres menses* gradum 8°·5 (Centigr.) haud attingit, ibi hordeum haud ad maturitatem pervenire potest. Hoc quidem jamdudum infra Enontekis contingit; sed nihilominus tamen arbores variæ æstate brevi et calida hujus regionis contentæ sunt: Betulæ enim et Salices alpes versus longe altius læte propagantur. Arbores coniferæ fere ac Hordeum æstatem longiorem quamquam temperatiorem, requirunt, itaque longe altius ascendunt in alpibus Helveticis quam Betula, &c. Ex observationibus thermometricis allatis constat, *æstatem in alpibus Helveticis, etiamsi temperatior sit, fere longiorem esse, quam in alpibus Lapponicis*; et pro certo scimus, temperaturam mediam omnium mensium per totum annum eo magis æquabilem esse in montibus Andium Americæ meridionalis, et igitur omnes arbores, calidiorem quam longiorem æstatem requirentes, ibi crescere desinunt duplo longius infra limitem nivalem quam apud nos; sed Hordeum aliaque Cerealia temperie moderata 7 vel 8 graduum contenta, si ea modo longior sit, duplo altius versus limitem nivalem ibi adscendunt quam omnes arbores." (p. liii.)

It is also well known that some plants will bear *forcing*, that is, will survive and flourish under constant excitement and irritation, much better than others; hence we could hardly expect any plant which will not bear some degree of forcing, to thrive in the rapid summer, with its long days and proportionally great meridional heat, of countries bordering on the Arctic circle; should it even subsist through the rigorous winter of that region.

I am sensible how much the absence of exact thermometrical observations takes away from the completeness of this sketch of part of the flora of the Pyrenees. I have none of my own to adduce, except a few made at the foot of the Western Pyrenees in the month of June, when I found the meridional temperature to often exceed 90° Fahrenheit.

whether phytostatical or phytological, are imperfect; yet they have all their use in placing the same object before us under different points of view. As regards the Pyrenees, I have judged it best under all the circumstances to adopt the climatal arrangement sanctioned by the usage of the most eminent resident botanists. The first exposition of this is to be found in the writings of Ramond, one of the earliest observers in geographical botany. He ascertained that the oak (*Quercus robur*) ascended from the plains to the height of 1600 metres; that the beech (*Fagus sylvatica*) occupied a zone of from 600 to 1800 metres; the fir (*Pinus Abies*) and the yew (*Taxus communis*) a zone of from 1400 to 2000 metres; and that the Scotch fir (*Pinus sylvestris*), commencing at the latter limit, ascended in its smaller forms (especially that called *Pinus Mughus* by Jacquin) as high as 2400 metres. Above this limit (he observes) there are no more trees. Here commence *shrubs, with dry leaves, and mostly procumbent or prostrate stems,* which are concealed under the snow during the winter. Such are *Rhododendron ferrugineum,* various species of *Daphne, Passerina* and *Globularia, Salix herbacea* and *reticulata,* &c. Leaving these, we meet humble herbs with *perennial roots, leaves in rosettes* and mostly *naked stems*: first in the series are *Gentiana campestris, Primula villosa, Saxifraga longifolia, Aizoon,* &c.; next, *Ranunculus alpestris, nivalis* and *parnassifolius, Androsace alpina,* &c.; lastly, *Ranunculus glacialis, Saxifraga cæspitosa, oppositifolia, androsacea* and *grœnlandica* (Lapeyr., non L.): these, with lichens, reach 3000 or even 3400 metres, and extend to and even beyond the line of eternal snow. Guided by these observations of Ramond, and by others of his own, M. des Moulins, in the admirable memoir above-cited, has proposed to divide the Pyrenees into zones of altitude, as follows. The commencement of the *subalpine zone* he places at 4200 feet, about which altitude the cultivation of esculent vegetables (rye, potatoes, cabbages, &c.) ceases. It extends as far as 6000 feet, which is the upper limit of the growth of the spruce-fir and the beech*. The plants of the mountains, united with certain plants frequent in the plains, form the basis of its vegetation, and the real *subalpines* attain in it their greatest development both as to size and number. *Meadows* are scarce in this zone and do not occur above it.

The alpine region M. des Moulins divides into *three zones.* First, the *inferalpine,* which extends from 6000 to 7200 feet, and is characterized chiefly by the presence of *Pinus sylvestris,* which

* My own observations are here somewhat at variance with those of M. des Moulins. The beech has seemed to me to fail ordinarily some hundred feet below the fir, and in effect about the point where the latter attains its greatest development.

even in its most stunted form scarcely passes the upper limit. *Rhododendron ferrugineum* expires in this zone at from 6600 to 6900 feet, and above this altitude the herbage is composed chiefly of *Nardus stricta* (a grass common in the marshes of the Landes !) and of *Festuca eskia*, Ram. (*F. varia γ. crassifolia*, Koch; *Eskio, Jispet* and *Oursagno* of the mountaineers of the Pyrenees). Amongst the shrubs characteristic of this zone may be mentioned *Vaccinium Myrtillus* and *uliginosum, Empetrum nigrum, Sorbus chamæmespilus* and *Salix Pyrenaica*; amongst the herbaceous plants, *Silene ciliata* and *Arenaria ciliata*. *Crocus multifidus*, which is a conspicuous ornament of the lower mountains (as around Bagnères-de-Bigorre), reaches the very summit of the inferalpine zone.

The *medialpine zone* extends from 7200 to 8400 feet. *Festuca eskia* attains the upper limit of this zone, but *Nardus stricta* fails below it. *Juniperus nana* is the giant of the vegetation, already so much contracted. Here the *weeds* which follow the traces of man and of the domesticated animals from the plains, cease to exist. The following species are abundant in this zone: *Statice alpina, Gentiana alpina, Potentilla nivalis, Cherleria sedoides, Silene acaulis, Iberis spathulata*, Berger., and *Pyrethrum alpinum*.

Lastly, above 8400 feet, in order to characterise the *superalpine zone*, we have merely to add to the plants of the middle zone a very small number of herbaceous plants, *all perennial*, and rarely descending into the medialpine zone. Such are *Ranunculus glacialis* and *parnassifolius, Stellaria cerastoides, Androsace alpina, Sibbaldia procumbens, Saxifraga grœnlandica*, Lap., and *S. androsacea*.

Thus far M. des Moulins. Of the zone below the subalpine, which I call the *Zona montosa*, he says nothing, because it was not necessary to his estimation of the flora of the Pic du Midi. It corresponds very nearly to Mr. Watson's "Agrarian Region," and were it our sole object to determine the distribution of Phanerogamia within its limits, it would be expedient to divide it into *three* zones, as M. des Moulins does the alpine region. Ascending from the plain, these zones might conveniently be separated, first by the upper limit of the cultivation of the *vine*, and secondly by that of *maize*, and the three divisions would be of nearly equal breadth. The cultivation of the vine in the Pyrenees is, as Humboldt observed it to be in South America, very nearly coterminous with the natural forests of chestnut-trees. It is true that chestnuts occur above the vineyards, but it is only sporadically; and so do vines occur here and there, trained to cottages in sheltered situations, considerably beyond the zone where they normally find a suitable climate. The cultivation of maize extends to about the point where the box begins to flourish luxuriantly. For the purpose, however, of estimating the climatal distribution of mosses, it will rarely be requisite to divide the montose zone; and where I find occasion to speak of an *inferior* and a *superior montose zone*, it is to be supposed divided into two equal portions.

In order to enable any one to compare more completely the distribution of plants in the Pyrenees with that of the rest of Europe, and especially with that of our own islands, I add the names of several plants which I have myself observed in the various zones, of which many of them have appeared to me characteristic.

Planities ($= Z_0$). Teesdalia nudicaulis, Helianthemum alyssoides et guttatum, Viola lactea, Silene bicolor, Lupinus angustifolius, Corrigiola littoralis, Illecebrum verticillatum, Hyoseris minima, Erica scoparia et ciliaris, Anagallis tenella et crassifolia, Pinguicula lusitanica, Phalangium bicolor, Avena Thorei, Agrostis setacea et elegans, Airopsis globosa, Cynosurus echinatus, &c. &c.

Zona montosa ($= Z_1$). *Pars inferior.* Ranunculus nemorosus, Anemone ranunculoides, Hepatica triloba, Geranium phæum, Saxifraga Geum, Asperula cynanchica, Prunella grandiflora, Stachys alpina, Euphorbia hyberna et dulcis, Cephalanthera ensifolia, Kœleria cristata, Melica ciliata.

Zona montosa superior. Potentilla micrantha, Orobus luteus, Saxifraga Geum, Astrantia major, Heracleum Pyrenaicum, Arnica montana, Cirsium Monspessulanum, Prenanthes purpurea, Soyeria lapsanoides, Scrophularia Scopolii, Erinus alpinus, Teucrium Pyrenaicum, Calamintha sylvatica, Rumex scutatus, Buxus sempervirens, Carex montana, Asplenium septentrionale.

Zona subalpina ($= Z_2$). Ranunculus aconitifolius, Spiræa Aruncus, Meconopsis Cambrica, Arabis alpina, Hutchinsia alpina, Cardamine latifolia et resedifolia, Viola cornuta, Dianthus Monspessulanus, Saponaria ocymoides, Geranium cinereum, Hippocrepis comosa, Trifolium alpinum, Sempervivum montanum, Saxifraga Geum et aquatica, Chærophyllum hirsutum, Sambucus racemosa, Galium vernum, Ramondia Pyrenaica, Scrophularia Scopolii, Digitalis purpurea et lutea, Linaria alpina, Veronica Ponæ et saxatilis, Tozzia alpina, Teucrium Chamædrys, Nigritella angustifolia, Lilium Pyrenaicum, Merendera Bulbocodium, Carex ornithopoda, Asplenium Halleri.

Zona inferalpina ($= Z_3$). Ranunculus Gouani, Helianthemum Œlandicum, Viola biflora, Gypsophila repens, Geranium cinereum, Trifolium alpinum, Dryas octopetala, Geum Pyrenaicum, Potentilla alchemilloides et rupestris, Epilobium alpinum, Paronychia serpyllifolia, Saxifraga Aizoon *β.* minor, Eryngium Bourgati, Aster alpinus, Homogyne alpina, Carduus carlinoides, Crepis pygmæa, Jasione perennis, Erinus alpinus var. hirsutus, Veronica aphylla, Bartsia alpina, Pedicularis comosa, Horminum Pyrenaicum, Pinguicula grandiflora, Androsace carnea et villosa, Primula integrifolia, Globularia nudicaulis et rupestris, Statice alpina, Salix Pyrenaica et reticulata, Luzula pediformis, Carex sempervirens, Festuca varia, Aspidium Lonchitis, Lycopodium Selago, Polypodium Phegopteris.

Zona medialpina ($=Z_4$). Ranunculus alpestris, montanus, Pyrenæus, Cardamine bellidifolia, Draba aizoides, Sisymbrium pinnatifidum, Saponaria cæspitosa, Arenaria purpurascens, Stellaria cerastoides, Cerastium alpinum, Cherleria sedoides, Geum montanum, Potentilla nivalis, Rhodiola rosea, Saxifraga aretioides, bryoides et muscoides, Asperula hirta, Aronicum scorpioides, Chrysanthemum alpinum, Erigeron alpinus, Gnaphalium leontopodium et supinum, Senecio Tournefortii, Crepis pygmæa, Taraxacum officinale var. alpinum, Campanula pusilla, Jasione perennis, Phyteuma hemisphæricum, Euphrasia minima, Pedicularis Pyrenaica et rostrata, Pinguicula alpina, Soldanella alpina, Daphne Cneorum, Veronica alpina, Juniperus nana, Juncus trifidus, Luzula spadicea et pediformis, Carex Pyrenaica, Festuca varia.

Zona superalpina ($=Z_5$). Cardamine bellidifolia, Draba nivalis, Potentilla nivalis et Salisburgensis, Saxifraga bryoides, granulata *var.*, muscoides et grœnlandica, *Lap.*, Senecio Tournefortii, Gentiana alpina, Myosotis sylvatica *var.* alpestris, Pedicularis rostrata, Soldanella alpina, Statice alpina, Salix retusa et herbacea, Luzula spicata, Carex curvula et nigra, Agrostis vulgaris *var.* alpina, Sesleria disticha.

Throughout the following catalogue of the mosses, the zones which each species occupies will be distinctly specified; and to enable me to do this in the smallest possible compass, I propose the notation of *zones* above indicated, that is to say, Z_1 for the first zone above the plain, Z_2 for the second, &c., and Z_0 for the plain itself. It is in many cases difficult to ascertain the zone in which a moss has normally its station, for in mountainous countries the seeds, &c. of mosses are carried down by the streams, precisely as those of flowering-plants are; but a large proportion of mosses are found *only* near streams, and that especially in a low latitude, where the requisite degree of moisture is more rarely met with. Hence certain mosses, natives of the alpine region, are occasionally found some thousands of feet below it. To take an instance in *Grimmia spiralis*, a species which is stated by the authors of the 'Bryologia Europæa' to have its "véritable habitat au-dessus de toute végétation forestière." Near Cauterets, opposite the baths of La Raillère, on the rude blocks of granite which are thickly strewn along the banks of the Gave de Marcadaou, this species forms large lax tufts, disfigured by the sand of the stream, yet bearing a few capsules. This is far *below the commencement of the subalpine zone*; but in continuing to ascend the stream, until we emerge on the broken plain adjacent to the Lac de Gaube, where the only trees are a few scattered pines (i. e. *towards the upper limit of the inferalpine zone*), we find the same species, forming small compact tufts and bearing a profusion of fruit, growing on the same sort of rock, and often far removed from any stream. *Here* it is obviously *at home.*

The localities visited within Z_5 are for the most part entirely destitute of mosses, in consequence of the declivities being covered with *sliding* fragments of schistose rock. Two species of Hepaticæ, *Sarcoscyphus emarginatus* and *Alicularia scalaris*, common in the plains, ascend in varying forms nearly to the limit of perpetual snow, and with *Jungermannia julacea* form the sole representatives of the tribe in Z_5. I must also observe, that nowhere in the Pyrenees do mosses and lichens ascend higher than *all* flowering-plants. Even above the line of perpetual congelation, wherever a rock peeps out of the snow (its sides being too steep for the snow to rest upon them), Saxifrages, and two or three other kinds of plants equally hardy, fix themselves in its crevices. This is also the case with lichens, but scarcely with *real frondose mosses*, and I very much doubt whether there be any region in the world (alpine or arctic) where mosses leave below them *every* phanerogamous plant, although we have long been taught to believe that such is the case. Ramond found flowers to accompany Mont Perdu almost to its summit.

I proceed now to exhibit in a tabular form a list of those Musci, Hepaticæ and Lichenes which have appeared to me characteristic of the various zones in the Pyrenees. I have considered a species characteristic of a particular zone for the following reasons: 1. It is either abundantly distributed in that zone throughout the chain, and scarcely seen above or below it; or, 2. It occurs at various (it may be distant) points of the chain, and nowhere abundantly, yet is always confined to one zone; or else, 3. It is distributed through several zones, but exists in its perfect state only in one. A few species flourish with equal luxuriance in two or more zones. Those mentioned for the superalpine zone were almost its sole occupants, and most of them were sterile. The species united by *brackets* were frequently grouped together *in one tuft*, so as to be taken up at once by the hand; or, in the case of crustaceous lichens, occupied the surface of *one stone*. The species printed in *italics* are considered peculiarly characteristic of the zone in which they are placed.

…imes …valis.	Musci.	Hepaticæ.	Lichenes.
Zona superalpina. (= Z_5.) …400′.	*Polytrichum juniperinum.* sexangulare. Encalypta rhabdocarpa. Hypnum molluscum var. *Desmatodon latifolius, var. muticus.* Weisia crispula var.	*Jungermannia julacea.* Sarcoscyphus emarginatus. Alicularia scalaris.	Parmelia chrysoleuca. *Lecidea atrobrunnea.* *Umbilicaria proboscidea var.* Endocarpon miniatum, var. complicatum.
Zona medialpina. (= Z_4.) …200′.	Weisia crispula var. *Dicranum Starkii.* *Arctoa fulvella.* Grimmia sulcata. atrata. Tortula vinealis, var. nivalis Dissodon Frœlichianus. Anacalypta latifolia. *Bryum turbinatum, var. latifolium.* Hypnum plicatum.	Jungermannia julacea. Sarcoscyphus emarginatus. Alicularia scalaris. *Gymnomitrium concinnatum.*	Umbilicaria proboscidea. atropruinosa. Cetraria pinastri. Cladonia vermicularis. gracilis. *Lecidea Morio.* *confluens.* Wahlenbergii. Parmelia ventosa. Peltigera crocea.
Zona inferalpina. (= Z_3.) …000′.	Hypnum plicatum. *Leskea incurvata.* *Tortula aciphylla.* Dicranum Starkii. *Desmatodon latifolius.* Hypnum reflexum. callichrous. Grimmia spiralis. ovata var. *alpestris.* Timmia megapolitana. Bryum polymorphum, var. curvisetum. *alpinum.* capillare var. 3. Bartramia ithyphylla. Gymnostomum curvirostrum Hypnum dimorphum.	Gymnomitrium concinnatum Jungermannia albicans var. trichophylla. Mastigobryum deflexum.	*Peltigera crocea.* Lecidea Wahlenbergii. *Parmelia ventosa.* Lecidea Morio. Parmelia badia. Biatora decipiens.
Zona subalpina. (= Z_2.) …200′.	Hypnum dimorphum. Starkii. Bryum acuminatum. *Zierii.* *capillare var. 2.* *Hypnum Crista-castrensis* *uncinatum.* Schreberi. salebrosum. Halleri. subtile. Isothecium striatum. Bartramia Halleriana. Trichostomum glaucescens. Campylopus longirostris. *Grimmia elatior.* Gymnostomum rupestre. *Ptychomitrium polyphyllum.* *Grimmia ovata.*	Mastigobryum deflexum. Jungermannia trichophylla *curvifolia.* reclusa. Scapania apiculata. *Jungermannia nana.* *sphærocarpa.* lanceolata. riparia. acuta.	Cetraria juniperina. Parmelia ventosa. Biatora lurida. *Umbilicaria pustulata.*

4200′.	Musci.	Hepaticæ.	Lichenes.
Zona montosa (= Z_1). Superior.	Pterogonium filiforme. *Leskea attenuata.* Entodon insidiosus. *Hypnum rugosum.* *abietinum.* catenulatum. Bryum elongatum. Dicranum polycarpum. *Rhabdoweisia fugax.* Orthotrichum Hutchinsiæ rupestre. *Tortula paludosa.* *Trichostomum tortile.* *Grimmia leucophæa.* Fissidens grandifrons. Bryum obconicum. Hypnum crassinervium.	Plagiochila Pyrenaica. *Jungermannia acuta.* Wilsoniana.	*Parmelia fulgens.* crassa. Lecidea candida. *vesicularis.* Verrucaria maxima. *Opegrapha cerebrina.* *Verrucaria Dufourei.*
Zona montosa (= Z_1). Inferior.	*Isothecium repens.* Hypnum Haldanianum. *pratense.* Teesdalii. *Leucodon sciuroides.* Dicranum montanum. Tortula revoluta. chloronotos. Bryum atropurpureum. Grimmia crinita. Fissidens incurvus.	*Jungermannia Wilsoniana.* Southbya tophacea.	
Planities. (= Z_0.) 0000′.	Hypnum illecebrum. Leptodon Smithii. Bryum torquescens var. Tozeri. Muelleri. Entosthodon Templetoni. Tortula cuneifolia. Trichostomum subulatum.	Jungermannia Francisci. Saccogyna viticulosa. Mastigobryum trilobatum. Reboulia hemisphærica. Riccia fluitans. natans.	*Parmelia chrysophthalma.* rubiginosa. *Clementiana.* Opegrapha elegans. Lyellii.

It was my intention to have given here a comparative view of the distribution of Musci and Hepaticæ in the Pyrenees and in the other great mountain-ranges of the world, as also with that of our own islands, but this introduction has already swelled to a tedious length, and I hasten to close it with a few general observations.

As there are certain flowering-plants which accompany the habitations of men and of cattle from the plains nearly to the tops of the mountains, namely, in the Pyrenees, *nettles, mallows* and *docks* (*Rumex Patientia*); so there are likewise certain mosses which cling with equal tenacity to these traces of civilization.

The most notable are *Ceratodon purpureus* and *Funaria hygrometrica*. *Tortula ruralis* is associated with these until in the inferalpine zone it meets and is supplanted by *T. aciphylla*, which I have never seen away from the sheep-cotes and the huts of the shepherds. At about the same height *Hypnum rutabulum* and *Bryum capillare* give place to *Hypnum plicatum* and *Leskea incurvata*; these last, along with *Tortula aciphylla*, indicate the localities where the domesticated animals have taken up their temporary sojourn, throughout all the higher mountains.

The cryptogamic vegetation of the Pyrenees, taken in the *mass*, has great general resemblance to that of our own islands, especially of Ireland, and the species common to both attain nearly the same *comparative* altitude. Yet there are features in the former which would forcibly strike a bryologist accustomed only to the mosses of the British Isles. About the foot of the Pyrenees he would be struck with the luxuriant fructification of *Dicranum glaucum* and *Leucodon sciuroides*, the fruit of the latter being one of the greatest rarities of our islands; and he would equally remark the absence of *Bryum cæspiticium*, of which I gathered only a single tuft, on a wall near Oloron; nor has it been observed elsewhere in the Pyrenees, though we are accustomed to look on it as the commonest of mosses. *Bryum cernuum* and *inclinatum* are almost equally scarce, though frequent with us and ascending high into the mountains. Were he next to climb the lower calcareous hills, he would see *Hypnum rugulosum, abietinum*, and *Leskea attenuata* profusely covering the scattered stones and rocks, and forming quite a marked feature even in the scenery. But he would miss *Hypnum undulatum* and the *Sphagna* which ornament our moist turfy hills; and if he ascended higher, he would probably see no *Splachna* or *Andreææ*. The rarity of the latter cannot be attributed to the southern latitude of the Pyrenees, for they exist even under the equator, as for instance on Mount Pichincha. The abundance of these two genera in the Alps of Switzerland must give a character to their vegetation wanting in the Pyrenees; and in general the Alps would seem to be much more *mossy* than the Pyrenees, *above* the region of forests, giving birth for example to an immense number of *Brya*, which in the Pyrenees are nowhere abundant above the inferalpine zone. This may reasonably be attributed to the more northerly position of the Alps, to their extending through a far wider zone of latitude, and not consisting like the Pyrenees of a single narrow chain; and to their greater humidity, which is probably dependent on the immense breadth of snow that perpetually covers them. The species described in this catalogue as new have none of them been observed in the Alps, with the exception of *Hypnum Pyrenaicum*, which was the only one noticed above the subalpine zone; and there are a few other Pyrenæan mosses wanting to the Alps*.

Two *Jungermanniæ* exceedingly common in Britain, *Lophocolea bidentata* and *heterophylla,* are all but absent from the Pyrenees; and two others, *Jungermannia barbata* and *Ptilidium ciliare,* great ornaments of our mountainous districts, are altogether wanting. The latter attains its southern limit in the north of Italy; it is distributed throughout middle and northern Europe, but grows in greatest luxuriance within the Arctic circle. (Conf. Wahlenberg and the accounts of our Northern voyagers.)

According to Wahlenberg, there are in Lapland, as in the Pyrenees, extensive forests of *Pinus Abies* and *P. sylvestris,* and both descend into the plain; the former cease at the altitude of 800 feet and the latter at 1200 feet, indicating respectively the upper limits of the "regio sylvatica" and the "regio subsylvatica." But in the Pyrenees these trees ascend proportionally far higher than in Lapland; and that they do not occupy the same climatal zones we shall see by comparing the positions of a few mosses common to both countries. In the Pyrenees, *Tortula tortuosa, Bryum crudum, Didymodon capillaceus* and *Dicranum virens* are found in the region of coniferous trees, and are rarely seen above it; but these are precisely species mentioned by Wahlenberg as characteristic of his "Alpes inferiores," which are above the region even of the *birch* ("regio subalpina, Wahl."), and are characterized by the presence of *Betula nana, Diapenzia lapponica* and *Silene acaulis.* Yet the comparative altitudes attained by the mosses in the Pyrenees and in Lapland accord very nearly, and the species which ascend highest in the one for the most part do the same also in the other. Hence the zone occupied by a moss common to both has probably in both the same average *æstival* temperature.

The abbreviations made use of in this Catalogue are (besides those above-mentioned for the zones of altitude) *P. occ., P. c.* and *P. or.* for *Pyrenæi occidentales, centrales* and *orientales,* respectively; *M. P.* for "*Musci Pyrenaici* quos in Pyrenæis centralibus occidentalibusque, necnon in Agro Syrtico, A.D. 1845–46 decerpsit Richard Spruce. Londini: 1847;" and *H. P.* for a similar fasciculus of the *Hepaticæ* of the Pyrenees, and of the same date.

I have made a point of citing the original description of each species, and one good figure of it, where such exists: the few synonyms that are occasionally given have been in most cases ascertained from authentic specimens.

* The number of species which I have found in the Pyrenees new to the flora of France is considerable; but I cannot give a correct list of them, as I have not the dates of several species discovered in the Alps and Jura and nearly contemporaneously in the Pyrenees.

As to those localities which I owe to the observations of my friends, I have affixed an autopsial mark (!) to the finder's name in all cases where I have had the opportunity of examining his specimens; and where I have not only done this but have also observed the same species in the very same place, a similar mark of verification is attached also to the locality: see, for an example, the stations mentioned for *Hypnum Starkii.*

Ordo MUSCI.

Hemicyclum 1. *Pleurocarpi.*

Tribus 1. Hypnaceæ.

1. *Hypnum,* Dill., Linn.

Obs. A large proportion of the species of this genus inhabit the *Zona montosa superior* and the *Zona subalpina,* in some instances exclusively. In Z_3 they become much more rare, and above the line where forests disappear, *Hypna* can barely be said to exist. Of the rupestral species, the following were observed only on *calcareous* rocks or soil: *H. abietinum, recognitum, striatulum, murale, crassinervium, Vaucheri, Teesdalii, tenellum, rugosum, commutatum, polymorphum* and *depressum.* Of the other species, several are occasionally found on trees, but they all grow with equal facility on rocks or on the ground.

§ 1. Tamariscina.

1. *H. abietinum,* L. Sp. Pl. p. 1591; Hedw. Musc. Frond. iv. t. 32; M. P. 1.
Hab. Z_{1-2} in rupibus calcareis umbrosis, per Pyrenæos vulgatissimum, semper autem sterile.

2. *H. recognitum,* Hedw. Musc. Frond. iv. p. 92. t. 35.
Hab. Z_1 in Pyr. orientalibus; W. P. Schimper.

3. *H. tamariscinum,* Dill.; Hedw. Sp. Musc. t. 67. *H. proliferum,* L. Sp. Pl. p. 1590; M. P. 2.
Hab. Z_{0-3} in sylvaticis, passim.

§ 2. Umbrata.

4. *H. splendens,* Hedw. Sp. Musc. p. 262. t. 67.
Hab. Z_{0-3} locis umbrosis humidiusculis: fertile nusquam vidi.

5. *H. umbratum,* Ehrh. Crypt. Exsicc. n. 66; Hedw. Sp. Musc. t. 67; Sullivant! Musci Allegh. n. 2; M. P. 3.
Hab. Z_2 in nemore obscuro juxta cataractam *la Cascade du Cœur* dict., in valle *du Lys* P. centr.; necnon in valle *Jéret* P. occ.

6. *H. Pyrenaicum,* Spruce in Musc. P. n. 4: caule procumbente subdiviso, divisionibus irregulariter pinnatis, ramisque *stuppa radiculosa brevi, pallida, pinnato-divisa,* obtectis; *foliis* patentibus, ovatis (ramorum ovato-lanceolatis) apiculatis acuminulatisve, margine reflexis, *argute et subduplicato-serratis, nervo*

tenui ultra medium evanescente (rarissime nervis binis) *et plicis tribus striæformibus* instructis.

Hab. in summa zona sylvatica (Z_3) montis *Crabioules,* saxa caulibus implexis dense obtegens. In Alpibus Helveticis et Tyrolensibus viget, sec. cel. Schimper.

Caulis procumbens, subdivisus, divisiones irregulariter pinnatæ vel subbipinnatæ, ramique crocei, subcurvati, dense foliosi et inter folia radicibus pallidis, decompositis, planis, versus basin 2–4 cellulas latis, obsessi. *Folia* imbricata, patentia, ovata, apiculata et acuminulata, apice subtorta, concava, margine reflexa, argute et in parte superiori subduplicato-serrata; plicis tribus striæformibus, media nervum debilem, sæpe ramosum, rarissime duplicem, supra medium evanescentem involvente, instructa; e cellulis minoribus areolata, lutescentia: *ramulina* angustiora, plica media fere obliterata et ex eo nervo manifestiori. *Flores* et *fructus* desiderantur.

Ab hoc differt *H. umbratum,* Ehrh., divisionibus bipinnatis, *ramulis gracillimis*; radiculis compressis, latioribus, e 5–6 cellularum seriebus conflatis; *foliis multo minoribus, magis patulis, caulem ramulosque haud velantibus,* plerumque nervis binis instructis.

Tab. XII. 1. *rami pars augm.*; 2. *folium caulis*; 3. *ramuli augm.*; 4. *apex folii augm. circiter* 240*ies*; 5. *pars stuppæ radiculosæ interfoliaris pariter aucta.*

Obs. Although this comes so near *H. umbratum* in essential character, it has yet a very different habit, arising from the less divided stems and the much larger leaves, which are imbricated at such an angle as not to allow the stem to appear between them. All the states of *H. brevirostre* differ from it in the *leaves being contracted below the long acumen,* and especially in their being prolonged at the base into *two semicircular free auricles,* which are inflexed and embrace the stem *; they are also usually *squarrose* and furnished with *two short nerves. H. plicatum,* Schleich., is very similar in habit, and has the leaves plicato-striate in the same manner, but the latter are *subsecund,* with *a longer nerve,* their *margins entire* and most widely reflexed at about two-thirds of their length. *H. Kamounense,* Harv. (Hook. Icones, i. t. 24. f. 10), an Indian species, seems also to approach it very closely, differing chiefly in the *shorter, almost obsolete nerve, the less sharply toothed margins of the leaves,* and their more twisted apices, often describing two spires.

§ 3. Squarrosa.

7. *H. brevirostre,* Ehrh. Pl. Exsicc. n. 85; Schwgr. Suppl. t. 225; M. P. 5.

Hab. Z_{0-2} in umbrosis fere ubique, copiose fructiferum.

8. *H. triquetrum,* L. Sp. Pl. p. 1593; E. Bot. t. 1622; M. P. 7.
Hab. Z_{0-3} in sylvaticis.

* This has not altogether escaped the notice of Schwaegrichen, who says of *H. brevirostre,* "folia cordato-ovata . . . . . angulis baseos lateralibus inflexis."

9. *H. squarrosum,* L. Sp. Pl. p. 1593; Dill. t. 39. f. 38.
Hab. Z_{0-3} in sylvis, pascuis, etc., rarissime fructificans.

10. *H. loreum,* L. Sp. Pl. p. 1593; H. et T.! Musc. Brit. p. 181. t. 26; M. P. 8.
Hab. Z_{1-2} in umbrosis.

§ 4. Stellata.

11. *H. stellatum,* Schreb. Fl. Lips. p. 92; Schwgr. Suppl. t. 144.
Hab. Z_1 locis humidis, haud vulgatum.

12. *H. polymorphum,* Hedw. Sp. Musc. t. 66.
Hab. Z_{1-3} P. occ. et c. ad rupes calcareas. *Jurançon*; *Bagnères-de-Bigorre, &c.* In alpinis semper sterile invenitur.

13. *H. Halleri,* L. Diss. Musc. p. 34; Hedw. Musc. Frond. 4. t. 21; M. P. 58.
Hab. Z_2 P. occ. in regione media montis *Pic de Ger,* etiam circa *Cauterets*; P. c. loco *Labassère*: rupestre. "In Pyren. jugis depressis in planitiem excurrentibus;" Dufour apud Bridel Br. Un.

§ 5. Heteroptera.

14. *H. dimorphum,* Brid. Suppl. Musc. ii. p. 149; Grev. Scot. Cr. Fl. t. 160; M. P. 57.
Hab. Z_{2-3} locis umbrosissimis, terrestre; P. occ. circa *Cauterets*; P. c. *Lac Lehou* (Philippe!): P. or. *Mt. Canigou* et *Port Nègre* (Arnott!).

15. *H. heteropterum,* Bruch apud Schwgr. (sub *Pterogonio*): dioicum; caule prostrato, diviso, divisionibus subpinnatis; *foliis laxe imbricatis, erectiusculis vel subsecundis, obliquis,* ovatis, subacuminatis, nunc acutis nunc obtusis, *margine planis, subserratis, nervo perbrevi nonnunquam furcato instructis, dorso papillosis*; pedicello lævi; capsula ovato-oblonga, cernua; *operculo rostrato, capsulam vix æquante*; calyptra dimidiata glabra; peristomio *Hypni.*

Musci Pyrenaici, 56. *Pterogonium heteropterum,* Bruch in Schwaegr. Suppl. iii. v. 1. t. 210 *b*; *vix Pterigynandrum h.,* Brid. Bryol. Univ. ii. p. 176. *Hypnum catenulatum,* H. et T.! Musc. Brit. ed. 2. p. 160. t. 24; Hook. Eng. Flora, v. P. 1. p. 81; non autem Schwgr. Suppl. 1. v. 1. p. 218; nec *Pterigyn. catenulatum,* Brid. Musc. Rec. ii. P. 1. p. 64. t. 5. f. 4.

Hab. Z_{1-2} ad saxa in sylvis Pyrenæorum centralium, sat frequens sed rarissime fructificans. Prope *B.-de-Bigorre* capsulis onustum legi 17 Octobris, 1845. In Hibernia ad *Powerscourt Waterfall,* ubi primus omnium beatus Taylor detexit. In Angliæ et Scotiæ plurimis locis repertum est. In monte Vogeso et Germania occidentali, teste Bruch, *l. c.*

Cæspites densi, implexi. *Caulis* prostratus, hic illic radicans, varie divisus; divisiones irregulariter pinnato-ramosæ, ramis alternis, ascendentibus, plurimo tempore subsecundis, simplicibus, subramosis, rarius pinnatis. *Folia* caulis divisionumque ovato-acuminata, in summo caule acumine sæpius valde elongato, acuta, basi decurrentia et e marginibus inflexis semi-amplexicaulia; "aliorum ramorum erectiuscula, aliorum secunda" (Schwgr.), laxe et subquadrifarie imbricata, alia recta, alia oblique incurva, ovata, ovato-lanceolata et ovato-acuminata, quoad apicem nunc acuta nunc obtusa, margine plana; *omnia* denticulata, nervo perbrevi quartam folii partem ut plurimum emetiente, nunquam ad medium usque producto, nunc lato et obscuro, nunc ramoso vel e basi ipsa bifurcato, instructa; cellulis mediocribus, oblongis, prominulis areolata et dorso valde papillosa; in cæspitibus sterilibus sæpe pallida, flavescentia, in fertilibus autem fere semper saturate viridia. *Florescentia* dioica. *Caules masculi* cum fœmineis immixti, iis tenuiores: *flores* numerosi, alares, ovati, foliis 12 plus minus, ovatis, exterioribus obtusis, internis acuminatis, acumine torquato, enerviis, valde concavis, obscure denticulatis, areolatione laxiori; antheridiis haud copiosis, paraphysatis. *Fœminei floris* folia perichætialia sat numerosa, externa brevissima, interna elongata et flexuoso-acuminata, enervia, subdenticulata, laxe areolata, haud papillosa. *Vaginula* teres, viridis, apice tamen atro-rubens, archegoniis et paraphysibus numerosis perichætium haud æquantibus onusta. *Pedicellus* semuncialis, lævis, rufus. *Capsula* ovato-oblonga, cernua, e brunneo olivacea. *Peristomii externi* dentes 16, trabeculati, linea media exarati, pallidi: *interni* membrana carinato-sulcata, in processus totidem solidos, ciliis binis filiformibus interjectis, ultra medium fissa. *Annulus* duplex, revolubilis. *Operculum* e basi conica rostratum, rostro oblique curvato, capsulam fere æquans. *Calyptra* dimidiata, glabra. *Semina* congenerum.

Ab hoc differt *H. dimorphum*, Brid., *foliis caulis divisionumque primariarum squarrosis*; *ramis dense foliosis, foliis arcte appressis* "unde ramulorum facies teres" (Brid.), *latioribus*, obtusioribus, *nervis binis* tenuioribus et plerumque longioribus, e cellulis brevioribus areolatis, et maxime *operculo conico.*

Obs. I have been thus particular in my description of this disputed moss in the hope of finally settling its name and synonymy. The characteristic figure of Schwaegrichen, though representing a barren specimen, and his description, accurate as far as it goes, place it beyond a doubt that his *Pterogonium heteropterum* is the same plant as the *Hypnum catenulatum* of English authors; but that it cannot be identical with the *H. catenulatum* of Schwgr. will be obvious from the following considerations. The leaves differ from Schwgr.'s description of *H. catenulatum* in being *oblique*, decurrent at the base and slightly embracing the stem, the *margins plane* (by no means "stria utrinque marginali brevi," which implies a decidedly reflexed or recurved margin), *papillose and truly denticulate**, the *nerve very short*, not "ultra medium evanescente." Besides these discrepancies are the very important ones of a *dioicous inflorescence* and a *decidedly rostrate lid*†, not "conicum *brevissimo* rostello."

* The authors of 'Musc. Brit.,' for want of examining with sufficient minuteness, supposed that the denticulation of the margins was only *apparent*, arising from the papillosity of the surface.

† Represented shorter in the 'Musc. Brit.' figure than in my Pyrenæan specimens, and in original ones from the authors.

Presuming the identity of our plant with the *Pterogonium heteropterum* of Schwaegrichen, and its diversity from the *Hypnum catenulatum* of the same author, to be sufficiently established, I have further to remark that the *Pterigyn. heteropterum* of Brid. *l. c.* is surely a different plant from that of Schwaegrichen; for it has "rami inordinate fasciculati," and "theca erecta oblonga, *omnino Pterigynandri*," to which is added "Inter *P. gracile* et *filiforme* intermedium." These characters point rather to a form of *P. filiforme*, with which species we find Schwaegrichen identifying it, at the close of his description, in these terms: "Hunc muscum propterea pingi curaveram, ut botanicorum curæ commendaretur et fructus completi exquirerentur; sed acceptis nuper a Bridelio speciminibus, illud a *Pt. filiformi* non differre convictus sum." He erred, however, in supposing his moss the same as Bridel's, and consequently a var. of *P. filiforme*, which may be excused him from the circumstance of his possessing only barren specimens.

It still remains to inquire what is the veritable *Hypnum catenulatum* of Bridel and Schwgr.; but I fear this question can only be settled by a reference to the herbaria of these authors. The moss published under that name in Schimper's 'Stirpes Normales,' &c. agrees with Schwaegrichen's description in the "folia obesa et mollia . . . . stria utrinque marginali brevi," and in the nerve, &c., but the inflorescence is certainly *dioicous*, while Schwaegrichen, whom it is difficult to suppose mistaken on this point, states that of his moss to be *monoicous*. A moss agreeing perfectly with Schimper's has been found by Mr. Ibbotson on Pen-y-ghent in Yorkshire, and the *H. catenulatum* of Drummond's 'Musci Americani,' No. 219, is possibly not specifically distinct. These three mosses are all sterile, and their identification is consequently the more difficult, if not quite impossible. I gathered the same moss in the Pyrenees in numerous stations, extending between the extreme limits of my explorations to the westward and eastward, yet always sterile, which would be inconceivable in a monoicous species distributed over so wide a space. However, rather than propose a new name for it, I am willing for the present to receive it as *H. catenulatum*.

16. *H. catenulatum*, Brid.? Mant. Musc. p. 167; Schwgr.? Suppl. P. 2. p. 218. "*Leskea Vaucheri*, Schimp." M. P. 82.

Hab. $Z_{1\,\text{sup.}}$ in saxis arborumque radicibus per Pyrenæos occidentales et centrales, haud raro cum *Leskea attenuata* et *nervosa* sociatum.

I gave this moss in 'Musci Pyrenaici' as *Leskea Vaucheri*, Schimp., from a comparison with specimens under that name in Dr. Montagne's herb. at Paris; but I have since learnt that M. Schimper really intended by *Leskea Vaucheri* the species mentioned in this catalogue as *L. nervosa*, and it is therefore not improbable that the tuft I examined contained both species, for they frequently grow intermixed and are quite similar in habit. Very lately I have received from M. Schimper fertile specimens of *H. catenulatum*; the capsule and operculum are much of the same form as in *H. heteropterum*, and *the processes of* *the inner peristome are imperforate,* not "quatuor lacunis notati," as described by Schwaegrichen.

§ 6. Serpentia.

17. *H. serpens,* L. Sp. Pl. p. 1596 ; E. Bot. t. 1037 ; M. P. 60.
Hab. Z_{0-2} in arboribus imis, &c. ; in montibus sequente minus frequens.

18. *H. subtile,* Hedw. Musc. Frond. iv. t. 9 (sub *Leskea*) ; M. P. 61.
Hab. Z_{1-2} ad truncos vetustos, sat frequens ; rarius ad rupes. *Forêt de Lhieris ; Vallée de Lutour,* &c.

19. *H. Sprucii,* Bruch in litt. (sub *Leskea*) ; Spruce in Lond. Journal of Botany, iv. p. 180 ; M. P. 62. *Hypnum confervoides,* Drumm. ! Musc. Amer. n. 190 (*ex parte*) : non Bridelii.
Hab. Z_2 P. occ. ♀ in rupium umbrosarum fissuris montis *Lizé* et vallis *Béost* ; P. c. ♂ *Vallon de Courbettes* et *Forêt de Lhieris,* cæspitibus *Mnii serrati* immixtum.

The inflorescence of this species is truly *dioicous* *, and from the circumstance of *female plants alone* being found *in the W. Pyrenees,* and *only male plants in the Central,* it may readily be conjectured that no fruit was observed.

§ 7. Tenella.

20. *H. tenellum,* Dicks. Cr. Fasc. iv. t. 11. f. 12 ; M. P. 25.
Hab. Z_1 in muris rupibusque calcareis circa *Pau* et *B.-de-Bigorre. Mt. Ferrand,* P. or. (Arnott !).

§ 8. Depressa.

21. *H. silesiacum,* P. Beauv. Prodr. d'Æth. p. 70; Schwgr. Suppl. t. 94 ; M. P. 46. *H. repens,* Poll. palat. ; Duby, Bot. Gall. ed. 2. ii. p. 562.
Hab. Z_{1-3} ad truncos putrescentes per Pyrenæos præcipue occidentales.

In the Pyrenees I never observed this species but on rotten wood, but in Dec. 1847 I met with it on soft sandstone in Arncliffe Wood, Eskdale. All the other British specimens I have seen belong to the following species.

22. *H. Mühlenbeckii,* Schimp. ! mst.
Hab. Z_{2-3} in terra rupibusque subhumidis, rarissimum. *Lac de Séculéjo.* Inter pagos *Luz* et *Barèges.*

23. *H. depressum,* Bruch ! in Bot. Zeit. 1824, p. 763. *H. confertum* var. ζ. *depressum,* Brid. Br. Univ. ii. p. 767.
Hab. Z_1 P. c. *Vallon de Serris,* ad rupes calcareas.

* *Planta mascula* fœminea tenuior. *Flores* sparsi, cauli ramisque solute adhærentes. *Folia perichætialia* sub–10, externa minuta, lanceolata, interna ovata brevi acumine, omnia serrata, enervia. *Antheridia* 2, ovalia, brevipedicellata, singula paraphysibus 2 stipata.

This species is abundant in woods *on calcareous soil* near Castle-Howard, but is always sterile.

24. *H. elegans*, Hook. Musc. Exot. t. 9; Schwgr. Suppl. t. 282*a*. *H. planifolium*, Brid.? Bryol. Univ. ii. p. 411.

Hab. Z_{1-2} P. c. prope *B.-de-Bigorre*, ad terram (♀); *Bois de Sajust* prope *B.-de-Luchon*, ad rupes graniticas (♀ et ♂).

Mr. Wilson has lately found in Mr. Turner's herbarium fertile specimens of this (gathered near Bantry by Miss Hutchins, but confounded with *H. denticulatum*) which agree in every respect with the original specimen in Herb. Hook. (gathered by Menzies on the N.W. coast of America). He also suggests that *H. planifolium*, Brid., *l. c.*, gathered by Lapylaie near Falaise, is the same species, but there are some discrepancies not easily reconcileable. For instance, our plant has the leaves remarkably deflexed at the apices so as to appear *secund in profile*, whereas Bridel says "folia recta;" but on the whole I admit that it is very probable he had the same species under his eye.

In the *Bois de Sajust* I found male and female plants intermixed. The former are very slender and elongated: the flowers are situated on the stem and the lower part of the branches, those near the base of the stem often fascicled, but the upper usually solitary; they consist of about ten ovato-lanceolate, shortly acuminate, concave leaves, and include about four paraphysate antheridia.

In April 1846 Mr. Borrer and myself gathered *H. elegans* on the sand-rocks in Eridge Park, Tunbridge Wells, and I have since met with it abundantly in the neighbourhood of Castle-Howard, in Eskdale, &c. Perhaps Dr. Taylor was the first who ascertained its existence in the British Isles and clearly distinguished it; Messrs Wilson and Mitten have also found it in several stations. It grows on decaying vegetable matter, on the earth or on rocks, *avoiding only such as are calcareous*, while *H. depressum*, its very near ally, is quite pertinacious in selecting a calcareous matrix. The former differs from the latter chiefly in the *more faintly toothed or quite entire leaves*, their *slenderer points* and closer more chlorophyllose areolation, but especially in the *pendulous capsule*. Both species are dioicous, scarcely ever fruiting, but propagating themselves by slender *deciduous flagelliform ramuli*, which spring from the stem in fascicles. These ramuli are sometimes so numerous as to be alone visible, and being clad with minute distant leaves, they give to the tufts the aspect of drawn-up *H. subtile*.

25. *H. trichophorum*, Spruce in mst. *Leskea pilifera*, Swartz! (ex herb. Smithii). *Neckera p.*, Musc. Pyr. 66. *H. denticulatum* var. *Donnianum*, Drumm.! Musc. Am. n. 165 (*nonnull. exemplorum*): non *H. Donnianum*, Sm.

Hab. Z_2 ad latera scopulorum graniticorum versus terram spectantia, in umbrosissimis vallis *Jéret*, P. occ.

Inflorescence monoicous: flowers fascicled, the male and female in separate fascicles. *Peristome very pale*, especially the outer; the *inner* cloven to ⅔rds of its length: *processes perforated, between the articu-*

lations, nearly throughout their length : *cilia* none or quite rudimentary.

In 'Musci Pyr.' I placed this moss along with the first section of *Neckera* (*Omalia*, Brid.), to which it approaches very much in habit; but the *Omaliæ* differ from it so essentially in some of their characters, that I feel compelled to withdraw it from their society. *O. complanata* has the capsule very narrow-mouthed, the peristome consequently small and the outer teeth remarkably slender; *the processes of the inner are entire, very slender and fragile, and the basal membrane rises very little above the mouth of the capsule* (so that the moss might be considered a *true Neckera* with as much justice as *N. pumila*, from which I am not certain that it should be separated). The inflorescence is *dioicous*. *O. trichomanoides* has a wider-mouthed capsule; the inner peristome firmer, *reddish*, the basal membrane $= \frac{1}{4}$th of the whole, *the processes deeply carinate but not lacunose.* The inflorescence is *monoicous*, and the flowers are mostly solitary.

Hypnum trichophorum differs from both these, not only in the peristome, but in the *flaccid* irregularly divided *stems*; the *symmetrical leaves*, which are not 4-stichous, nor (as in the *Omaliæ*) so decurved at the apices as to make the branches appear channeled when viewed from below; the *long-necked capsule*; the *conical lid*, &c. In nearly all these characters it is closely allied to *H. denticulatum* and *pulchellum*, both of which have not unfrequently a nearly symmetrical capsule. *H. elegans* is intermediate as to the form of its leaves between *H. denticulatum* and *H. trichophorum*.

It is with great reluctance I change Swartz's specific name, but this is rendered compulsory by the removal of the species into *Hypnum*, where there is already a "*piliferum*." I shall not, however, quarrel with those who are disposed to raise this section into a separate genus, and restore to the species its original name.

26. *H. pulchellum*, Dicks.! Fasc. ii. p. 13. t. 5. f. 6; Herb. Sicc. fasc. ix. n. 22. *H. nitidulum*, Wahl. Fl. Lapp. p. 370; M. P. 63.

Hab. Z_{2-4} ad truncos putridos, in rupium fissuris, &c., P. occ. et c. *V. de Jéret*; *Esquierry*, &c. *En montant au Lac Lehou* (Philippe!).

27. *H. denticulatum*, L. Sp. Pl. p. 1595; Hedw. Musc. Frond. 4. t. 3.

Hab. Z_{0-2} ad ligna putrida. A sequente *florescentia monoica* distinctum.

28. *H. sylvaticum*, L. Syst. Veg. p. 950; Schwgr. Suppl. t. 87; M. P. 64 (ex parte).

Hab. Z_{0-4} ad ligna putrida, in rupibus subhumidis, &c.

When growing in water or in moist places, the leaves of this species often put forth radicles from or near their apices.

29. *H. undulatum*, L. Sp. Pl. p. 1589; Schwgr. Suppl. t. 282; M. P. 65.

Hab. Z_{2-3} in umbrosis humidiusculis, rarius. *Vallée de Lesponne. Mt. Crabioules.*

§ 9. Rugosa.

30. *H. rugosum,* Ehrh. Dec. n. 291. *H. rugulosum,* H. et T.! Musc. Brit. p. 187. t. 26; M. P. 42.

Hab. $Z_{1\,sup.-2}$ ad saxa calcarea per totos Pyrenæos.

§ 10. Plicata.

31. *H. plicatum,* Schleich. Cent. iv. n. 27; Schwgr. Suppl. 1. P. 2. p. 301; M. P. 6.

Hab. Z_{3-4} ad saxa præcipue granitica in alpinis, plerumque secus ovilia, sociis *Leskea incurvata* et *Tortula aciphylla.* In valle *Arise* P. c. fructif. invenit cl. Philippe!

Paraphylla are present in this species, which completely cover the stem between the leaves with a short felt. The largest are leaflike, though many times smaller than the true leaves, lanceolate or lanceolato-subulate, entire or with one or two teeth near the base. In their more rudimentary form they simulate radicles, being one or more cellules in breadth and slightly and irregularly branched. Hence the species may be considered to have some affinity with *H. filicinum* on the one hand, and with *H. Pyrenaicum* on the other.

§ 11. Adunca.

32. *H. riparium,* L. Sp. Pl. p. 1595; Hedw. Musc. Frond. iv. t. 3.

Hab. Z_1 P. c. in ripis flum. *Adour* prope *Bagnères* (Philippe!).

33. *H. fluitans,* L. Fl. Suec. 1074; Hedw. Musc. Frond. t. 36.

Hab. P. or. in monte *Canigou* (Arnott!). In Pyrenæis nusquam ipse inveni.

34. *H. palustre,* L. Sp. Pl. p. 1593; Eng. Bot. t. 1655; M. P. 37.

Hab. Z_{1-2} in rivulis saxis emersis adhærens.

35. *H. falcatum,* Brid. Musc. Rec. ii. P. 2. p. 63; Schwgr. Suppl. t. 145; M. P. 38.

Hab. Z_2 in scaturiginosis calcareis juxta rivulum *Ruisseau d'Ardalos* dictum, in valle *Lesponne.*—An mera sequentis forma?

36. *H. fluviatile,* Sw. Musc. Suec. p. 63; Hedw. Sp. Musc. t. 81.

Hab. Z_1 P. occ. in rivulis supra pagum *Jurançon*; P. c. in ripis fl. *Adour* prope *Bagnères* (Philippe!). (*Pic St. Loup* prope *Montpellier*: Arnott!)

37. *H. filicinum,* L. Sp. Pl. p. 1590; Hedw. Sp. Musc. t. 76; M. P. 39. *H. conspurcatum,* Brid.! in hb. Requien.

Hab. Z_{1-2} in saxis udiusculis præcipue rivulorum.

"*Var.* foliis rigidis, nervo crassissimo instructis;" M. P. 40.
H. Vallisclausæ, Brid.! Br. Univ. ii. p. 534.

Hab. in fontibus profundis secus ripas flum. *Adour*, in vicinia pagi *Asté*, P. c.

Specimens gathered by Messrs. Arnott and Requien at *Vaucluse* agree well with Bridel's description, and are quite the same as my own from *Asté*. In 'Musci Pyren.' I had considered *H. filicinum* and *fluviatile* not distinct, relying on Bridel's description of the latter (Br. Univ. p. 532), where the *falcato-secund leaves* (rarely seen in *real H. fluviatile*) are strongly insisted on. *H. fluviatile verum* is, however, readily distinguished from *H. filicinum* by the *monoicous inflorescence*.

38. *H. commutatum*, Hedw. Musc. Frond. iv. t. 26.

Hab. Z_{1-2} per Pyrenæos in scaturiginosis calcareis.

Var. alpestre, Schimp. in litt.; P. c. *Vallon d'Arise* (Philippe!) P. or. *Port Nègre* (Arnott!).

39. *H. uncinatum*, Hedw. Musc. Frond. 4. t. 5; M. P. 41.

Hab. Z_{2-3} ad saxa et ligna putrida.

§ 12. Cupressiformia.

40. *H. Crista-castrensis*, L. Sp. Pl. p. 1591; Hedw. Sp. Musc. t. 76; M. P. 43.

Hab. Z_2 in Pyr. centralium sylvaticis, ad cataractam dict. *la Cascade du Cœur* in valle *du Lys*, etiam in valle *Lesponne*; in P. occ. loco *Pont d'Espagne*.

41. *H. molluscum*, Hedw. Musc. Frond. iv. p. 56. t. 22; M. P. 44.

Hab. Z^{0-5} in rupibus arborumque basi.

"*Var. terrestre*, foliis insigniter serratis plerumque striatis;" M. P. 45.

Hab. ad terram in sylvis circa *Pau*, locis *Parc de Pau*, *Bois de Gan*, &c.

In the Pyrenees, this species sports into innumerable forms, sometimes simulating *H. flagellare* in the laxly spreading, scarcely at all secund leaves, which are shorter than ordinary, more sharply serrated and distinctly striated; at other times it puts off the characteristic pectinato-pinnate ramification and assumes the habit of *H. callichrous*, to which also it approaches in the form of the leaves and their faintly-toothed margins. A small tuft of male plants was gathered in Z_5 (*Port de Cauterets*) growing with *Encalypta rhabdocarpa*.

42. *H. flagellare*, Dicks. Crypt. Fasc. ii. p. 12; H. et T.! Musc. Brit. t. 25; M. P. 9.

Hab. $Z_{1\ \mathrm{sup.}}$ P. c. ad cataractam inter pagum *Labassère* et fontem dict. *la fontaine sulfureuse*: nusquam alias vidi.

43. *H. pratense,* Koch (fide Bruch); Spruce in Lond. Journ. of Bot. iv. p. 177; M. P. 51.

Hab. Z_1 per totos Pyrenæos, in graminosis montium humiliorum: sterile solum ipse vidi. Ad pedem monticuli *Bédat* prope *B.-de-Bigorre* fructif. invenit cl. Philippe!

44. *H. callichrous,* Brid. Br. Univ. ii. p. 631; M. P. 47.

Hab. Z_{2-4} P. occ. in rup. irroratis ad pontem dict. *le Pont d'Espagne,* non procul a *Cauterets;* P. c. in fauce *la Gorge d'Esquierry* dicta, etiam in montibus *Maladetta* et *Crabioules,* necnon *en montant au Lac Lehou* (Philippe!).

45. *H. incurvatum,* Schrad. Crypt. Gew. n. 80; Schwgr. Suppl. t. 94; M. P. 48.

Hab. Z_1 per Pyr. centr. et occidentales: pulcherrime ad saxa umbrosa prope *Oloron.*

46. *H. resupinatum,* Tayl.! in schedis recentioribus. *H. multiflorum,* ejusd. in Fl. Hibern. P. 2. p. 46; M. P. 49. *H. polyanthos,* E. Bot. t. 1664.

Hab. Z_{0-1} P. occ. ad arbores prope *Pau;* etiam in Agro Syrtico prope Aq. Tarbellicas.

The two localities here cited are the only ones noted in the Pyrenees, but in Britain this species is nearly as frequent as the following.

47. *H. cupressiforme,* L. Sp. Pl. p. 1592; Hedw. Musc. Frond. iv. t. 23; M. P. 50.

Hab. Z_{0-4} passim.

48. *H. Haldanianum,* Grev.! in Ann. Lyc. Hist. Nat. Novi-Eborac. i. p. 275. t. 23 (e specim. a cel. auctore communicatis); Sulliv.! Musc. Allegh. n. 14; M. P. 52. *H. pulchrum,* Drumm.! Musc. Amer. n. 180. *H. cylindricum,* B. et S.!

Hab. $Z_{1\ \mathrm{inf.}}$ P. c. ad terram et arborum radices in sylvis sicrioribus circa *B.-de-Bigorre* (*Bois de Lagaillaste et d'Asté*).

Inflorescence monoicous: male flowers confined to the stem. The teeth of the outer peristome and the processes of the inner are remarkably attenuated, and the latter (as well as the cilia) are papillose upwards. There is considerable variation in the form of the apex of the leaf: in Sullivant's specimens the leaves are merely *acute*; in Drummond's they are decidedly *acuminate*; and my Pyrenæan specimens are intermediate in this respect.

§ 13. Cuspidata.

49. *H. cuspidatum,* L. Sp. Pl. p. 1595. *H. palustre,* &c., Dill. t. 39. f. 34.

Hab. Z_{0-3} in pascuis rupibusque subhumidis: sterile semper vidi.

50. *H. Schreberi,* Willd. Fl. Berol. p. 325; E. Bot. t. 1621; M. P. 53.

Hab. Z_{0-3} in umbrosis humidis : in Zona subalpina sola copiosiss. fructificans.

51. *H. purum,* L. Sp. Pl. p. 1594; E. Bot. t. 1599; M. P. 54.
Hab. Z_{0-2} in sylvis, &c.

§ 14. Julacea.

52. *H. julaceum,* Schwgr. in Schultes Reis. &c. (sub *Leskea*); M. P. 55. *H. moniliforme,* Wahl. Fl. Lapp. p. 376. t. 24.

Hab. Z_{2-4} in rupestribus per Pyrenæos, rarius tamen et sterile. *Mont Lizé. Lac de Séculéjo* (♀). *Lac Lehou* (*var.* foliis longius apiculatis). *V. d'Eynes* (Arnott!).—"Folia apiculo minuto plerumque incurvato semper reperi;" Musc. Pyr. *l. c.*

§ 15. Salebrosa.

53. *H. albicans,* Neck. Meth. Musc. p. 180; E. Bot. t. 1300.
Hab. Z_{0-1} in arenosis, rarum. *St. Pandelon. B.-de-Bigorre.*

54. *H. glareosum,* Bruch.! in litt.; M. P. 29. *H. salebrosum,* H. et T. Musc. Brit. p. 166. t. Suppl. 5 (*ex parte*).

Hab. Z_1 P. occ. ad saxa in valle *Béost*; P. c. in arenosis ad basin monticuli *Bédat,* et in saxosis sylvæ *Bois de Gouerdère* dictæ: loca calcarea amat.

In the *Bois de Gouerdère* this grows intermixed with *H. salebrosum,* from which it is distinguished at sight by its *leaves being paler and more silky, with longer more flexuose points and very faintly toothed margins*; but the most important character is the *dioicous inflorescence.* It is a very abundant species in the neighbourhood of York and Castle-Howard, but is rarely fertile: *it never grows on trees. H. salebrosum* I have seen in England only on trees in woods near Kirkham Abbey, in the vale of the Yorkshire Derwent.

55. *H. salebrosum,* Hoffm. Fl. Germ. ii. p. 74; Brid. Br. Univ. ii. p. 477; Grev.! Scott. Cr. Fl. t. 284; M. P. 30.

Hab. Z_{1-2} P. c. ad saxa et supra ligna putrida circa *Bagnères-de-Luchon,* locis *Bois de Gouerdère* et *Vallée du Lys,* copiose; circa *B.-de-Bigorre,* rarius.

56. *H. campestre,* Bruch! in litt.; M. P. 31.

Hab. Z_1 in graminosis circa thermas *de Salut* dictas, prope *B.-de-Bigorre.* Inter *H. salebrosum* et *rutabulum* medium.

§ 16. Rutabula.

57. *H. pseudoplumosum,* Brid. Musc. Rec. ii. P. 2. p. 108; M. P. 36. *H. plumosum,* H. et T.! Musc. Brit. p. 162. t. 25.

Hab. Z_{1-2} in rivulorum saxis: socio consuetissimo *H. populeo.*

Var. (*H. subsphæricarpon,* Schleich. exs. cent. 2. n. 46); in Pyrenæis (Bridel).

58. *H. populeum,* Hedw. Sp. Musc. t. 70; M. P. 27.
Hab. Z_{1-2} ad saxa ex alveo emersa rivulorum.

59. *H. reflexum,* Starke; W. et Mohr. Bot. Tasch. p. 306 et 476; Schwgr. Suppl. t. 143; M. P. 26.

Hab. Z_3 P. c. in altioribus montis *Crabioules,* saxatile; P. or. *Port Nègre* (Arnott!).

60. *H. Starkii,* Brid. Musc. Rec. ii. p. 167 et Bryol. Univ. ii. p. 595; M. P. 34.

Hab. Z_{2-4} P. occ. ad terram in monte *Lizé,* et juxta pontem dict. *d'Espagne,* socio *H. dimorpho*; P. c. ad rupes argillaceo-schistosas loco *Port de Benasque*! (Arnott!).

The leaves of this species, especially in smaller and fertile specimens, are often subfalcate, and it then approaches very closely *H. paradoxum,* Hook. f. et Wils. (Crypt. Ant. p. 113. t. 155. f. 2), its representative of the southern hemisphere.

61. *H. velutinum,* L. Sp. Pl. p. 1595; Hedw. Musc. Frond. iv. t. 27; M. P. 35.

Hab. Z_{0-3} ad terram, &c. in umbrosioribus.

62. *H. rivulare,* Bruch! in litt.; M. P. 33.

Hab. Z_{1-3} ad rivulorum lapides, P. c. circa *B.-de-Bigorre* (*Forêt de Transoubât,* &c.); P. occ. *Gave de Valentin.*

63. *H. rutabulum,* L. Sp. Pl. p. 1590; Hedw. Musc. Frond. iv. t. 12; M. P. 32.

Hab. Z_{1-3} in terra, &c. fere ubique.

64. *H. illecebrum,* L. Sp. Pl. p. 1594; Schwgr. Suppl. 1. P. 2. p. 255; M. P. 16. *H. blandum,* Lyell! in Hook. Fl. Lond. cum icone.

Hab. Z_{0-1} P. occ. in arenosis inter herbas circa *Pau, St. Sever* et Aquas Tarbellicas; in montes editiores haud ascendens.

65. *H. cæspitosum,* Wils.! E. Bot. Suppl. t. 2878; M. P. 17.

Hab. Z_0 ad arborum radices in pratis irriguis arenaque suffusis prope Aq. Tarbellicas.

§ 17. Prælonga.

66. *H. Teesdalii,* Sm. Fl. Brit. iii. p. 1291; E. Bot. t. 202; M. P. 24. *H. laxepennatum,* Brid.! in hb. Requien (=*H. curvisetum,* Brid. = *Pylaisæa radicans,* Brid.; ex cl. Arnott). *H. Schleicheri γ. obscurum,* Brid.? Br. Univ. ii. p. 405.

Hab. Z_1 ad rivulorum exsiccat. lapides, P. c. locis *Elysée Cottin, Labassère,* &c.; P. occ. circa *Gélos.*

67. *H. pumilum,* Wils.! in E. Bot. Suppl. t. 2942; M. P. 23.

Hab. Z_{0-1} P. occ. et centr. in solo calcareo sylvarum, sterile; ♀ prope *Pau* et *B.-de-Bigorre*; ♂ in arenosis prope *Dax.*

68. *H. Swartzii,* Turn. Musc. Hib. p. 151. t. 14. *H. prælongum,* M. P. 22 (*ex parte*).

Hab. Z_{0-1} in terra rupibusque udiusculis.

69. *H. prælongum,* L. Sp. Pl. p. 1591; Hedw. Musc. Frond. iv. t. 29; M. P. 22 (*ex parte*).

Hab. Z_{0-1} ad terram et truncos, priori multo minus frequens.

70. *H. piliferum,* Schreb. Fl. Lips. p. 91; Hedw. Musc. Frond. iv. t. 14; M. P. 21.

Hab. $Z_{1\ sup.}$ in virgultis, haud frequens: ad cataractam dict. *la Cascade du gros Hêtre* prope *les Eaux Bonnes,* pulcherrime fructiferum. Loca calcarea amat, vix tamen iis proprium.

71. *H. Vaucheri,* Lesquereux! mst.: dioicum; caule prostrato, diviso; *divisionibus* ascendentibus, *apice attenuato decurvo sæpe radicantibus,* irregulariter bipinnatis; *ramulis cuspidatis, subsecundis*; *foliis* suberectis, dense imbricatis, *caulinis ovatis ex apice obtusiusculo longe subulato-acuminatis,* ramulinis lanceolatis in acumen brevius sensim attenuatis, omnibus concavis, *margine inferiori reflexis,* apicem versus *subserratis,* nervo simplici furcatove ad medium evanescente; *pedicello scabro*; *capsula ovata,* inclinata, subcernua; *operculo* inclinato, *conico-acuminato v. subrostrato,* apice obtuso, *capsulæ dimidium vix excedente*; calyptra dimidiata, glabra; peristomii interni processibus pertusis, ciliis interjectis.—M. P. 19.

Hab. $Z_{1\ sup.-2}$ P. centr. prope *B.-de-Bigorre* in vallibus *Serris* et *Castelloubon,* saxa calcarea dense vestiens; sociis *H. crassinervio* et *Isothecio lutescente.* Hyeme fructificat.—*Var. β. minus* (M. P. 20) in imis truncis saxisque graniticis ad ripas rivuli *Gave du Lys* umbrosissimas, prope *B.-de-Luchon*: nonnisi sterile vidi.

Simile *H. crassinervio,* Tayl., cui tamen sunt *folia breviter acuminata, margine tota reflexa v. explanata, argute serrata, nervo crasso instructa,* capsula longior, *rostrumque operculi duplo longius. H. piliferum,* Schreb., *statura majore, divisionibus bifariam pinnatis*; *foliis* laxioribus, majoribus, *caulinis ex apice obtusissimo naviculari longius attenuato-acuminatis* (acumine $=\frac{1}{3}$ fol.) vix serrulatis; *operculo duplo longiori* et peristomio interno minus profunde fisso dignoscendum est. *H. cirrhosum,* Schwgr. Suppl. 1. P. 2. p. 214, habitu *H. Vaucheri* haud absimile, folia iis *H. piliferi* fere longius acuminata habet.

72. *H. tenuicaule,* Spruce: dioicum, ascendens, *parce ramosum,* ramis subdichotomis, subparallelis; *foliis nitidis,* erectopatulis, *lanceolatis, longe acuminatis, margine inferiori reflexis, vix serrulatis,* nervo folii dimidium raro attingente, nonnunquam obsoleto.

Hab. Z_1 P. c. in arborum radicibus sylvæ *Bois de Lagaillaste* dictæ in vicinia *B.-de-Bigorre,* ♀ sola, sterilis; sociis *H. Haldaniano* et *Isothecio repente.*

Planta pusilla ($=$ *H. incurvatum*), cæspitosa. *Rami* pauci, superiores tamen nonnunquam fastigiati. *Folia* uniformia, flavescenti-viridia, nitida, sicco statu apice patula, areolatione e cellulis parvulis elongatis; caulina haud raro nervo perbrevi furcatoque instructa. *Flores fœminei*: folia perichætialia externa minima, rotundata, apiculata; interiora majora, e basi ovato-lanceolata, capillari-acuminata; intima parvula, subulata capillariave; *omnia* enervia, integerrima. Archegonia sub-5, paraphysibus longiora. *Planta muscula* non aderat.

Habitu fere *Isothecii myosuroidis* formæ pusillæ, differt *foliis nitidis, minime argute serratis.* Ab *H. Vaucheri foliis caulinis haud ex obtuso acuminatis et nervo breviori distinctum.*

73. *H. crassinervium,* Tayl.! in Fl. Hibern. Pt. 2. p. 43; Wils.! in E. Bot. Suppl. t. 2706; M. P. 18.

Hab. $Z_{1\ sup.}$ ad rupes calcareas, haud infrequens. *Les Eaux Bonnes*; *B.-de-Bigorre,* &c.

§ 18. Longirostria.

74. *H. murale,* Hedw. Musc. Frond. iv. t. 30; M. P. 15.

Hab. Z_1 ad saxa calcarea.

75. *H. confertum,* Dicks. Fasc. Crypt. iv. p. 17; Schwgr. Suppl. t. 90; M. P. 14.

Hab. Z_{0-1} in saxosis montium humiliorum; in arborum truncis ad rivuli *Luy* ripas prope Aq. Tarbellicas (*forma major*).

76. *H. Megapolitanum,* W. et M. Bot. Tasch. p. 326; Brid. Br. Univ. ii. p. 491.

Hab. Z_0 P. occ. in arenosis prope Aq. Tarbellicas.

77. *H. rusciforme,* Weiss. Crypt. Goett. p. 225; M. P. 13. *H. riparioides,* Hedw. Musc. Frond. iv. t. 13. *H. atlanticum,* Brid.! in hb. Requien.

Hab. Z_1 in rivulis ad saxa lignaque demersa.

78. *H. longirostre,* Ehrh. Pl. Exsicc. n. 75. *H. striatum,* Schreb.; Hedw. Musc. Frond. iv. t. 13.

Hab. Z_{0-1} locis sylvaticis.

79. *H. striatulum,* Spruce in Musci Pyr. 12: dioicum; *caule prostrato,* diviso; divisionibus subpinnatis, ramis ascendentibus, simplicibus compositisque; *foliis nitidis,* patentibus, caulinis cordato-triquetris, ramulinis cordato-ovatis, *omnibus longe acuminatis, striatis,* margine præter ad basin planis, *serratis, nervo valido paulo ultra medium desinente*; pedicello lævi; operculo e basi convexo-conica rostrato, *capsulam ovali-oblongam subcernuam* subæquante; calyptra glabra.

Hab. Z_1 P. occ. et c. in valle *d'Ossau* et circa *Bagnères-de-Bigorre* (locis *Bédat, Vallon de Serris,* &c.) in saxis calcareis quibus arcte adnascitur. In Pyrenæis Asturiacis invenit Durieu. In Angliæ et Hiberniæ austrinis cl. Wilson, Thwaites et Mitten detexerunt. Ad auctumni finem fructificat.

Caulis prostratus, varie divisus, subpinnato-ramosus, ramis ascendentibus, simplicibus, ramosis vel subpinnatis. *Folia* patentia, cordato-triquetra (ramulorum cordato-ovata), longe acuminata, plicato-striata, argute serrata, margine utrinque ad basin reflexa superne plana, nervo crasso paulo ultra medium desinente instructa, areolatione mediocri, amœne viridia v. fuscescentia, nitida. *Florescentia* dioica. *Flores masculi* ad caulem et ramos plantæ tenuioris nati; *folia perigonialia* sat numerosa, ovato-acuminata, concava, integerrima, enervia vel rarius quadam nervi umbra prædita; *antheridia* circiter 20, brevi-pedicellata; *paraphyses* illis numerosiores sublongioresque. *Flores fœminei* folio caulino longiores; *folia perichætialia* circiter 17, erecta, *externa* minuta, rotundato-ovata, enervia, *intima* oblonga, in acumen flexuosum, serratum et ad basin nonnunquam inciso-serratum subito attenuata, nervo rudimentario in acumen producto instructa; *archegonia* paraphysibus numerosis stipata. *Vaginula* oblonga, teres. *Pedicellus* uncialis, aut paulo longior, lævis, siccitate dextrorsum contortus. *Capsula* ovali-oblonga, inclinato-subcernua, badia. *Operculum* e basi convexo-conica rostratum, capsulæ longitudine. *Peristomium*: *dentes externi* sedecim, subulato-acuminati, linea media exarati: *interius* membrana pallidior, in processus totidem carinatos et in carina sæpe perforatos, ciliis 2–3-nis, haud ferme fragilibus, interjectis, apice usque ad $\frac{2}{3}$ fissa.

Ab *H. longirostri* quod proximum refert, *statura duplo minori*; *caule prostrato*; *foliis nitidis, longius acuminatis*, minus conspicue striatis, *angulum* 45°–50° *cum ramo efformantibus* (nec ut in *H. striato* fere squarrosis); *capsula breviori, nequaquam horizontaliter cernua*, et peristomio interno profundius fisso, ciliis validioribus, distinguitur.

Obs. Specimens gathered by Mr. Wilson near Killarney have the leaves sometimes more widely spreading, and therefore approach *H. longirostre* more nearly; still the habit is the same as in my Pyrenæan plant, namely very nearly that of *H. velutinoides*, Bruch, which however differs essentially from *H. striatulum* in the rough pedicel and the form of its leaves. Mr. Mitten's specimens, gathered in Sussex, about the roots of trees in a chalky soil, have much of the external aspect of *Isothecium myosuroides*.

80. *H. strigosum*, Hoffm. Deut. Fl. ii. p. 76; M. P. 11. *H. pulchellum*, Hedw. Sp. Musc. t. 68.

Hab. Z_3 P. occ. ad terram in alpinis prope *Cauterets* (*Mont Lizé*; *V. de Combascou*).

†*H. circinatum*, Brid. Mant. Musc. p. 165.

Hab. ad muros prope Burdigalam. Circa Vallem Clausam (Arnott !).

In all probability this species exists also in the Pyrenees, though hitherto not observed there.

Tribus 2. Isotheciaceæ.

2. *Climacium*, W. et Mohr.

81. *C. dendroides*, L. Sp. Pl. p. 1593 (sub *Hypno*); M. P. 90; B. et S. Bryol. Eur. fasc. 16.

Hab. Z_{0-2} in umbrosis humidis; circa *B.-de-Bigorre* haud raro fertile.

3. *Isothecium,* Brid. Br. Univ. ii. p. 355.

Obs. The four sections into which I divide this genus are separated from each other by such wide intervals, that I shall not be surprised if at some future period they be placed in at least as many different genera. The family of Hypnoid mosses requires to be completely rearranged, and this can only be done well by a person perfectly familiar with exotic species.

Isoth. rufescens is found only on calcareous rock, and its stems are mostly incrusted below with carbonate of lime. *I. lutescens* seems to grow on no other rock than limestone, but it is also occasionally found on trees. The three species of the last section prefer to grow on the living bark of trees, and *I. striatum* selects the slenderest twigs of subalpine shrubs and humble trees.

§ 1. Dendroidea.

82. *I. alopecurum,* L. Sp. Pl. p. 1594 (sub *Hypno*); Schwgr. Suppl. t. 227; M. P. 10.

Hab. Z_1 in rupibus subhumidis, haud vulgare.

83. *I. Myurum,* Pollich, Pl. Pal. iii. n. 1054. f. 8 (sub *Hypno*); M. P. 73. *Hyp. curvatum,* Sw.; H. et T.! Musc. Brit. p. 102. t. 25.

Hab. Z_{0-3} in sylvaticis, ad saxa et arborum truncos.

" *Var.* ramis incrassatis vix curvatis, operculo breviori;" M. P. 74; in rupibus terra obtectis pinetorum circa pontem *d'Espagne* dictum; etiam secus lacum *Séculéjo.*

84. *I. myosuroides,* L. Sp. Pl. p. 1596 (sub *Hypno*); E. Bot. t. 1567; M. P. 75.

Hab. Z_{0-3} in umbrosis præcipue secus rivulos, saxatile et arbustivum.—Folia nonnunquam subsecunda.

§ 2. Sericea.

85. *I. aureum,* Lagasca in Ann. de Cienc. Nat. n. 14 (sub *Hypno*); Brid. Br. Un. ii. p. 469.

Hab. Z_3 P. c. in rupibus prope lacum Espingo, sterile (♀), socia *Tayloria serrata.*

The leaves are incorrectly described by Bridel as nerveless: in my specimens, as in others gathered by M. Schimper in the Sierra Morena, the leaves are (like those of *I. lutescens*) *strongly 3-plicate, the middle fold involving the nerve.*

86. *I. lutescens,* Huds. Fl. Angl. (sub *Hypno*). *H. lutescens,* Hedw. Musc. Frond. iv. t. 16; M. P. 88.

Hab. Z_1 in terra rupibusque calcareis, necnon in arboribus.—Circa *B.-de-Bigorre* (locis *Elysée Cottin, Bois d'Asté,* &c.) capsulis ovato-cylindricis fere erectis ludit.

The *scabrous setæ*, the *tristriate leaves*, and the whole *habit* of this species bring it so near *I. sericeum*, that in a natural distribution I apprehend they must be placed in the same genus. Besides, if we compare the fructification, we shall not find very great differences. The *capsule* of *I. lutescens* (as above intimated) is sometimes elongated and *very nearly erect*, although never quite symmetrical. The *inner peristome*, as in *I. sericeum* and *Philippianum*, *has the cilia either wholly or in part absorbed at the period of maturity*, although capsules not quite ripe show slender 2–3-nate cilia. (I have observed similar circumstances in *I. polyanthum.*) The chief difference from *I. sericeum* is in the *lacunose processes* and their very slight granulation. The annulus is double. The inner membrane of the capsule projects beyond its mouth the breadth of the annulus before it is divided. The teeth are strongly trabeculate within and enveloped in a delicate membrane.

87. *I. sericeum*, L. Sp. Pl. p. 1595 (sub *Hypno*); M. P. 76. *Leskea s.*, Hedw. Musc. Frond. iv. t. 17.

Hab. Z_{0-2} in arboribus, &c. vulgatissimum.

88. *I. Philippianum*, Spruce in Musc. Pyr. 77: dioicum; caule prostrato, radicante, diviso; divisionibus pinnato-ramosis, ramis erectis, plerumque simplicibus; *foliis* dense imbricatis, *erectis, lanceolato-acuminatis*, striatis, toto ambitu minute denticulatis, *nervo percurrente*; *pedicello lævi, rarius scabriusculo*; capsula erecta, symmetrica, ovato-cylindrica; operculo breviter rostrato, rostro subcurvato; *calyptra* dimidiata, *glabra*.

Hab. $Z_{1\ \mathrm{sup.}}$ P. c. ad saxa calcarea in umbrosis montis *Lhieris*, prope *Bagnères-de-Bigorre*; etiam in rupibus graniticis sylvæ *Bois de Gouerdère* dictæ, prope *B.-de-Luchon*. Auctumno et hyemis initio fructificat.

Plantæ latas plagas efficientes. *Caulis* 2–6 uncias longus, pinnatus, ramis suberectis, simplicibus, rarius furcatis, hic illic radicans et isthinc divisiones pinnato-ramosas edens. *Folia* densa, erecta, superiora nonnunquam (in sicco saltem statu) subsecunda, omnia lanceolata seu ovato-lanceolata, acuminata, acumine caulinorum tenuiori, plicato-striata, toto ambitu minute denticulata, nervo continuo instructa, e cellulis minimis lineari-elongatis areolata, viridia aut auro subnitentia. *Florescentia* dioica: *flores masculos* non habui: *fœminei* cauligeni, elongati, foliis numerosis, 24 et pluribus, erectis, arcte vaginantibus, interioribus acumine setaceo, flexuoso terminatis, leviter plicatis, obsolete nervosis, paraphyses copiosissimas archegoniis longiores complectentibus. *Vaginula* oblongo-cylindrica, viridis. *Pedicellus* uncialis, lævis vel rarius et inferne præcipue scabriusculus, siccitate dextrorsum contortus. *Capsula* erecta, symmetrica, ovato-cylindrica, microstoma, pallida. *Peristomii externi* dentes subulati, quadrangulares, transverse *septati* (haud trabeculati) ad basin versus tantum linea media exarati, sparsim papillosi, pallidi: *interni* membrana profunde (usque ad $\frac{1}{3}$) fissa, lutescens; processibus dentes fere æquantibus, lineari-subulatis, solidis, papillis minutissimis opacis obsitis, unde fuligine quasi oblitis, ciliis interjectis nullis seu rudimentariis. *Annulus* e duplici serie cellularum conflatus. *Operculum* breviter rostratum, rostro subinclinato. *Calyptra* dimidiata, glabra, capsulam fere totam obtegens. *Semina* minutissima, minute granulosa.

Ab *Isothecio sericeo nitore minus spectabili,* ramis siccitate vix curvatis, *folii nervo perdurante, pedicello sublævi, calyptra* (*etiam juvenili*) *glaberrima, peristomii dentibus minime* (*I. sericei* instar) e septis in facie externa internaque prominulis *trabeculatis,* notisque aliis differt. Ab *I. lutescente foliis solidinerviis, capsula erecta symmetrica,* ut et peristomii interni configuratione distinguitur.

Tab. II. 1, 2, 3. *folia aucta;* 4. *apex folii magis aucta;* 5. *capsula aucta;* 6. *peristomii pars;* 7. *ejusdem dens externus a latere visus, 240-ies auct.;* 8. *dens peristomii* Isothecii sericei *a latere visus, ad id. augm.*

§ 3. Rufescentia.

89. *I. rufescens,* Dicks. Cr. Fasc. 3. t. 8. f. 4 (sub *Hypno*); M. P. 78.

Hab. Z_1 sup. in monte *Lhieris* et juxta aquas dict. *les Eaux Chaudes,* ad rupes calcareas irroratas. In Pyrenæis (Bridel).

90. *I. chryseum,* Schwgr. in Schultes Reise auf den Glockner, ii. p. 364 (sub *Hypno*). *Leskea rufescens β. chrysea,* Brid. Br. Univ. ii. p. 286.

Hab. Z_{2-4} P. occ. et c. in rupium humidarum fissuris. *Col de Louvie. Esquierry. Bois de Sajust.*

This is the moss mentioned in my 'Musci and Hepaticæ of Teesdale' (Trans. ii. 80.) under no. 91, *Hypnum multiflorum,* Tayl., of which, in deference to Dr. Taylor's opinion, I considered it a form. It is however quite distinct from both that species and *I. rufescens,* and is not like the latter confined to calcareous rocks.

§ 4. Polyantha.

91. *I. polyanthum,* Schreb. Fl. Lips. p. 97 (sub *Hypno*); M. P. 79. *Leskea p.,* Hedw. Musc. Frond. iv. t. 2.

Hab. Z_1 P. c. in Tiliæ unicæ trunco juxta thermas oppidi *Bagnères-de-Luchon;* necnon in sepibus prope *Arreau*: rarius.

92. *I. repens,* Brid. Suppl. Musc. p. 131 (sub *Pterigynandro*); M. P. 80; Schwgr. Suppl. t. 27, et t. 246 B (sub *Neckera*).

Hab. Z_1 inf. P. occ. et c. in arborum præsertim Castanearum radicibus circa *Pau* et *B.-de-Bigorre.*

Peristomium duplex: dentes externi pallidi: interius ad basin usque in cilia brunnea, tenuissima, sæpe apice inter se anastomosantia, e cellularum serie singula (rarius ex parte duplici) conflata, fissum.

93. *I. striatum,* Schwgr. Suppl. t. 27 (sub *Pterogonio*) et t. 246 A. (sub *Neckera*); M. P. 81.

Hab. Z_2 P. c. pulcherrime fructiferum in fruticum ramulis ad latera montis *Lhieris,* ubi detexerunt cl. Philippe et De Lugo! Sterile infra lacum *Espingo* ipse inveni. *Perist. duplex,* ac in præcedente.

4. *Leskea,* Hedw.

94. *L. nervosa,* Brid. Mant. Musc. p. 128 (sub *Pterigynandro*). *Pt. longifolium,* Schleich.! Cent. 4. n. 8. "*Leskea Frœlichii,* Brid.?;" M. P. 83.

Hab. Z_1 P. occ. et c. in arboribus imis saxisque graniticis, circa *Cauterets* et *Pierrefitte* præcipue. *Bords de l'Adour à B.-de-Bigorre* (Philippe!).

95. *L. incurvata,* Hedw. Sp. Musc. t. 53; M. P. 84. *H. atrovirens,* Dicks. Cr. Fasc. 2. p. 10.

Hab. Z_{3-5} in saxis graniticis præcipue secus ovilia. *Mt. Maladetta, Mt. Lizé,* &c.—Subter nivibus fructus maturat.

96. *L. polycarpa,* Ehrh. Crypt. Exsicc. n. 96; M. P. 85. *Hypnum medium,* Dicks.; H. et T.! Musc. Brit. p. 154. t. 24.

Hab. Z_{0-1} P. occ. et c. in truncis imis secus ripas rivuli *Luy,* prope Aq. Tarbellicas; etiam juxta fl. *Adour, Bagnères*! (Philippe!).

97. *L. rostrata,* Hedw. Sp. Musc. t. 55; Sullivant! Musci Allegh. n. 63; M. P. 86.

Hab. $Z_{1\ \mathrm{sup.}}$ in sylvaticis ad rupes inque fruticum radicibus. *Vallon de Serris; Superbagnères,* &c.

98. *L. longifolia,* Hartm.! in litt. (sub *Anomodonte*); M. P. 87.

Hab. Z_1 P. c. in *Carpini Betuli* truncis secus rivulum *Gave du Lys,* socia *L. attenuata*; etiam ad saxa in monticulo *Camp de César* dicto prope *B.-de-Bigorre.*

I possess specimens of this gathered by Messrs. Gardener and Scott in Forfarshire.

99. *L. attenuata,* Schreb. Fl. Lips. p. 100 (sub *Hypno*); Hedw. Musc. Frond. i. t. 12; Sullivant! Musci Allegh. n. 61; M. P. 88.

Hab. Z_{1-2} in regione *Fagi sylvaticæ* per totos Pyrenæos, saxa calcarea et truncos veteriores dense obtegens.

100. *L. viticulosa,* L. Sp. Pl. p. 1592 (sub *Hypno*); M. P. 89. *Neckera v.,* Hedw. Sp. Musc. t. 48.

Hab. Z_{0-2} in saxis sylvarum.

I do not think this can be separated generically from *L. attenuata.* The two approach very closely in the form and texture of the leaves: both have the same pallid peristome (internal and external), the only difference being that in the latter the sporular sac extends a little beyond the mouth of the capsule, before it is divided into the processes constituting the inner peristome. In *L. viticulosa* the inner peristome is cloven quite down to the mouth of the capsule, and besides the slender processes (or rather cilia) there are interposed *ciliola,* but exceedingly short (= about two cellules).

5. *Entodon,* C. Müller in Linnæa, 1844, Band 2. Heft 6.

101. *E. cladorrhizans,* Hedw. Sp. Musc. t. 47 (sub *Neckera*). *Neckera c.,* Sullivant! Musci Allegh. n. 77. *Isoth. c.,* M. P. 71.
Hab. $Z_{1\ sup.}$ P. c. in ulmo unica ad ripas rivuli dict. *Gave du Lys.*

102. *E. insidiosus,* Mont.! in Ann. des Sciences Nat. Dec. 1843, tom. 20. t. 15. f. 1 (sub *Isothecio*); M. P. 72. *Entodon Montagnei,* C. Müll. l. c.
Hab. $Z_{1\ sup.}$ in terra saxisque calcareis circa *B.-de-Bigorre,* locis *Elysée Cottin, Medous,* &c.: semper absque fructu.

Very soon after my return to England from the Pyrenees, I discovered this beautiful species in several stations around Castle-Howard, growing always in calcareous soil, and often accompanied by *Hypnum recognitum.*

Tribus 3. Neckeraceæ.

6. *Neckera,* Hedw. (ex parte).

(*Neckera Distichia,* Brid. Br. Univ. 2. p. 238.)

103. *N. crispa,* L. Sp. Pl. 1589 (sub *Hypno*); Hedw. Fund. Musc. ii. t. 14; M. P. 70.
Hab. Z_{1-2} in rupibus arboribusque passim.

104. *N. pumila,* Hedw. Musc. Frond. iii. t. 20; M. P. 69.
Hab. Z_1 P. c. in arborum cortice sylvæ *Forêt de l'Escaladieu* dictæ: nusquam alias vidi.

7. *Omalia,* Brid. Br. Univ. 2. p. 325.

105. *O. complanata,* L. Sp. Pl. p. 1588 (sub *Hypno*). *Leskea c.,* Hedw. Fund. Musc. ii. t. 10. *Neckera c.,* M. P. 67.
Hab. Z_{0-2} in fruticibus præcipue Buxis.

106. *O. trichomanoides,* Schreb. Fl. Lips. p. 88 (sub *Hypno*). *Hypnum tr.,* H. et T.! Musc. Brit. p. 152. t. 24. *Neckera tr.,* M. P. 68.
Hab. Z_{0-1} in umbrosis humidis ad arborum radices; haud frequens.

Tribus 4. Hookeriaceæ.

8. *Hookeria,* Smith.

107. *H. lucens,* L. Sp. Pl. p. 1589 (sub *Hypno*); E. Bot. t. 1902; M. P. 91.
Hab. Z_{1-2} P. c. in sylvaticis secus rivulos, rarissima. Circa *B.-de-Bigorre.* *Lac de Séculéjo.*

Tribus 5. Pterogoniaceæ.

9. *Leptodon*, Web., Tab. Syn. Musc.

108. *L. Smithii*, Dicks. Fasc. ii. p. 10. t. 5. f. 4 (sub *Hypno*). *Hab.* Z_{0-1} in arborum cortice circa *Pau*, &c. In Pyr. orientalibus (Arnott ! Montagne !). Circa Burdigalam, socia *Cryphæa heteromalla*, legi.

10. *Pterogonium*, Swartz.

109. *P. filiforme*, Hedw. Musc. Frond. iv. t. 7; M. P. 92. *Hab.* Z_{1-3} ad saxa et arbores, circa *Cauterets* præcipue, frequens.

" *Var.* foliis secundis. *P. heteropterum*, Brid. ? Br. Univ. ii. p. 176. *Hab.* in rupibus secus lacum *Espingo* prope *B.-de-Luchon*;" M. P. 93.

110. *P. gracile*, L. Syst. Veg. p. 952 (sub *Hypno*); M. P. 94. *Pterigynandrum gr.*, Hedw. Musc. Frond. iv. t. 6.

Hab. Z_{0-2} in saxis Pyrenæorum, semper sterile; in arboribus sylvæ *Lespéron* prope Aq. Tarbellicas Agri Syrtici fructiferum legi 20 Novembris, 1845.

The leaves of this species, besides being *papillose* from the projecting cellules, are *tuberculate on the back in the upper half*; the tubercles arranged with some regularity parallel to the sides of the leaf, three or four cellules apart, and springing from the points where four cellules meet.

111. *P.? subenervium*, Spruce; dioicum; *caule* prostrato, *vage bipinnato*, ramis ascendentibus, subparallelis; *foliis e basi patala apice surrectis, ovatis oblongo-ovatisve, acuminatis*, concavis, *margine inferiori leviter reflexis*, integerrimis, *nervo rudimentario vix ullo, areolatione guttulata.*

Hab. Z_1 in arborum cortice prope *B.-de-Bigorre* et *Pau*: ♀ sola, sterilis.

Caules ½–1 unc., intricati, hic illic radiculos rufos emittentes. *Folia* saturate viridia, integerrima, margine tamen inferiori e cellularum parietibus prominulis subundulata; nervo brevissimo, longitudine latitudinem haud excedente; siccando appressa, apice autem recurva patulave: in ramis tenuioribus nonnunquam adsunt folia angustiora, acumine cirrhoso chlorophyllo carente instructa. *Cellulæ* discretæ; inferiores latitudine tertiam partem long. habent, superiores vix dimidiam; *reflexus vero rotundatæ, minores, unde folium ibidem magis opacum videtur. Flores fœminei* ad caulem et ramos primarios nati; *folia perichætialia*, intimis minoribus *subulatis* exceptis, ovato-lanceolata, acuminata, serrata, *cellulis marginalibus curvatis*, enervia. *Archegonia crassa*, numerosa, 10 circiter, *paraphysibus omnino destituta.*

Folia iis *Pt. gracilis* haud absimilia, *epapillosa autem et apice an-*

gustiora sunt. Cæterum *ramos nec incurvos nec fasciculatos* habet. *Clasmatodon pusillus*, Hook. et Wils. in Drumm. Mosses of S. States of N. America (*Regmatodon parvulus,* Hampe, Icones, t. 14) habitu et magnitudine ut etiam foliis margine basali reflexis, areolatione guttulata, &c., similis, certe differt *florescentia monoica* et *foliis latioribus ad medium usque nervatis.*

11. *Leucodon,* Schwgr.

112. *L. sciuroides,* L. Sp. Pl. p. 1596 (sub *Hypno*); Schwgr. Suppl. t. 125.

Hab. Z_{0-1} in arborum truncis; copiose fructificans.

12. *Cyrtopus,* Brid. Bryol. Univ. 2. p. 235.

113. *C. curtipendulus,* L. Sp. Pl. p. 1594 (sub *Hypno*). *Anomodon c.,* H. et T.! Musc. Brit. ed. 1. p. 79. t. 22 (1818). *Antitrichia c.,* Brid. Mant. Musc. p. 136 (1819) et Br. Univ. ii. p. 223.

Hab. Z_1 ad saxa et truncos. Fertilem in sylva *Forêt de Transoubât* dicta invenit cl. Philippe!

This species agrees well enough in habit and character with some of the exotic species of *Cyrtopus,* e. g. *C. acuminatus,* Hook. Musc. Exot. t. 151, and I therefore place it along with them rather than in *Anomodon* or *Antitrichia,* both of which genera have been founded on incorrect views of the structure of the inner peristome. The cilia neither spring *from the sides of the teeth,* as stated in 'Muscologia Britannica,' nor are they *opposite to the teeth,* as Bridel says; on the contrary, they are (as in all mosses) *a continuation of the sporular sac,* and they alternate with the teeth. They are the most slender and delicate I have seen in any moss, and consist either of a single series of cellules throughout, or here and there of a double series, when they are often perforated. There are sometimes rudimentary *ciliola* (solitary or twin) between them.

Tribus 6. Fabroniaceæ.

13. *Fabronia,* Raddi.

114. *F. pusilla,* Raddi, Act. Florent.; Schwgr. Suppl. t. 99.

Hab. Pyr. or. prope *Rodez* (Arnott!); etiam "in rupibus cavis ad *St. Martin* in radicibus montis *Canigou*" (Mont. in Arch. de Bot. tom. 1). "Circa *Dax* Aquitaniæ" (Grateloup in Brid. Br. Univ.).

Tribus 7. Anacamptodonteæ.

14. *Anacamptodon,* Brid.

115. *A. splachnoides,* Brid. Mant. Musc. p. 136; Sulliv.! Musci Allegh. n. 82; M. P. 97. *Neckera s.,* Schwgr. Suppl. t. 82.

Hab. Z_1 sup. P. c. *Vallée du Lys,* in trunco *Carpini Betuli* unico.

Tribus 8. Cryphæaceæ.

15. *Cryphæa,* Brid.

116. *C. heteromalla,* Hedw. Musc. Frond. 3. t. 15 (sub *Neckera*); M. P. 96.

Hab. Z_{0-1} corticicola per Pyrenæos humiliores.

Hemicyclum 2. *Acrocarpi.*

Tribus 9. Bartramiaceæ, Bryol. Europ.

16. *Bartramia,* Hedwig.

§ 1. (= Bartramia, Bridel.)

117. *B. stricta,* Brid. Mant. Musc. p. 116; Br. Europ. *Bartramia,* t. 1.

Hab. P. or. "in Pyrenæis et Monte serrato Hispaniæ, anno 1803" (Bridel, Br. Univ. ii. p. 45); *Concampa,* etiam *au montant de Boulon à Bellegarde* (Arnott!).

118. *B. gracilis,* Floerke in Schrad. Bot. Journ. 1799; M. P. 100. *B. Oederi,* Swartz; Br. Europ. *l. c.* t. 3.

Hab. Z_{1-2} in rupibus umbrosis, haud infrequens.

119. *B. ithyphylla,* Brid. Mant. Musc. p. 116; Br. Europ. *l. c.* t. 2; M. P. 101.

Hab. Z_{2-5} in rupibus graniticis terra obtectis.

120. *B. pomiformis,* Hedw. Sp. Musc. p. 164; Brid. Europ. *l. c.* t. 4; M. P. 102.

Hab. Z_{1-3} in umbrosis, terrestris et rupestris.

Var. *crispa,* M. P. 103. *Bartramia crispa,* Sw. Musc. Suec. p. 73. *Hab.* in rupestribus præcipue subalpinis.

121. *B. Halleriana,* Hedw. Musc. Frond. 2. t. 40; Br. Europ. *l. c.* t. 5; M. P. 104.

Hab. Z_{2-3} ad rupes in regione sylvatica superiore.

§ 2. (= Philonotis, Bridel.)

122. *B. calcarea,* B. et S.! Br. Europ. *l. c.* p. 19. t. 10; M. P. 105.

Hab. Z_{1-3} P. occ. et c. in solo calcareo secus ripas rivulorum vel in scaturiginosis calcareis. *Gélos*; *Gave de Combascou,* &c. *Tourmalet* et *Cirque d'Arbizon* (Philippe!).

123. *B. fontana,* L. Sp. Pl. p. 1574 (sub *Mnio*); Br. Europ. t. 9; M. P. 106.

Hab. Z_{0-4} in humidis.

124. *B. marchica,* Hedw. Musc. Frond. 2. t. 39 (sub *Mnio*); Br. Europ.! *l. c.* t. 8.

Hab. Z_{1-2} P. occ. *Vallée de Béost,* sterilis; P. c. *B.-de-Bigorre, sur la route de Toulouse,* fertilis (Philippe!).

Tribus 10. Oreadeæ, Br. Europ.

17. *Catoscopium,* Bridel.

125. *C. nigritum,* Dicks. Cr. Fasc. 3. p. 9 (sub *Bryo*); Br. Europ. *Catoscop.* (cum icone); M. P. 99.

Hab. Z_2 P. occ. *Mont Lizé,* in paludosis secus rivulos.

Tribus 11. Georgiaceæ.

(*Tetraphideæ,* Br. Europ.)

18. *Georgia,* Ehrh. Hann. Magaz. 1780, p. 931.

(*Tetraphis,* Hedw. Fund. Musc. 2. p. 87.)

126. *G. pellucida,* L. Sp. Pl. p. 1574 (sub *Mnio*). *G. Mnemosyne,* Ehrh. *l. c.*; C. Muell. Synops. Musc. p. 182. *Tetraphis pellucida,* Hedw.; Br. Europ. *Tetraphis* (cum ic.); M. P. 319.

Hab. Z_{0-2} ad ligna putrida.

127. *G. Browniana,* Dicks. Crypt. Fasc. 4. p. 7. t. 10. f. 6 (sub *Bryo*); C. Muell. Synops. Musc. p. 181. *Tetrodontium Brownianum,* Schwgr. Suppl. t. 128.

Hab. Z_2 P. c. locis occultis ad rupes arenaceas, &c. præprimis ferro oxydatas: rara et semper *Campylostelio saxicola* consociata. *Labassère. V. de Castelloubon.*

Tribus 12. Bryaceæ.

(*Bryaceæ* et *Mielichoferieæ,* Br. Europ.)

19. *Mielichoferia,* Hornsch. et Nees.

128. *M. nitida,* H. et N. Br. Germ. P. 2. § 2. p. 183. t. 41; Br. Europ.! *Mielichof.* (cum ic.); M. P. 98.

Hab. Z_{1-4} P. occ. et c. in rupibus argillaceo-schistosis, locis *Gorge de Cauterets* et *Port de Bénasque.* P. or. *Crabère* (Arnott!); in convalle *Eynes* (Montagne, *l. c.*); in valle *de Lio* (Thomas in Br. Europ.).

20. *Bryum,* Dillenius.

§ 1. (= Stenobryum, Wils. in litt.)

129. *B. pyriforme,* L. fil. (sub *Mnio*); Br. Europ. *Bryum,* t. 18.

Hab. $Z_{1\ sup.}$ P. c. locis *route de Bagnères à Gazos* et *bords de la route de Toulouse,* ubi invenit am. Philippe!

§ 2. Elongata.

130. *B. acuminatum,* Hoppe et Hsch. Bot. Zeit. 1819, p. 94 (sub *Pohlia*); Br. Europ.! *l. c.* p. 21. t. 6; M. P. 107.

Hab. Z_{2-4} in rupibus terra obtectis Pyr. centralium. *Esquierry. Lac d'Espingo. En montant au Lac Lehou* (Philippe!).

Var. *β. minus,* Br. Europ. *l. c.*; M. P. 108. *Pohlia minor,* Schleich.; Schwgr. Suppl. t. 64.—*Hab.* ad viarum cavarum latera in regione sylvatica. P. occ. *Gorge de Cauterets*; *Pont d'Espagne.* P. c. *Chaos de Gavarnie.*

Florescentia haud semper *monoica*; nonnunquam *hermaphrodita* est, et in tali re *sterilis*; quandocunque autem *dioica* invenitur tunc plerumque *fertilis*!

131. *B. polymorphum,* H. et H. Bot. Zeit. 1819, p. 95 (sub *Pohlia*); Br. Europ.! *l. c.* p. 25. t. 8; M. P. 109.

Hab. Z_2 terrestre in abiegnis juxta pontem dict. *d'Espagne.*

Var. *curvisetum,* Br. Europ. *l. c.* *Pohlia curviseta,* H. et H. *l. c.* p. 98.—*Hab.* Z_{3-4} *V. de Combascou. Esquierry. Port de Bénasque.* In P. or. locis *Mt. Canigou* et *Vallée d'Eynes* detexit cl. Arnott!

132. *B. elongatum,* Dicks. Crypt. Fasc. 2. p. 8; Br. Europ.! *l. c.* p. 32. t. 10.—Var. 1, M. P. 110.

Hab. Z_{1-3} ad vias cavas, in rupibus terra obtectis, &c., per totos Pyrenæos sylvaticos.

"Var. 2. foliis angustissimis, *peristomio interno perfecto.* Ad *Br. elongatum* γ. *macrocarpum,* Br. Europ. accedit." M. P. 111. —*Hab.* ad pinorum truncos cariosos in monte *Crabioules.*

"Var. 3. foliis brevioribus, capsulis longioribus, peristomii interni *ciliis subnullis.*" M. P. 112.—*Hab.* circa *B.-de-Luchon* in sylvaticis editioribus, terrestre, locis *Bois de Sajust, Lac de Séculéjo,* &c.

133. *B. longicollum,* Sw. Musc. Suec. pp. 49, 99. t. 6; M. P. 133.

Hab. Z_2 P. c. in rupium fissuris juxta lacum *Séculéjo.*

134. *B. crudum,* Schreb. Fl. Lips. p. 83; Br. Europ. *l. c.* p. 37. t. 13; M. P. 114.

Hab. $Z_{1 \text{ sup.}-4}$ in rupibus montium humiliorum, frequens: rarius in alpes ascendens (*Port de Bénasque*).

§ 3. Nutantia.

135. *B. nutans,* Schreb. Fl. Lips. p. 81; Br. Europ. *l. c.* p. 34. t. 12; M. P. 115.

Hab. Z_{0-4} ad terram in sylvis, nec non in alpinis.

136. *B. Ludwigii,* Spreng. var. β. *gracile,* Bryol. Europ. *l. c.* p. 39. t. 14; M. P. 119.

Hab. Z_4 P. c. in vicinia molium glacialium montis *Crabioules*; secus ripas lacus *Lehou* (Philippe!).

137. *B. albicans,* Wahl. in Web. et Mohr Ind. Musæi. *B. Wahlenbergii,* Schwgr.; Br. Europ. *l. c.* p. 44. t. 17; M. P. 118.

Hab. (*forma typica*) Z_1 ad rivulorum ripas circa *Gélos,* P. occ.: rarius.

Var. *glaciale,* Br. Europ. *l. c.* *Bryum glaciale,* Schleich. in Brid. Br. Univ. i. p. 852.

Hab. Z_4 P. c. in eodem loco ac *B. Ludwigii β.* P. or. *V. d'Eynes* (Arnott!).

138. *B. carneum,* L. Sp. Pl. p. 1587; Br. Europ. *l. c.* p. 43. t. 16; M. P. 116.

Hab. Z_1 P. c. in rivulorum glareosis circa *B.-de-Bigorre*: rarius.

139. *B. Tozeri,* Grev. Scot. Crypt. Fl. t. 285; M. P. 117.

Hab. $Z_{0-1\,\text{inf.}}$ P. occ. in argillaceo-arenosis circa *Pau* et *St. Sever;* in rupibus ophiticis *Sti. Pandelon* prope Aq. Tarbellicas. Auctumno et vere fructificat.

§ 4. Julacea.

140. *B. julaceum,* Smith, Fl. Brit. p. 1357; H. et T.! Musc. Brit. p. 197. t. 28; Schwgr. Suppl. t. 195; M. P. 120.

Hab. Z_2 P. c. ad rupes humectas juxta cataractam dict. *la Cascade du Cœur*: nusquam alias visum.

141. *B. concinnatum,* Spruce in Musc. Pyr. n. 121: dioicum, *gracilescens,* parce ramosum; *caule ramisque tereti-julaceis;* foliis nitidis, erectis, imbricatis, ovatis et ovali-lanceolatis, *breviter apiculatis,* concavis, integerrimis vel sub apice obsolete denticulatis, anguste areolatis, *margine planis, nervo cum apice evanido.*

Hab. Z_1 P. occ. in rupibus humidiusculis ad viam quæ ducit a pago *Pierrefitte* ad opp. *Cautereis;* P. c. in via cava ad pedem montis *Superbagnères* prope *B.-de-Luchon.*—In Anglia ad cataractam *Caldron Snout* dictam fl. *Tees,* mense Julio, 1843, detexi. —Planta ♀ sola, sterilis, hucusque observata.

Pusillum, cæspitosum; cæspites in parte inferiori tomento radiculoso cohærentes. *Caulis* $\frac{1}{2}$–1 unc. erectus vel ascendens, julaceus, e basi ipsa uno eodemque modo foliosus, ramos nonnullos teretes plerumque simplices, inferiores sæpius fastigiatos proferens, inferne rubellus, superne viridis. *Folia* erecta, imbricata, ovata v. ovali-lanceolata, apiculo brevi subreflexo, concava, alis basilaribus inflexis, margine ipsa plana, integerrima, rarius ad apicem versus obsolete denticulata, nervo percurrente instructa, e cellulis elongato-rhomboideis-hexagonisve minoribus curvulis, superne arctius, basi cellulis latioribus laxius, areolata, inferiora paulo longiora fuscescentia, superiora pallide viridia nitida. *Flores fœminei* terminales seu pseudoalares; *folia* erecta, elongato-lanceolata, subplana, interiora minora; *archegonia* et *paraphyses* numerosi, pari longitudine.

Differt *B. julaceum,* Smith, statura majori, *foliorum apice obtusiori subinflexo, nervo ante apicem evanido,* areolisque angustioribus; *B. atropurpureum* gemmiparum (= *B. gracilentum* Tayl. olim) *foliis erecto-patulis, brevioribus, apiculo obtuso* quasi truncato terminatis, e cellulis minus elongatis conflatis; *B. Funkii,* Schwgr., *foliis nervo validiori excurrente instructis, areolisque multo majoribus;* *B. Blindii,* Schimp., *foliis evanidinerviis*; *B. semiovatum*, Brid., foliis *nervo crasso apicem excedente.*

Obs. In foliorum superiorum axillis nonnunquam adsunt gemmæ fasciculatæ (2–9-natæ) saturate purpurascentes, folia minuta arcte imbricata sistentes, iis *B. julacei* haud absimiles.

§ 5. Argentea.

142. *B. argenteum,* L. Sp. Pl. p. 1586; Br. Europ. *l. c.* p. 78. t. 41.

Hab. Z_{0-1} in ruderatis, muris, &c.

143. *B. Zierii,* Dicks. Crypt. Fasc. i. t. 4. f. 10; Br. Europ. *l. c.* p. 29. f. 9; M. P. 122.

Hab. Z_{2-3} in rupibus humidiusculis. P. c. *Lac de Séculéjo*; *Labassère,* &c. P. or. *Mont Louis* (Arnott !).

§ 6. Cæspiticia.

144. *B. pallens,* Sw. Musc. Suec. p. 47. t. 4; Br. Europ. ! *l. c.* p. 68. t. 33; M. P. 123. *B. turbinatum,* H. et T. ! Musc. Brit. p. 202. t. 29.

Hab. Z_{1-3} in humidis præcipue secus rivulos, frequens.

145. *B. pallescens,* Schwgr. Suppl. t. 75; Br. Europ. ! *l. c.* p. 51. t. 22; M. P. 124.

Hab. Z_{2-3} plerumque secus rivulos, haud rarum. *Les Eaux Chaudes*; *Chaos de Gavarnie*; *Lac Lehou* et *Pic du Midi* (Philippe !), &c. In tugurii pastoricii tecto ad latus orientale montis *Tourmalet.*

146. *B. bimum,* Schreb. Fl. Lips. p. 83; Br. Europ. *l. c.* p. 50. t. 21.

Hab. Z_2 P. or. *Vallée d'Eynes* (Arnott !).

147. *B. cirrhatum,* H. et H. Bot. Zeit. 1819, p. 70; Br. Europ. fasc. 32. p. 8. t. 11.

Hab. Z_{3-4} in humidis graminosis P. c., locis *Esquierry* et *Port de Bénasque.*

148. *B. inclinatum,* Sw. Musc. Suec. p. 45 et 96 (sub *Pohlia*); Br. Europ. ! *Bryum,* p. 17. t. 3; M. P. 125.

Hab. Z_{1-2} ad terram saxaque, sed rarius. P. occ. circa *Cauterets.* P. c. *V. de Lesponne.* P. or. *Cambrédazes* (Arnott !).

149. *B. cernuum,* Hedw. Sp. Musc. p. 58. t. 9 (sub *Cynontodio*); Br. Europ. *l. c.* p. 14. t. 1.

Hab. Z_{1-4} ad saxa, rarius. P. occ. *Oloron.* P. c. prope pagum *Luz*; *Pic du Midi à* 1300 *toises* (Philippe !).

150. *B. cæspiticium,* L. Sp. Pl. p. 1586; Br. Europ. *l. c.* t. 34.

Hab. Z_1 P. occ. prope *Oloron,* ubi *cæspitem unicum* inveni ! !

? Var. γ. *imbricatum,* Br. Europ. *l. c.* p. 70. t. 35; M. P. 126. —*Hab.* ad muros in valle *Campan* juxta *Ste. Marie,* sterile.

151. *B. erythrocarpon,* Schwgr. Suppl. t. 70.
Hab. Z_1 P. occ. supra pagum *Jurançon,* in solo arenoso juxta rivulum.

152. *B. atropurpureum,* W. et M. Ind. Mus.; Br. Europ. *l. c.* p. 73. t. 37; M. P. 127.
Hab. Z_{0-1} in muris, ad terram, &c., vulgatum.

153. *B. alpinum,* L. Mant. 2. p. 309; Br. Europ. *l. c.* p. 76. t. 39; M. P. 128.
Hab. $Z_{1\ sup.-3}$ in saxis secus rivulos: fructiferum juxta thermas supra pagum *Penticosa* Aragoniæ, etiam in faucibus dict. *Gorge de Luz* et *Gorge de Labassère.*

154. *B. pseudotriquetrum,* Hedw. Musc. Frond. 3. t. 7 (sub *Mnio*); Br. Europ. *l. c.* p. 54. t. 24; M. P. 129. *B. ventricosum,* Dicks.; H. et T.! Musc. Brit. p. 205. t. 30.
Hab. $Z_{1\ sup.-3}$ in rupibus humidis, frequens.

155. *B. turbinatum,* Hedw. var. *γ. latifolium,* Br. Europ.! *l. c.* p. 65. t. 32; M. P. 130. *B. Schleicheri,* Schwgr. Suppl. t. 73.
Hab. Z_{3-5} ad fontes in alpinis. *Penticosa; Lac de Séculéjo; Mt. Maladetta,* &c. *Vallon d'Arise* (Philippe!).

§ 7. Capillaria.

156. *B. obconicum,* Hornsch.; Bryol. Europ.! *l. c.* p. 59. t. 27; M. P. 131.
Hab. Z_1 P. occ. et c. ad muros, haud infrequens. *Jurançon; Bagès; Arreau,* &c. *Bagnères* (Philippe!).

157. *B. platyloma,* Schwgr. Suppl. 1. P. 2. p. 116. t. 76 (non Br. et Sch.); M. P. 132.
Hab. Z_1 P. c. in rupibus humidiusculis prope pagum *Pierrefitte.*

This plant agrees closely with Schwaegrichen's figure and description above-cited, with the sole exception that the stems are rather more elongated. Through the favour of Mr. Wilson I have examined specimens gathered in the Canary Islands by Mr. Webb, and named "*Br. platyloma,* Schwgr." by Dr. Montagne: these agree in all characters of importance with the Pierrefitte plant. The latter differs essentially from the *B. platyloma* of B. and S. (*B. Donnianum,* Grev.) in the leaves having *a broad margin of* 4–6 *rows of cellules* ("in sex circiter series digestæ," Schwgr. *l. c.*), but composed of *only a single layer*; while those of *B. Donnianum* have a margin *only* 2 *or* 3 *cellules in width,* but *decidedly thickened* ("margine e strato *duplici* cellularum . . . . circumducta," Br. Europ.), in other words they are *pachylomatous* but not *platylomatous.* The leaves of the true *B. platyloma* differ further in being *far smaller, rigid, nearly erect,* by no means "in comam patulam congesta" (as represented in 'Bryol. Europæa,' but not in Schwaegrichen), the strong nerve running out into a point which equals $\frac{1}{3}$ or $\frac{1}{4}$ of the rest of the leaf, while those of the 'Bryol. Europæa' plant "n'offrent ordinairement qu'une pointe courte, formée par le rapprochement des bords de la feuille." In habit the two plants differ very considerably.

There is still one doubt remaining, namely whether *B. platyloma*, Schwgr., and *B. obconicum*, Hornsch., be merely forms of one and the same species. There is some difference in external aspect, and the latter has the leaves *scarcely marginated*, paler and less rigid, with a longer-necked, *perfectly symmetrical* and usually more pendulous capsule.

158. *B. torquescens*, B. et S. Br. Europ. *l. c.* p. 49. t. 20; M. P. 133.

Hab. Z_{0-1} P. occ. ad terram prope *Jurançon* et *Cauterets*.—Circa *Montpellier* (Arnott !).

"Var. florescentia *monoica*;" M. P. 134. *B. fuscescens*, nob. in hb.—*Hab.* Z_{0-1} P. occ. prope *St. Sever* in Agro Syrtico, loco *Landes de Mugriet*, in terra arenosa; etiam in muro prope *Oloron*.

(*Descr.* varietatis.) *Plantæ* gregariæ. *Folia* fuscescentia, *subpatula*, siccando appressa *parum tortilia*, elongato-obovata, apiculata, nervo tenui excurrente cuspidata, concava, *haud carinata*, 2–3 cellularum angustiorum seriebus marginata, apice denticulata. *Flores fœminei constricti*, 6–8 folii. *Flores masculi gemmiformes ad fœminei basin nati*, sessiles vel in innovationibus terminales (rarius in planta propria); *folia perigonialia* sub-6, conniventia, exteriora ovato-acuminata, interiora minora, late-ovata, apiculata, antheridia numerosa paraphysibus numerosis sublongioribus stipata, complectentia. *Capsula* in pedunculo basin versus geniculato arcuatove subpendula, elongato-pyriformis, fere clavata, e fusco purpurascens. *Operculum* convexum, apiculatum, aurantiacum, nitens. *Peristomium*: externi dentes pallidi; *internum* membrana in processus carina valde pertusos *apice attenuatos*, ciliis 2–3-nis appendiculatis interjectis, fere ad medium fissa. *Annulus* latus, compositus. *Sporæ* olivaceæ.

The *monoicous inflorescence* is so constant a character in all the individuals from the two localities above-cited, that I am led to suppose this will prove a distinct species. In the typical form of *B. torquescens*, from Jurançon and Cauterets, the fertile flowers are all *hermaphrodite*, and quite *turgid* from the *numerous antheridia* they enclose along with the archegonia. Yet a minute comparison of all the other parts does not reveal any marked difference in the two plants, and I prefer waiting for further evidence before I undertake to decide on their being distinct or otherwise.

159. *B. capillare*, Hedw. Sp. Musc. p. 182; Br. Europ. *l. c.* p. 60. t. 28.

Hab. Z_{0-4} "Var. 1." M. P. 135 (=*B. capillare* α. Br. Europ.): in planitie et montibus humilioribus, fere ubique ad saxa, &c.

"Var. 2. foliis longioribus, obovato-lanceolatis, siccitate patulis vix tortilibus (minime *spiraliter* tortis), capsulis elongatis pallidis;" M. P. 136.—*Hab.* Z_{2-3} ad truncos putrescentes locis *Pont d'Espagne, Hourquette d'Aspin, Lac de Séculéjo,* &c.

"Var. 3." M. P. 137 (=*B. capillare* β. *cochlearifolium,* Brid. Br. Univ. 1. p. 666=*B. capillare* η, Br. Europ.).—*Hab.* Z_{3-4} in alpinis, saxatile et terrestre, rarissime fertile. P. occ. *V. de Combascou.* P. c. *Lac Lehou*; *Esquierry.* P. or. in monte *Canigou* (Arnott !).

160. *B. Donnianum,* Grev. ! in Linn. Soc. Trans. 15. p. 345. t. 3. f. 6. *B. platyloma,* Br. Europ. *l. c.* p. 58. t. 26 (non Schwgr.). *B. Muelleri,* M. P. 138.

Hab. Z_0 in terra arenosa Agri Syrtici prope *St. Sever,* sterile.

I published this in 'Musci Pyrenaici' as *B. Muelleri* mst., feeling convinced that it was perfectly distinct from the *B. platyloma* of Schwgr. (See above, under No. 157, for an exposition of the differences of the two species.) I owe to Mr. Mitten the suggestion that it is in reality the *B. Donnianum* of Greville, which we have since confirmed by an examination of the author's original specimens. The fertile plant has been found in Sussex by Messrs. Mitten and Jenner.

161. *B. roseum,* Schreb. Fl. Lips. p. 84; Br. Europ. *l. c.* t. 25; M. P. 139.

Hab. Z_1 in sylvis, plerumque sterile. Fertile in sylva *Bois de Gerde* dicta (Philippe !).

21. *Mnium,* Dillenius, Linnæus.

162. *M. spinosum,* Voit in Sturm. Flor. Germ. Crypt. 11. t. 16 (sub *Bryo*); Br. Europ. fasc. 5, *Mnium,* p. 26. t. 6; M. P. 140.

Hab. Z_2 P. c. sub abietum umbra juxta pontem *Pont d'Espagne* dictum.

163. *M. spinulosum,* B. et S. ! Br. Europ. fasc. 31. p. 4. t. 4.

Hab. Z_2 P. c. cum priore; etiam in trunco carioso *V. du Lys.*

164. *M. hornum,* L. Sp. Pl. p. 1576; Br. Europ. fasc. 5. p. 22. t. 4.

Hab. Z_{0-2} in sylvis, haud vulgatum.

165. *M. serratum,* Schrad. Spic. Fl. Germ. p. 71 (sub *Bryo*); Br. Europ. *l. c.* p. 24. t. 5.

Hab. Z_{1-2} in umbrosis præcipue secus rivulos. *Les Eaux Bonnes,* &c. *En montant au Lac Lehou* (Philippe !). *V. d'Eynes* (Arnott !).

166. *M. lycopodioides,* Br. Europ. fasc. 31. t. 2. (An *Bryum lycopodioides,* Hook. in litt. ad Schwgr. ?)

Hab. Z_2 P. c. *Vallon de Courbettes* (Philippe !).

167. *M. orthorhynchum,* Br. Europ. fasc. 5. p. 25. t. 5 (non Bridel).

Hab. Z_{1-2} P. occ. et c.: socio *M. serrato. Les Eaux Bonnes. Col de Louvie. Vallon de Courbettes,* etiam *en montant au Lac Lehou* (Philippe !).

168. *M. undulatum,* Hedw. Sp. Musc. p. 195; Br. Europ. *l. c.* p. 20. t. 3.

Hab. Z_{0-1} in umbrosis: fertile circa *Dax* (Grateloup !), *Pau* (Southby !) et *B.-de-Bigorre* (Philippe !).

169. *M. affine,* Bland. Musc. Exs. fasc. 3. n. 153; Br. Europ. *l. c.* p. 30. t. 9.

Hab. Z_1 locis umbrosis humidiusculis: fertile prope *B.-de-Bigorre* (Philippe !).

170. *M. medium,* B. et S. ! Br. Europ. *l. c.* p. 32. t. 12; M. P. 142 (*forma major*).

Hab. Z_2 P. c. in saxosis umbrosis secus rivulos sylvæ *Bois de Gouerdère* dictæ prope *B.-de-Luchon.*

171. *M. rostratum,* Schrad. Spicil. p. 72 (sub *Bryo*); Br. Europ. *l. c.* p. 27. t. 7; M. P. 143.

Hab. Z_1 ad latera viarum cavarum.

172. *M. cuspidatum,* Hedw. Sp. Musc. p. 192. t. 45; Br. Europ. *l. c.* p. 29. t. 8.

Hab. Z_1 in sylvaticis humidis, rarius. *Jurançon. V. du Lys.*

173. *M. punctatum,* Schreb. Fl. Lips. p. 85 (sub *Bryo*); Br. Europ. *l. c.* p. 19. t. 2; M. P. 144.

Hab. Z_{1-2} in scaturiginosis.

174. *M. stellare,* Hedw. Sp. Musc. t. 40; Br. Europ. ! *l. c.* p. 33. t. 13; M. P. 145.

Hab. Z_{1-2} P. occ. et c. supra ligna putrida inque saxosis umbrosis montis *Goursi* prope *les Eaux Bonnes*; nec non in valle *du Lys* et circa *B.-de-Bigorre*: rarissime fructiferum.

† "*M. latifolium,* foliis ovato-subrotundis solidinervibus marginatis subdenticulatis concavis, caule longo subsimplici.

"Lectum est a Schleichero in Helvetia, missum e Pyrenæis; sine flore.

"Foliorum forma *punctato* aliquo modo simile, si madet; sed habitu et foliis erecto-incumbentibus, siccitate parum plicatis, distinctum. Locum hic habet propter foliorum texturam, Mnio similem." Schwgr. Suppl. 1. P. 2. p. 138.

Very probably this is nothing more than a sterile form of *B. punctatum,* such as I have myself gathered in the Vallée de Lutour, remarkable for its elongated stems and appressed leaves when dry: hence resembling externally *M. cinclidioides,* Blytt.

22. *Aulacomnion,* Schwgr.

175. *A. androgynum,* L. Sp. Pl. p. 1574 (sub *Bryo*); Br. Europ. *Aulacomnion,* p. 11. t. 4; M. P. 146.

Hab. Z_1 in rupibus umbrosis, rarum. P. occ. *Gave de Gabas.* P. c. *Forêt de Transoubât* (Philippe !).

176. *A. palustre,* L. Sp. Pl. p. 1574 (sub *Bryo*) ; Br. Europ. *l. c.* p. 9. t. 3.

Hab. Z_1 in paludosis. P. c. prope *Bagnères* (Philippe !). P. or. *Mt. Canigou* (Arnott !).—Plantam per Europam septentrionalem *vulgatissimam* nusquam in Pyrenæis loco natali conspicere mihi contigit !

23. *Timmia,* Hedwig.

177. *T. Megapolitana,* Hedw. Musc. Frond. i. p. 83. t. 31; Br. Europ. *Timmia,* t. 1.

Hab. Z_3 P. c. *Pic du Midi de Bigorre* (Philippe !). P. or. *Mt. Canigou, Mt. Cady* et *Cambrédazes* (Arnott !).

178. *T. austriaca,* Hedw. Sp. Musc. p. 176. t. 42 ; Br. Europ. *l. c.* t. 2.

Hab. "in Pyrenæis" (Bryol. Europ.).—Planta mihi haud obvia.

Tribus 13. POLYTRICHACEÆ, Bryol. Europ.

24. *Polytrichum,* Dillenius.

§ 1. (= CATHARINEA, *Ehrh.* = ATRICHUM, *P. Beauv.*)

179. *P. undulatum,* L. Sp. Pl. p. 1530 (sub *Bryo*) ; M. P. 300 ; Br. Europ. *Atrichum,* p. 8. t. 1, 2.

Hab. Z_{0-3} in umbrosis humidiusculis.

180. *P. angustatum,* Hook. Musci Exot. t. 50 ; M. P. 301 ; Br. Europ. *Atrichum,* p. 9. t. 3. *Catharinea a.,* Brid. ; Sulliv. ! Musci Allegh. n. 118.

Hab. Z_{0-1} P. c. in collibus siccis dumetosis sylvæ *Bois de Lagaillaste* dictæ prope *B.-de-Bigorre.* P. occ. locis similibus *Sti. Pandelon* prope *Dax.*

§ 2. (= OLIGOTRICHUM, *DeCandolle.*)

181. *P. hercynicum,* Hedw. Musc. Frond. i. t. 13; M. P. 302 ; Br. Europ. *Oligotrichum,* t. 5.

Hab. Z_{3-4} P. c. in regione inferalpina montis *Crabioules,* terrestre ; in alpinis juxta lacum *Lehou* et supra pagum *Gazos* (Philippe !).—? "*Dax,* dans les endroits tourbeux." (Thore in Fl. Franç.)

§ 3. (= POGONATUM, *Pal. Beauv.*)

182. *P. nanum,* Hedw. Musc. Frond. i. t. 13 ; M. P. 303 ; Br. Europ. *Pogonatum,* p. 5. t. 7.

Hab. Z_{0-1} ad aggeres arenosas subhumidas.

The *obscurely toothed* (not sharply serrate) leaves and their *wavy lamellæ* afford good characters for distinguishing this species from *P. aloides.* I gathered near Pau, by the Bordeaux road, an anomalous *Polytrichum*, which may possibly be a starved form of *P. nanum*. It has the capsule subcernuous, nearly spherical; *the columella 4-sulcate*, or rudimentarily alate (not *terete* as in typical *P. nanum*); and *the calyptra sheathing the whole of the capsule.*

183. *P. aloides*, Hedw. Musc. Frond. i. t. 14; M. P. 304; Br. Europ. *Pogonatum*, p. 6. t. 8.

Hab. Z_{0-3} in humidiusculis, præsertim in arena rivulorum, altius versus alpes ascendens quam *P. nanum*.

184. *P. urnigerum*, L. Sp. Pl. p. 1573; M. P. 305; Br. Europ. *Pogonatum*, p. 7. t. 9.

Hab. Z_{0-2} in arenosis humidiusculis.

185. *P. alpinum*, L. Sp. Pl. p. 1573; Br. Europ. *Pogonatum*, p. 9. t. 10.

Hab. Z_{2-4} P. c. in monte *Crabioules*.

Var. caule valde elongato, subsimplici; M. P. 306.—*Hab.* in saxosis umbrosis vallis *Lutour* prope *Cauterets*.

The curious way in which the *epiphragm* (the *tympaniform* dilatation of the summit of the columella) is attached to the peristome in this and other *Polytricha* does not seem to have been anywhere described. In *P. alpinum* it is originally placed at the base of the teeth, to which it is attached by means of processes equaling them in number and exactly covering their internal face. After the fall of the lid, these processes are gradually detached and the epiphragm rises, probably from the pressure of the full-grown spores beneath it, so as to allow the latter to escape through the interstices of the peristome. When the epiphragm is quite liberated, either naturally or by art, *the processes curve inwards upon its upper surface* (see Pl. I. fig. 1) so as to be with difficulty seen, unless the light be properly regulated or the epiphragm be set up on its edge. The processes are composed of only a single layer of cellules, which are so disposed that their interstices form vertical lines corresponding to those on the teeth.

The adhesion of the epiphragm to the teeth is so great as to resist the action of the columella to draw it down into the capsule, and often ultimately to cause the rupture of the columella. The ragged portion at the underside of the section (fig. 2) is where the rupture takes place between the columella and the epiphragm.

In *P. urnigerum, aloides* and *nanum* the epiphragm is attached to the teeth in the same manner, but the processes are very thin and tender, and when the epiphragm is detached by force they often remain adhering to the teeth. In *P. angustatum* (as also probably in *P. undulatum*) the processes are united to each other by an intervening membrane, which is *granulated* on the surface, while the processes themselves are *smooth* and marked by lines similar to those on the teeth: in other words, the epiphragm is bordered by an inflexed *continuous* membrane, by means of which it adheres to the peristome. The figure of *P. angustatum* in 'Bryol. Europæa' represents this pretty well, but no mention is made of it in the text.

§ 4. (= POLYTRICHUM, Brid. et Bryol. Europ.)

186. *P. sexangulare,* Hoppe, Bot. Taschb. p. 150; Br. Europ. *Polytrichum,* p. 7. t. 11.
Hab. Z_{3-4} P. c. locis *Esquierry* et *Port de Paillère* (Arnott!).

187. *P. formosum,* Hedw. Sp. Musc. t. 9; Br. Europ. *Polytrichum,* p. 9. t. 12; M. P. 307.
Hab. Z_{0-2} ad terram in sylvis, haud infrequens.

188. *P. commune,* L. Sp. Pl. p. 1573; Br. Europ. *Polytr.,* p. 13. t. 17; M. P. 308.
Hab. Z_{0-2} in Agri Syrtici ericetis; in Pyrenæorum rupestribus humidis.

189. *P. juniperinum,* Hedw. Sp. Musc. t. 13; Br. Europ. *Polytr.,* p. 12. t. 15; M. P. 309.
Hab. Z_{1-5} in rupibus terra obtectis, e montibus humilioribus usque in summos alpes ascendens.

190. *P. piliferum,* Schreb. Fl. Lips. p. 74; Br. Europ. *Polytr.,* p. 11. t. 14; M. P. 310.
Hab. Z_{1-4} locis sterilibus ventosis: haud vulgare.

Tribus 14. BUXBAUMIACEÆ, Bryol. Europ.

25. *Buxbaumia,* Haller.

191. *B. aphylla,* Hall. Stirp. Helv. 2. p. 83; Br. Europ. fasc. 1 (cum icone).
Hab. Z_0 P. occ. in vicinia *St. Sever,* ubi in declivibus arenosis umbrosis secus fl. *Adour* ripas invenit cel. Dufour!

192. *B. indusiata,* Brid. 1. p. 331. t. Suppl. 2; Br. Europ. fasc. 1. p. 6. t. 2.
Hab. Z_{1-2} in truncis putridis, rarissime. P. occ. in regione media montis *Pic de Ger;* nec non in valle *Jéret.* P. c. *Vallée de Campan* in sylva *Forêt de Paiollest* dicta (Philippe!).

26. *Diphyscium,* Web. et Mohr.

193. *D. foliosum,* L. Syst. Veg. ed. 14. p. 925 (sub *Buxbaumia*); Br. Europ. fasc. 1. p. 3. t. 2; M. P. 320.
Hab. Z_{0-1} ad terram in sylvis, vulgatum.

Tribus 15. MEESIACEÆ, Bryol. Europ. (ex parte).

27. *Meesia,* Hedwig.

194. *M. trichodes,* L. Suec. n. 1006 (sub *Bryo*); M. P. 147. *Meesia uliginosa,* Hedw.; B. et S.! Br. Europ. fasc. 10. p. 5. t. 1.
Hab. Z_{2-4} P. occ. in spongiosis montis *Lizé.* P. c. secus ripas lacus *Lehou; Vallon du Houre* (Philippe!); *Esquierry* (Arnott!). P. or. *V. d'Eynes* (Arnott!).

Tribus 16. FUNARIACEÆ, Bryol. Europ. (ex parte).

28. *Amblyodon*, Pal. Beauv.

195. *A. dealbatus*, Dicks. Crypt. fasc. 2. p. 8. t. 5. f. 3 (sub *Bryo*); Br. Europ. *Amblyodon* (cum ic.).

Hab. Z_2 in spongiosis. P. occ. in monte *Lizé*, socio *Meesia trichode*. P. or. *Port Nègre* (Arnott !).

29. *Funaria*, Schreber.

196. *F. hygrometrica*, L. Sp. Pl. p. 1575 (sub *Mnio*); Br. Europ. *Funaria*, t. 3; M. P. 148.

Hab. Z_{0-3} locis exustis, ruderatis et calcareis.

197. *F. convexa*, Spruce in Musci Pyr. 149. *F. serrata*, B. et S. Br. Europ. *Funaria*, p. 8. t. 2 (non Brid. Br. Univ. 2. p. 57).

Hab. Z_0 P. occ. *St. Sever*, in aggeribus arenosis, socio *F. Muehlenbergii*, a quo *operculo convexo* neutiquam convexo-conico primo visu dignoscenda.

I had come to the conclusion that this moss must be distinct from the *F. serrata* of Bridel (whose specimens were Pennsylvanian ones communicated by Palisot-de-Beauvois) before I had the opportunity of examining the specimens so named by Hooker and Wilson in Drummond's 'Mosses of the Southern States,' &c., No. 76, and those of Sullivant in his beautiful 'Musci Alleghanyenses,' No. 126; and it is satisfactory to find my opinion supported by the decisions of these eminent botanists. The American specimens agree much better with Bridel's description in the form of the leaves, &c. than do those of Bruch and Schimper. I find the perichætial leaves of the former to be *oblong-lanceolate*, acute or subapiculate (*never acuminate*), plane, *serrated almost to the very base*, the rather strong nerve reaching *nearly to the point*, and it is sometimes only with a tolerably high power that it can be ascertained to fail one or two cellules below it. Bridel calls the leaves "acuminata" in his spec. char., but in his description he uses the more applicable term "acutiuscula." Of the nerve he says "proxime sub apicem abrupto nunc paulum excurrente:" I have never seen it excurrent, but it may well have appeared so in some cases with the inferior instruments which Bridel seems to have used.

F. convexa has the leaves larger, proportionally *much wider, spathulato-acuminate* ("forma peculiari, subspathulata," Br. Europ.), concave, the marginal serratures rarely descending below the middle, *the feeble nerve only $\frac{3}{4}$ the length of the leaf*, and the areolation wider; the pedicel shorter, when dry *twisted to the right*; the mouth of the capsule more oblique and the teeth of the peristome with fewer articulations.

F. convexa is distinguished from *F. Muehlenbergii* by another obvious character, besides the one above-mentioned, namely by the calyptra being *persistent* on full-grown dried capsules, its beak *pointing downwards* and usually parallel to the pedicel; whereas in the latter, the calyptra is *rarely persistent* on nearly mature capsules, in the dried state, and in these rare cases it is nearly *erect.* See also Bryol. Europæa, *loc. cit.*

198. *F. Muehlenbergii,* Turn. in Ann. of Bot. ii. p. 198; Schwgr. Suppl. t. 66; Bryol. Europ. *l. c.* t. 1; M. P. 150.

Hab. Z_{0-1} P. occ. in solo arenoso circa *St. Sever.* P. c. in rupibus calcareis terra obtectis juxta thermas dict. *de Salut, B.-de-Bigorre.*

I gathered very sparingly on mortar in a wall near Oloron, a *Funaria* almost intermediate between this species and *F. hibernica.* The leaves are rarely obovate, usually ovate, acute or subapiculate; the nerve stronger than in *F. Muehlenbergii,* and failing very little below the apex; the margins almost quite entire. Pedicel when dry *twisted to the left,* except just beneath the capsule, where there is usually one turn to the right.

30. *Entosthodon,* Schwgr.

199. *E. Templetoni,* Hook. in Fl. Lond. ed. 2 (sub *Weisia*); H. et T.! Musc. Brit. p. 77. t. 14; Br. Europ. *Entosthodon* (cum ic.); M. P. 151.

Hab. Z_0 P. occ. in Agro Syrtico circa *St. Sever* et *St. Pandelon,* ubi ad terram arenosam socio *Physcomitrio fasciculari* viget.

31. *Physcomitrium,* Brid.

200. *Ph. ericetorum,* De Not. Syllab. p. 283; Bryol. Europ. *Physcomitrium,* p. 13. t. 3; M. P. 152. *Gymnostomum fasciculare,* H. et T.! Musc. Brit. p. 23. t. 7.

Hab. Z_{0-1} P. occ. ad fossarum margines circa *Pau* et *St. Sever.*

201. *Ph. fasciculare,* Hedw. Sp. Musc. t. 4 (sub *Gymnostomo*); Br. Europ.! *l. c.* p. 13. t. 4; M. P. 153.

Hab. Z_{0-1} cum præcedente; etiam P. c. circa *B.-de-Bigorre.*

202. *Ph. pyriforme,* Hedw. Sp. Musc. p. 38 (sub *Gymnost.*); Br. Europ. *l. c.* p. 11. t. 2; M. P. 154.

Hab. Z_{0-1} in iisdem locis ac n. 201.

203. *Ph. acuminatum,* Schleich. Cat. Plant. Helvet. p. 40 (sub *Gymnost.*); Br. Europ. *l. c.* p. 11. t. 3.

Hab. $Z_{1\ \mathrm{sup.}}$ in muro e limo constructo supra viculum *Bagès* vallis *d'Ossau*: rarissime.

32. *Ephemerum,* Hampe in Linnæa, 1832.

204. *E. serratum,* Schreb. de Phasco, p. 9. t. 2 (sub *Phasco*). *Phascum serratum,* Br. Europ. fasc. 1. p. 6. t. 1.

Hab. Z_1 in agris cultis prope *B.-de-Bigorre,* rarissime.

In the 'Synopsis Muscorum' of C. Mueller (Berolini, 1848), where the classification of the genera displays much originality and acuteness of observation, the *Ephemera,* along with *Ephemerella,*

C. M., and *Voitia*, Hornsch., form a distinct tribe, under the name of *Ephemereæ*; but, considered as to the *sum* of their characters, I apprehend they must be united to *Funariaceæ*. The transition to recognized members of the latter family is in fact so gradual that it is impossible to indicate where the break should be made. *Ephemerum patens*, for example, is undistinguishable except by very minute examination from *Aphanorhegma serrata*, Sullivant (in Gray's 'Manual of the Botany of the Northern United States,' p. 647), which on its side is scarcely generically distinct from *Physcomitrium*. And if, by the almost universal consent of bryologists, *gymnostomous* mosses are no longer to form a separate tribe, but are to be distributed among those peristomatous tribes and genera to which they have in all their other characters a perfect affinity, why should we accord a greater favour to *astomous* mosses, which repose on an equally *negative* character for their separation? In other words, if there be no acknowledged tribe of *Gymnocarpi*, why should there be one of *Cleistocarpi*? This query is rendered more unanswerable by the consideration, that as there are individual mosses (e. g. *Encalypta vulgaris*) which unite in themselves the characters of *Gymnostomi* and *Peristomati*, so there are other individuals which equally unite the characters of *Gymnostomi* and *Astomi*; I need only instance *Phascum rostellatum*, Brid., which has in some instances a *persistent*, in others a *deciduous* operculum, and is thus in itself both *cleistocarpous* and *stegocarpous*: if the former be considered its normal condition, it should be (according to our existing artificial systems) a *Phascum*; if the latter, a *Hymenostomum*!

I may in this place take occasion to remark on the very great rarity of Phascoid and other *annual* mosses in the Pyrenees. *Above the montose zone, I did not observe a single annual moss*, for *Funaria hygrometrica* cannot strictly be considered such. There is the same peculiarity in arctic countries, as for instance in Lapland, where according to Wahlenberg the *Phasca* and the smaller species of *Tortula* and *Gymnostomum* (i. e. *Pottia*) are altogether wanting! Contrast with this the following list of *Phasca*, abundant in cultivated ground near Montpellier in the autumnal and early winter months, which I owe to the kindness of Mr. Bentham: *Phascum axillare, bryoides, carniolicum, crispum, curvicollum, cuspidatum, Flœrkeanum, muticum, pachycarpum* and *rectum*.

Tribus 17. Splachnaceæ, Bryol. Europ.

33. *Tayloria*, Hook.

205. *T. serrata*, Hedw. Spec. Musc. t. 8 (sub *Splachno*); Br. Europ. *Tayloria*, p. 6. t. 1; M. P. 156.

Hab. Z_3 P. c. in monte *Crabioules* et ad lacum *Espingo*, juxta pastorum tuguria, terrestris.

Var. γ. *tenuis*, Br. Europ. *l. c.* t. 2; M. P. 157. *Splachnum tenue*, Dicks. Cr. Fasc. 2. p. 2.

Hab. Z_2 P. occ. supra ligna putrida in valle *Jéret*.

34. *Dissodon,* Grev. et Arnott.

206. *D. Frœlichianus,* Hedw. Musc. Frond. iii. p. 99. t. 40 (sub *Splachno*).

Hab. Z_4 in terra humida P. centr. locis *Cirque d'Arbizon* (Philippe!) et ad latus boreale montis *Pic du Midi* dict. (De Lugo!)

Tribus 18. Pottiaceæ, Br. Europ. (ex parte).

35. *Acaulon,* C. Muell. in Bot. Zeit. 1847, p. 99.

207. *A. muticum,* Schreb. (sub *Phasco*); Br. Europ. *Phascum,* p. 8. t. 2.

Hab. Z_{0-1} P. occ. et c. ad terram, sed rarius. *St. Sever. B.-de-Bigorre.*

As I have above considered it expedient to place *Ephemerum* in *Funariaceæ,* on the same principle *Acaulon* and its allies (*Phascaceæ,* C. Muell., excluding *Ph. crispum, multicapsulare, polycarpum* and *rostellatum,* which belong to *Weisiaceæ*) must go into *Pottiaceæ.* The near affinity of *Pottia minutula* to *Phascum cuspidatum,* &c. is too obvious to require proof; and as there are some *Phasca* (e. g. *Ph. bryoides*) which have an easily *separable,* not to say *deciduous* lid, there would seem to be no character, either natural or artificial, sufficiently constant to justify the separation of the latter from *Pottiaceæ.*

36. *Phascum,* Linnæus.

208. *Ph. cuspidatum,* Schreb. de Phasco, p. 8. t. 1; Br. Europ. *Phascum,* p. 12. t. 6; M. P. 322.

Hab. Z_1 in campis incultis prope *B.-de-Bigorre,* rarum.

37. *Pottia,* Ehrhart.

209. *P. truncata,* Hedw. Musc. Frond. i. p. 13. t. 5 (sub *Gymnostomo*); Br. Europ. *Pottia,* t. 4.

Hab. Z_{0-1} locis cultis, ruderatis, &c.

38. *Anacalypta,* Roehling.

210. *A. latifolia,* Web. et M. B. T. p. 147 (sub *Grimmia*); Br. Europ. *Anacalypta,* t. 4.

Hab. Z_4 P. c. in altioribus montis *Pic du Midi de Bagnères* (Philippe!).

211. *A. Starkeana,* Hedw. Musc. Frond. iii. p. 83. t. 34 (sub *Weisia*); Br. Europ. *l. c.* t. 1.

Hab. Z_{0-1} P. c. in solo calcareo juxta thermas dict. *de Salut* prope *B.-de-Bigorre.*

Var. *β. brachyodus,* Br. Europ. (*Weisia affinis,* Musc. Brit. p. 79. t. 14).—*Hab.* P. occ. in arenosis prope *St. Sever.*

212. *A. lanceolata,* Hedw. Musc. Frond. iii. p. 66. t. 23 (sub *Leersia*); Br. Europ. *l. c.* t. 2.

Hab. Z_1 P. c. locis ruderatis secus ripas fl. *Adour* supra *Bagnères* ! (Philippe !). Nusquam alias nobis nota.

39. *Desmatodon,* Bridel.

213. *D. latifolius,* Hedw. Musc. Frond. i. t. 30 (sub *Dicrano*); Br. Europ. *Desmatodon,* p. 5. t. 1; M. P. 158.

Hab. Z_{3-4} in alpinis, terrestris. P. occ. *V. de Combascou.* P. c. *Port de Bénasque*; *Pic du Midi* (Philippe !). P. or. *V. d'Eynes* (Montagne !); *Canigou, Cambrédazes* et *V. d'Eynes* (Arnott !).

Var. *β. muticus,* Brid.; Br. Europ. ! *l. c.* t. 2; M. P. 159. *D. glacialis,* Funk.

Hab. Z_{4-5} in summis Pyrenæis. *Port de Cauterets. Esquierry.*

214. *D. nervosus,* H. et T. ! Musc. Brit. p. 115. t. 20 (sub *Didymodonte*); Br. Europ. *l. c.* p. 6. t. 3; M. P. 160.

Hab. Z_1 P. c. in rupibus argillaceo-schistosis subdecompositis prope pagum *Loucrup,* non longe a *B.-de-Bigorre,* ubi am. Philippe detexit. P. or. ad viam quæ ducit a *Seo d'Urgel* ad Andorram (Arnott !); apud *Concampa* et ad *Pla de Sorroco* prope *Prats de Mollo* (Montagne !).

Tribus 19. TRICHOSTOMACEÆ, Bryol. Europ.

40. *Tortula,* Hedwig.

Obs. The following species were observed only on calcareous rocks or soil, or on mortar in walls: *T. rigida, aloides, chloronotos, tortuosa, inclinata, squarrosa* and *paludosa.* Above the region of forests only two species were seen, viz. *T. aciphylla* and a var. of *T. vinealis.*

§ 1. ALOIDEÆ, Bryol. Europ.

215. *T. rigida,* Schultz. Recens. Gen. Barbulæ et Syntr. t. 32. fig. 1 (sub *Barbula*); M. P. 161; Br. Europ. *Barbula,* p. 13. t. 1. *T. enervis,* H. et Grev. in Brewst. Journ. v. P. 1. p. 288.

Hab. Z_1 in terra calcarea, frequens. *Les Eaux Chaudes*; *Gavarnie*; &c.

216. *T. ambigua,* B. et S. ! Br. Europ. *Barbula,* p. 14. t. 2; M. P. 162.

Hab. Z_0 P. occ. in aggeribus subhumidis *St. Sever.*

217. *T. aloides,* Koch in Brid. Br. Univ. i. p. 816 (sub *Trichostomo*); M. P. 163; Br. Europ. *Barbula,* p. 15. t. 2. *Tortula rigida,* Turn.; H. et T. ! Musc. Brit. p. 53. t. 12.

Hab. Z_{0-1} P. occ. et c. in aggeribus calcareis circa *B.-de-Bigorre,* &c.

§ 2. CHLORONOTÆ, Bryol. Europ.

218. *T. chloronotos,* Brid. Mant. Musc. p. 90, et Br. Univ. i. p. 539 (sub *Barbula*). *T. membranifolia,* Hook. Musci Exotici, t. 26; M. P. 164. *Barbula membranifolia* et *chloronotos,* Br. Europ.

Hab. Z_{0-1} P. occ. in declivibus calcareis prope *Bilhères,* ad viam quæ ducit a *Pau* ad Bayonnam. P. c. ad pagum *Pouzac* (Philippe !). P. or. *Trancade d'Ambouilla* (Arnott !). "In Pyrenæis orientalibus et monte Serrato Cataloniæ ubi in terra ochracea primi legimus;" Bridel, *l. c.*

I have never been able to perceive the differences between *T. chloronotos* and *membrunifolia* insisted on in 'Bryol. Europæa' (*Barbula,* p. 18), and specimens of the former communicated by M. Schimper from Avignon have the *inflorescence monoicous,* the stem branched and the *leaves membranous at the apex,* precisely as in *T. membranifolia.* In these specimens, as in Arnott's, Philippe's, and my own from Bilhères, besides there being axillary male flowers on the fertile plants, there are also *separate male plants* with terminal flowers; but I have seen no specimen of *T. chloronotos* with a truly dioicous inflorescence.

§ 3. Cuneifoliæ, Bryol. Europ.

219. *T. cuneifolia,* Dicks. Crypt. Fasc. 3. p. 7 (sub *Bryo*); M. P. 165; Br. Europ. *Barbula,* p. 31. t. 17.

Hab. Z_0 P. occ. in terra argillaceo-arenosa circa *St. Sever*: sociis *Funaria convexa* et *Muehlenbergii.*

220. *T. canescens,* Mont. Archives de Bot. i. p. 133; M. P. 166; Br. Europ. ! *Barbula,* p. 34. t. 19.

Hab. Z_{0-1} P. occ. *Landes de Mugriet,* in solo arenoso. P. c. in rupibus schistosis prope *B.-de-Bigorre* et *Loucrup.* P. or. apud Illiberim in agro Ruscinonensi (Montagne).

221. *T. marginata,* B. et S. Br. Europ. *Barbula,* p. 33. t. 19.

Hab. Z_1 P. or. prope *Corbières,* loco *hermitage de St. Antoine de Galamus* (Montagne, *l. c.* sub nom. *T. cæspitosa,* H. et G.). P. occ. in muris prope *Cauterets.*

222. *T. muralis,* L. Sp. Pl. p. 1581 (sub *Bryo*); M. P. 167; Br. Europ. *l. c.* p. 35. t. 20.

Hab. Z_{0-3} in muris saxisque.

§ 4. Rurales, Bryol. Europ.

223. *T. ruralis,* L. Sp. Pl. p. 1581 (sub *Bryo*); Br. Europ. *l. c.* p. 42. t. 27.

"Var. 1, foliis patulis nec squarroso-recurvis;" M. P. 168. *Barbula ruralis β. rupestris,* Br. Europ. *Syntrichia intermedia,* Brid. ! Br. Univ. i. p. 586.

Hab. Z_{0-1} in calce arenato murorum prope *Pau.*

This form, which, as the authors of 'Br. Europ.' remark, is found only on a calcareous matrix, is sometimes scarcely larger than *T. muralis,* and its habit is very different from that of the larger, ordinary form of *T. ruralis*; yet it seems impossible to separate it specifically. I have the same form from Dr. Grateloup, gathered near

Bordeaux, and from Dr. Arnott gathered at Avignon, Vaucluse and Restinclières. It matures its fruit in the very early spring.

"Var. 2, foliis acutioribus nonnunquam acuminatis;" M. P. 169.—*Hab.* Z_{1-3} locis editioribus secus rivulos, saxatilis. *V. de Combascou*; *Gavarnie*; &c.

224. *T. aciphylla,* B. et S.! Br. Europ. *Barbula,* p. 42. t. 26; M. P. 170.

Hab. Z_{3-4} P. occ. et c. locis saxosis secus ovilia ad basin montis *Maladetta*; in valle *Combascou,* &c. *Vallon d'Arise* (Philippe!).

In the Pyrenees, as in the Alps, this occupies the highest region of pasturage, and is never found away from the summer habitations of men and cattle.

225. *T. lævipila,* Brid. Mant. Musc. p. 98 (sub *Syntrichia*); Br. Europ. *l. c.* t. 25.

Hab. Z_{0-1} ad arborum truncos.

226. *T. papillosa,* Wils.! mst.; Spruce in Lond. Journ. of Bot. iv. 193; M. P. 171.

Hab. Z_1 P. occ. in arboribus nemoris *Parc de Pau* dicti.

227. *T. latifolia,* Bruch!; Bryol. Europ. *l. c.* p. 41. t. 24; M. P. 172.

Hab. Z_1 P. occ. locis humidis circa *Jurançon,* ad arborum radices.

§ 5. Subulatæ, Bryol. Europ.

228. *T. mucronifolia,* Brid. Mant. Musc. p. 97 (sub *Syntrichia*); Br. Europ.! *l. c.* p. 38. t. 23.

Hab. "in Pyrenæis orientalibus" (Bridel, *l. c.*); *Mont Louis* (Arnott!).

229. *T. subulata,* L. Sp. Pl. p. 1581 (sub *Bryo*); M. P. 173; Br. Europ. *l. c.* p. 36. t. 21, 22.

Hab. Z_{0-4} ad terram, passim.

Var. *β. inermis,* Brid. Br. Univ. i. p. 581. *T. inermis,* Mont. Arch. de Bot. i. p. 136. t. 4.—*Hab.* "ad *Notre Dame de Peña* in agro Ruscinonensi;" (Montagne, *l. c.*)

This is quite possibly a distinct species, as Dr. Montagne still maintains, but as I have seen only barren specimens of it, gathered by Dr. Arnott at Vaucluse, I confess myself unable to form a decided opinion.

§ 6. Convolutæ, Bryol. Europ.

230. *T. convoluta,* Hedw. Musc. Frond. i. t. 32 (sub *Barbula*); M. P. 174; Br. Europ. *l. c.* p. 29. t. 16.

Hab. Z_{0-1} in terra et muris, haud vulgaris.

"Var. *fragilifolia,* foliis multo longioribus, linearibus, patulo-recurvis, alis undulatis, perichætii laxioris acuminatis;" M. P. 175. —*Hab.* P. occ. in muris pagorum *Jurançon* et *Bilhères.*

§ 7. Revolutæ, Bryol. Europ.

231. *T. revoluta,* Brid. in Schrad. Journ. Bot. 1800; Br. Europ. *l. c.* p. 27. t. 14; M. P. 176.

Hab. Z_{0-1} cum n. 230, multo autem copiosior.

§ 8. Tortuosæ, Bryol. Europ.

232. *T. tortuosa,* L. Sp. Pl. p. 1583 (sub *Bryo*); Br. Europ. *l. c.* p. 26. t. 13; M. P. 177.

Hab. Z_{1-3} in muris saxisque calcareis, copiosissima et pulcherrime fructifera; rarius ad arbores vetustas.

The cellules of the leaf are minutely papillose, and when viewed from above each marginal cellule usually shows two *salient* papillæ: it is this which gives the edge of the leaf the appearance of being granulated. Is it caused by the pressure of the grains of chlorophyll on the delicate walls of the cellules?

233. *T. inclinata,* Schwgr. Suppl. t. 33 (sub *Barbula*); Br. Europ. *l. c.* p. 25. t. 12; M. P. 178.

Hab. Z_1 P. occ. et c. in muris rupibusque calcareis, haud infrequens. *Les Eaux Chaudes. Rontignon. B.-de-Bigorre,* &c.

234. *T. squarrosa,* De Not. Specim. de Tort. Ital. n. 31; Spruce in Lond. Journ. of Bot. iv. p. 193; M. P. 179; Br. Europ. fasc. 31. p. 1. t. 1.

Hab. Z_1 in collibus calcareis prope *Jurançon* et *B.-de-Bigorre. Pic St. Loup* prope *Montpellier* (Arnott!).

235. *T. cæspitosa,* Schwgr. Suppl. t. 31 (sub *Barbula*); M. P. 180; Sullivant! Musci Allegh. n. 150. *Barbula cirrhata,* Bryol. Europ.! *Barbula,* p. 24. t. 11.

Hab. Z_2 P. occ. supra ligna putrida in faucibus inter pagum *Penticosa,* et balneas ejusdem nominis, in Aragonia: rarissima.

§ 9. Unguiculatæ, Bryol. Europ.

236. *T. unguiculata,* Hedw. Musc. Frond. i. t. 23 (sub *Barbula*); M. P. 181; Br. Europ. *Barbula,* p. 19. t. 5.

Hab. Z_{0-1} in muris, &c., frequens; in rupibus ophiticis loco *Gorge de Labassère.*

237. *T. paludosa,* Schwgr. Suppl. t. 30 (sub *Barbula*); M. P. 182; Br. Europ.! *l. c.* p. 21. t. 7.

Hab. Z_{1-2} in rupibus udis calcareis regionis fagorum, sat frequens. *Gorge de Hourat* prope *les Eaux Chaudes*; *Mt. Lhieris,* &c. Nusquam in *paludibus* vidi!

238. *T. gracilis,* Schwgr. Suppl. t. 34 (sub *Barbula*); Br. Europ. *l. c.* p. 22. t. 8.

Hab. in Pyrenæis orientalibus (Bridel, Br. Univ. 1. p. 537).

239. *T. fallax,* Hedw. Musc. Frond. i. t. 24 (sub *Barbula*); M. P. 183; Br. Europ. *l. c.* p. 23. t. 9.

Hab. Z_{0-2} in rupestribus subhumidis.

240. *T. vinealis,* Brid. Br. Univ. i. p. 830 (sub *Barbula*); Br. Europ. *l. c.* p. 24. t. 10.

Var. *β. flaccida,* Br. Europ.; M. P. 184.—*Hab.* Z_1 P. c. ad ripas rivuli qui ad monasterium *Médous* prope *B.-de-Bigorre* originem suam habet.

Var. *nivalis,* M. P. 185.—*Hab.* Z_4 in rupibus frigidis ab aqua nivali irrigatis vallis alpinæ *Esquierry* dictæ.

This second variety forms large compact tufts on the ledges of dripping rocks, growing near *Senecio Tournefortii, Euphrasia minima* and *Luzula spadicea.* The stems attain a length of 6 or 8 inches, and are clad throughout with leaves of a deep reddish brown. Hence its aspect is very different from that of the ordinary form of *T. vinealis,* but without the fruit I do not venture to separate it.

41. *Didymodon,* Schwgr. (*ex parte*).

241. *D. rubellus,* Hoffm. Deut. Fl. ii. p. 33 (sub *Bryo*); Br. Europ. *Didymodon,* p. 3. t. 1; M. P. 186. *Weisia curvirostra,* H. et T.! Musc. Brit. p. 84. t. 14.

Hab. Z_{0-2} in muris, rupibus, &c.

242. *D. cylindricus,* Bruch in Brid. Br. Univ. i. p. 806 (sub *Weisia*); Br. Europ. *l. c.* p. 5. t. 3; M. P. 187.

Hab. Z_2 P. occ. in saxis rivulorum supra thermas dict. *les Eaux Bonnes*; P. c. in vicinia *B.-de-Luchon,* frequens, locis *Superbagnères, Lac de Séculéjo, Cascade du Cœur,* &c.

42. *Trichostomum,* Hedwig.

Obs. T. flexicaule is the only species of this genus which seems absolutely confined to calcareous rock: *T. mutabile, crispulum* and *tophaceum* were observed on no other rock in the Pyrenees, but in England I have occasionally seen them in habitats where no trace of carbonate of lime was to be detected. The last five species form part of the genus *Leptotrichum* of Hampe, and are placed by C. Mueller in his tribe *Leptotrichaceæ* (Conf. Syn. Musc. p. 415).

§ 1. Crispula.

243. *T. mutabile,* Bruch mst.; Br. Europ. *Trichostomum,* p. 8. t. 5; M. P. 188.

Hab. Z_1 locis calcareis. P. occ. ad pagum *Narcastet.* P. c. in rupibus umbrosis prope *B.-de-Bigorre* (*Chemin de Labassère* et *Bains de Salut*). An revera a sequente distincta species?

244. *T. crispulum,* Bruch et Muell. in Regensb. Bot. Zeitung, 1829; Br. Europ. *l. c.* t. 4; M. P. 189. *Didymodon Benthamii,* Arnott! in Edinb. New Philosoph. Journ. 1846.

Hab. Z_1 in rupibus calcareis irroratis Pyren. occidentalium, frequens. *Pau*; *Narcastet,* &c. *Restinclières* prope *Montpellier* (Arnott!).

"Var. foliis acumine subrecto;" M. P. 190. (Medium inter vars. β. et γ. Br. Europ.)—*Hab. Vallée d'Ossau* prope pagos *Louvie* et *Jurançon.*

§ 2. Rigidula.

245. *T. tophaceum,* Brid. Mant. Musc. p. 84; Br. Europ. *l. c.* p. 9. t. 6; M. P. 191.

Hab. Z_1 P. c. ad mortarium in muris subhumidis pagi *Loucrup,* non longe a *B.-de-Bigorre.* P. or. "ad *St. Antoine de Galamus* cum *Tortula marginata,* nec non prope turrim nomine *La Massane* insignitam" (Montagne, *l. c.*).

246. *T. luridum,* Hsch. (sub *Cynodonte*); M. P. 192. *Didymodon luridus,* Br. Europ. *Didym.* p. 4. t. 2.

Hab. Z_1 P. occ. in calcareis subhumidis prope *Pau*: socio *Tortula chloronoto.* Prope Burdigalam (Grateloup!).

247. *T. rigidulum,* Hedw. Musc. Frond. iii. t. 4 (sub *Didymodonte*); Br. Europ. *Trichostomum,* p. 10. t. 7; M. P. 193.

Hab. Z_{1-2} in muris rupibusque tum siccis tum humidis, frequens. *Vallées de Castelloubon et d'Ossau*; *Luz*; *Mt. Lhieris,* &c.

§ 3. Glaucescentia.

248. *T. glaucescens,* Hedw. Musc. Frond. iii. t. 37; Br. Europ.! *l. c.* p. 18. t. 15; M. P. 194.

Hab. Z_{2-4} in rupium fissuris. P. occ. in vallibus *Combascou* et *Jéret.* P. c. *Lac de Séculéjo*; *Lac Lehou* (Philippe!). P. or. *Mt. Louis* et *V. d'Eynes* (Arnott!).

§ 4. Subulata (= Leptotrichum, Hampe).

249. *T. tortile,* Schrad. Crypt. Gewäsche, n. 49; Br. Europ.! *l. c.* p. 14. t. 10; M. P. 195.

Hab. Z_{0-2} in sylvaticis Pyrenæorum totorum ut et Agri Syrtici: terrestre. *V. du Lys*; *St. Pandelon de Dax,* &c.

250. *T. homomallum,* Hedw. Sp. Musc. t. 23 (sub *Didymodonte*); Br. Europ. *l. c.* p. 16. t. 2; M. P. 196.

Hab. Z_{0-2} in umbrosis humidis ad terram.

251. *T. flexicaule,* Schwgr. Suppl. t. 29 (sub *Cynodontio*); Br. Europ.! *l. c.* p. 15. t. 11; M. P. 197.

Hab. Z_1 locis calcareis, semper absque fructu.

252. *T. pallidum,* Hedw. Musc. Frond. 1. p. 71. t. 27; Br. Europ. *l. c.* p. 18. t. 14.

Hab. Z_{0-1} in arenosis umbrosis. P. occ. circa *Dax* (Thore, Grateloup). P. c. *B.-de-Bigorre*! (Philippe!). P. or. *Concampa* (Arnott!).

253. *T. subulatum,* Bruch! in Salzman Pl. Tingit.; Br. Europ. *l. c.* p. 17. t. 13; M. P. 198. *Didymodon aureus,* De Not. Syll. Musc. p. 190.

Hab. Z_0 P. occ. ad aggeres arenosos umbrosos circa *St. Sever,* copiose et pulcherrime!

43. *Distichium,* Bryol. Europ.

254. *D. capillaceum,* Hedw. Musc. Frond. ii. t. 26 (sub *Swartzia*); Br. Europ. *Distichium,* p. 4. t. 1; M. P. 199.
Hab. Z_{1-4} in rupibus udis præsertim calcareis, frequens.

255. *D. inclinatum,* Hedw. Musc. Frond. 2. t. 27 (sub *Swartzia*); Br. Europ. *l. c.* p. 5. t. 2; M. P. 200.
Hab. Z_{3-4} P. c. in rupibus micaceis juxta lacum alpinum dict. *Lac Lehou*; nec non in valle alpina *Esquierry*: rarissimum.

Tribus 20. Bruchiaceæ, C. Muell.

44. *Astomum,* Hampe.

256. *A. nitidum,* Hedw. Musc. Frond. i. t. 34 (sub *Phasco*); Br. Europ. *Phascum,* p. 12. t. 6; M. P. 322.
Hab. Z_{0-1} P. c. in argillosis humidis secus viarum latera in valle *Trébons,* rarissime! P. occ. circa *Dax* (Grateloup in Fl. Française).

257. *A. alternifolium,* Brid. Mant. Musc. p. 10 (sub *Pleuridio*). *Phascum altern.,* Br. Europ.! *l. c.* p. 15. t. 7 (non Dicks., nec Schwgr.).
"Var. 1, antheridiis in floribus cauligenis gemmiformibus; etiam paraphysibus absque antheridiis (rarissime antheridiis nonnullis abortivis adjectis) in axillis foliorum superiorum dispositis;" M. P. 323.—*Hab.* Z_1 in arenosis humidis circa *Jurançon.*
"Var. 2, antheridiis absque paraphysibus in floribus gemmiformibus, et insuper antheridiis paraphysatis numerosis (nonnunquam *quinis*) in foliorum superiorum axillis;" M. P. 324.—*Hab.* Z_{0-1} in arenosis circa *St. Sever, Pau* et *B.-de-Bigorre.*—"Florescentia valde variabilis; species distincta tamen a *Ph. subulato* foliis perichætialibus videtur. Confer Br. Europ.;" M. P. *l. c.*

The inflorescence of *Phascum alternifolium* and of several other mosses (*e. g.* certain *Brya*) is by no means so constant to the type assigned in 'Bryologia Europæa' as the authors of that work would lead one to suppose; and fully prepared as I am to acknowledge the importance of the characters derived from the inflorescence, it appears to me that science will lose rather than gain if we shut our eyes to the aberrations which it undeniably presents. To assume a greater degree of invariableness in the inflorescence than exists in any other part of the plant, is as illogical as in practice it is found to be inaccurate.

Tribus 21. Seligeriaceæ.

(*Seligeriaceæ* et *Campylosteliaceæ,* Bryol. Europ.)

45. *Campylostelium,* Bryol. Europ.

258. *C. saxicola,* W. et M. Bot. T. p. 167 (sub *Dicrano*); Br. Europ. *Campylost.* p. 3. t. 1.

Hab. Z_2 P. c. locis umbrosis in saxis arenaceis. *Labassère. V. de Castelloubon.*

46. *Brachyodus,* Fürnrohr.

259. *B. trichodes,* Mohr, Crypt. Gew. p. 85 (sub *Gymnostomo*); Br. Europ. *Brachyodus* (cum icone). *Weisia trichodes,* H. et T.! Musc. Brit. p. 82. t. 15; M. P. 228.

Hab. Z_1 P. c. in rupibus argillaceo-schistosis prope thermas dict. *de Salut, B.-de-Bigorre,* rarissime.

47. *Seligeria,* Bryol. Europ. (ex parte).

260. *S. Doniana,* Smith, E. Bot. t. 1582 (sub *Gymnostomo*); C. Muell. Syn. Musc. p. 420. *Anodus Donianus,* Br. Europ. (cum icone).

Hab. Z_1 P. c. in rupibus calcareis occultis prope *B.-de-Bigorre* (Philippe!).

261. *S. pusilla,* Hedw. Musc. Frond. ii. t. 29 (sub *Weisia*); Br. Europ. *Seligeria,* p. 4. t. 1; M. P. 227.

Hab. Z_{1-3} P. occ. in rupibus calcareis udis ad *Narcastet* prope *Pau.* P. c. in rupibus schistosis vallis *Castelloubon* et in ascensu ad *Port de Bénasque.*

262. *S. recurvata,* Hedw. Musc. Frond. i. t. 38 (sub *Grimmia*); Br. Europ. *Seligeria,* p. 6. t. 3; M. P. 229.

Hab. Z_1 P. c. in rupibus graniticis et arenaceis, locis *Gavarnie, V. de Castelloubon* et *Lesponne, Labassère* et *Superbagnerès.*

Tribus 22. Dicranaceæ, Bryol. Europ. (ex parte).

48. *Ceratodon,* Bridel.

263. *C. purpureus,* Linn. (sub *Mnio*); Br. Europ. *Ceratodon,* p. 5. t. 1, 2. *Dicranum purpureum,* Hedw. Sp. Musc. p. 136. t. 36.

Hab. Z_{0-4} ad terram, in habitationum vicinia præcipue, socio *Funaria hygrometrica.*

264. *C. cylindricus,* Hedw. Sp. Musc. t. 24 (sub *Trichostomo*); Br. Europ. *l. c.* p. 6. t. 3; M. P. 201. *Angstrœmia cylindrica,* C. Muell. Syn. Musc. p. 441.

Hab. Z_1 P. c. in rupibus arenaceis fragilibus montis *Superbagnères*: nusquam alias observatus.

49. *Cynodontium,* Bryol. Europ.

265. *C. Bruntoni,* Smith, E. Bot. t. 2509 (sub *Dicrano*); Br. Europ. *Cynodontium* (cum ic.); M. P. 210. *Didymodon obscurus,* Kaulf.; Grev.! Scot. Cr. Fl. t. 193.

Hab. Z_1 in sylvis, rupestre. P. occ. *Bagès* prope *les Eaux Bonnes.* P. c. *V. du Lys*; *Bois de Gouerdère*; *V. de Lesponne* (Philippe!). P. or. in radice montis *Canigou* (Montagne!).

50. *Dicranum,* Hedwig.

§ 1. Polycarpa, Br. Europ.

266. *D. polycarpum,* Hedw. Musc. Frond. ii. p. 85. t. 31 (sub *Fissidente*); M. P. 209.

Hab. $Z_{1\,sup.-2}$ in virgultis, rupestre.

Var. *β. strumiferum,* Br. Europ. *Fissidens strumifer,* Hedw. —*Hab.* in rupibus umbrosis convallium *Jéret* et *Castelloubon.*

§ 2. Virentia, Br. Europ.

267. *D. virens,* Hedw. Musc. Frond. iii. p. 77. t. 32.

Hab. Z_{2-3} P. c. in sylvis humidis vallis *Lesponne* (Dufour! Philippe!). P. or. *V. d'Eynes* (Arnott!).

§ 3. Squarrosa, Br. Europ.

268. *D. flavescens,* Dicks. Crypt. fasc. 2. p. 4 (sub *Bryo*). *Dicranum flav.,* Smith! Fl. Brit. p. 1224 et E. Bot. t. 2263; M. P. 213. *D. pellucidum* var. *γ. serratum,* Br. Europ.

Hab. $Z_{1\,sup.}$ P. occ. in arena torrentis ad latus boreale montis *Goursi* prope *les Eaux Bonnes.* P. c. loco simili vallis *Lesponne.*

269. *D. pellucidum,* L. Sp. Pl. p. 1583 (sub *Bryo*); Schwgr. Suppl. t. 48; M. P. 214.

Hab. Z_{1-2} in rivulorum glareosis.

270. *D. squarrosum,* Schrad. Bot. Journ. v. p. 68; Br. Europ. *Dicranum,* p. 17. t. 5. *Angstrœmia squarr.,* C. Muell. Syn. Musc. p. 438.

Hab. Z_{1-2} in arena rivulorum: haud vulgare et semper absque fructu. *V. de Lesponne,* &c.

§ 4. Crispa, Br. Europ.

271. *D. Schreberi,* Hedw. Sp. Musc. p. 144. t. 33; Br. Europ. *l. c.* p. 18. t. 6. *Angstrœmia Schr.,* C. M. Syn. Musc. p. 438.

Hab. Z_{0-1} P. occ. in rupibus ophiticis humidiusculis *Sti. Pandelon* prope *Dax*: fertile sed rarissimum. P. c. ad terram in occultis prope *B.-de-Bigorre*: sterile.

§ 5. Rufescentia, Br. Europ.

272. *D. varium,* Hedw. Musc. Frond. ii. t. 34; M. P. 222. *Angstrœmia varia,* C. M. Syn. Musc. p. 435.

Hab. Z_{0-1} in terra nuda subhumida, haud vulgatum.

273. *D. rufescens,* Turn. Musc. Hibern. p. 66; Smith! Fl. Brit. p. 1210, et E. Bot. t. 1216; M. P. 223. *Angstrœmia ruf.,* C. M. Syn. Musc. p. 436.

Hab. Z_1 P. occ. et c. in argillaceo-arenosis circa *Pau* et *B.-de-Bigorre,* sat frequens.

§ 6. Heteromalla, Br. Europ.

274. *D. curvatum,* Hedw. Sp. Musc. t. 31; M. P. 221. *Angstrœmia curv.,* C. M. Syn. Musc. p. 433.

Hab. Z_{1-2} P. c. in declivibus graminosis umbrosis vallis *Lesponne* et monticuli *Olivet,* ut et in sylva dict. *Bois de Gouerdère*: socio *Trichost. homomallo.* P. occ. ad terram in valle *Jéret.*

275. *D. heteromallum,* L. Sp. Pl. p. 1583 (sub *Bryo*); Br. Europ. *Dicranum,* t. 15. *Angstrœmia heter.,* C. M. Syn. Musc. p. 432.

Hab. Z_{0-2} in solo arenaceo.

Var. cæspitibus elongatis compactis; capsulis nonnullis subrectis; M. P. 220.—*Hab.* in rupibus ophiticis et arenaceis P. c. locis *Labassère* et *Superbagnères.*

§ 7. Falcata, Br. Europ.

276. *D. Starkii,* W. et M. Bot. T. p. 189; Br. Europ. *Dicranum,* p. 27. t. 17. "*D. falcatum,*" M. P. 219.

Hab. Z_{3-4} in montibus editioribus, rupestre. P. c. *Mt. Maladetta; Mt. Crabioules; Esquierry; Lac d'Espingo; En montant au Lac Lehou* (Dufour!). P. or. loco non designato (Arnott!).

I gave this in 'Musci Pyrenaici' as *D. falcatum,* as being the older name and under the supposition that *D. Starkii* was not a distinct species; but I had then seen no *authentic D. falcatum.* The latter I am now convinced differs essentially in the smaller size, the *more rigid habit,* the *leaves more strongly* and uniformly *hooked,* with slenderer points, not flexuose when dry; the *shorter* and redder *capsules,* which are not subcylindrical but *obovate,* and are *not strongly sulcate when dry*; lastly in the redder teeth, which are also wider and less deeply cloven.

277. *D. falcatum,* Hedw. Sp. Musc. t. 32; Br. Europ. *l. c.* t. 18.

Hab. Z_{3-4} P. c. secus lacus *Lehou* ripas (Philippe!).

§ 8. Orthocarpa, Br. Europ.

278. *D. montanum,* Hedw. Sp. Musc. p. 145. t. 35. "*D. flagellare,* Hedw." M. P. 208.

Hab. Z_1 P. occ. et c. ad truncos vetustos in sylvis supra pagum *Jurançon* et circa *B.-de-Bigorre.*

279. *D. fulvum,* Hook. Musc. Exot. t. 149; Sullivant! Musci Allegh. n. 159; M. P. 207. *D. interruptum,* Brid. Musc. Rec.

2. P. 1. p. 159, fide Bryol. Europ. (non *D. interruptum*, Smith ! Fl. Brit. p. 1205).

Hab. $Z_{1\ sup.}$ P. c. ad saxa granitica in sylvis convallium *Burbe* et *du Lys* prope *B.-de-Luchon.*

280. *D. Sauteri*, B. et S. ! Br. Europ. *l. c.* p. 33. t. 24; M. P. 206.

Hab. Z_{2-3} P. occ. in abiegnis nigris vallis *Jéret*; P. c. in regione inferalpina montis *Crabioules*: saxa granitica obtegens.

281. *D. longifolium*, Hedw. Musc. Frond. iii. p. 24. t. 9; M. P. 205.

Hab. Z_2 P. c. ad saxa granitica in nemore nigro secus cataractam dict. *Cascade du Cœur*, etiam in monte *Superbagnères*. P. or. *Port Nègre* (Arnott !).

§ 9. Scoparia, Br. Europ.

282. *D. scoparium*, Linn. ! Sp. Pl. p. 1582 (sub *Bryo*). *Dicranum scop.*, Hedwig; Smith ! Fl. Brit. p. 1201; Br. Europ. *l. c.* t. 26; M. P. 217.

Hab. Z_{1-2} in sylvaticis, copiose.

283. *D. fuscescens*, Turn. ! Musc. Hibern. p. 60 (1804); Smith ! Fl. Brit. p. 1204 (1804), et E. Bot. t. 1597; M. P. 218. *D. congestum*, Brid. Sp. Musc. i. p. 176 (1806); Br. Europ. *l. c.* t. 29.

Hab. $Z_{1\ sup.-2}$ P. occ. ad rupes graniticas et argillaceo-schistosas in vicinia oppiduli *Cauterets*, locis *Pont d'Espagne* et *Gorge de Cauterets*.

§ 10. Spuria, Br. Europ.

284. *D. spurium*, Hedw. Musc. Frond. ii. t. 20; Smith ! Fl. Brit. p. 1222, et E. Bot. t. 2167; M. P. 215.

Hab. Z_{0-1} P. occ. in ericetis Agri Syrtici loco *Landes de Mugriet*, necnon in monte *Goursi*.

§ 11. Undulata, Br. Europ.

285. *D. undulatum*, Schrad.; Smith ! Fl. Brit. p. 203; Sullivant ! Musci Allegh. n. 156. *D. polysetum*, Sw. Musc. Suec. p. 34 et 87; Schwgr. Suppl. t. 41; M. P. 216.

Hab. Z_1 in campis sylvarum gramineis, semper absque fructu. P. occ. *Bois de Jurançon*, &c. P. c. *V. de Serris*.

286. *D. majus*, Smith ! Fl. Brit. iii. p. 1202, et E. Bot. t. 1490; Br. Europ. *l. c.* t. 37.

Hab. Z_2 P. c. in rupibus umbrosis subhumidis vallis *Lesponne*: nullo alio loco in Pyrenæis mihi notum !

§ 12. (= Arctoa, Br. Europ.)

287. *D. fulvellum*, Dicks. Crypt. fasc. 4. t. 11. f. 1 (sub *Bryo*). *Dicranum fulvellum*, Smith; H. et T. ! Musc. Brit. p. 103. t.

Suppl. 3; M. P. 224. *Arctoa fulvella,* Br. Europ. *Arctoa,* p. 4. t. 1; et *A. hyperborea,* Br. Europ. ! *l. c.* p. 5. t. 2.

Hab. Z_4 P. c. in rupibus subhumidis. *Esquierry. Crabioules. Lac Lehou.*

The Pyrenean specimens have the leaves of *Arctoa fulvella* (Br. Europ.), and the striated capsules of *A. hyperborea.* All the British specimens that I have seen under the name of *Dicranum fulvellum* have the *capsule striated,* while the leaves exhibit all intermediate forms between those attributed to *A. fulvella* and to *A. hyperborea*; hence I do not hesitate to consider these two mosses mere forms of one and the same species.

51. *Blindia,* Bryol. Europ.

288. *B. acuta,* Hedw. Musc. Frond. iii. t. 35 (sub *Weisia*); Br. Europ. *Blindia* (cum ic.); M. P. 225.

Hab. Z_2 P. occ. et c. in rupibus humidis vallis *Jéret,* necnon ad rupes cataractæ *Cascade du Cœur* humectatas: rarior.

52. *Campylopus,* Bridel.

289. *C. longirostris,* W. et M. Bot. Tasch. p. 155 (sub *Didymodonte*); M. P. 202. *Cynodontium longir.*, Schwgr. Suppl. t. 29. *Dicranodontium longir.*, Br. Europ. fasc. 41 (cum icone). *Dicranum denudatum,* Brid.; C. M. Syn. Musc. p. 403.

Hab. Z_{1-2} P. occ. et c. supra ligna putrida, rarius ad rupes. *Vallées de Lutour* et *du Lys,* &c.

290. *C. fragilis,* Br. Europ. ? fasc. 41. p. 4. t. 2. *Dicranum Funkii,* C. M. Syn. Musc. p. 392.

Hab. Z_2 P. occ. in sylvis subhumidis circa *les Eaux Bonnes*: sterilis.

291. *C. atrovirens,* De Not. Syllab. Musc. p. 221; Br. Europ. fasc. 41. p. 5. t. 4. *Dicranum atr.*, C. M. Syn. Musc. p. 413.

Hab. Z_2 in sylvarum rupibus humidis, sterilis. P. occ. *Mt. Goursi.* P. c. *V. de Castelloubon.*

292. *C. longipilus,* Brid. Bryol. Univ. 1. p. 477; Br. Europ. fasc. 41. p. 6. t. 5; M. P. 203. *Dicranum longip.*, C. M. Syn. Musc. p. 411.

Hab. Z_1 P. occ. in saxis graniticis prope oppidulum *Laruns.*

†*C. elongatus,* Bridel: "caule indiviso elongato radiculoso-tomentoso apice fastigiato-ramoso, ramulis penicillatis, foliis caulinis inferioribus dissitis superioribus dense imbricatis omnibus appressis lineari-lanceolatis nervo latissimo obsoleto."

"*Hab.* circa *Dax* Aquitaniæ ubi D. Grateloup legit. Herb. Cand." Br. Univ. 1.

I suspect there is some mistake about the station attributed to this moss, which has a habit quite different from that of any European

Campylopus. May it not have been inadvertently transposed from Dr. Grateloup's exotic Cryptogamia (from the Mauritius, Guadaloupe, &c.) to his collection of native French species?

Tribus 23. Weisiaceæ.

(*Weisiaceæ* et *Anœctangiaceæ*, Bryol. Europ.)

53. *Eucladium*, Bryol. Europ.

293. *E. verticillatum,* L. Sp. Pl. p. 1585 (sub *Bryo*); Br. Europ. *Eucladium* (cum ic.); M. P. 226.

Hab. Z_1 in declivibus calcareis subhumidis.

54. *Rhabdoweisia,* Bryol. Europ.

294. *Rh. fugax,* Hedw. Sp. Musc. t. 13 (sub *Weisia*); Br. Europ. *Rhabdow.* p. 4. t. 1. *Dicranum striatum,* M. P. 211.

Hab. Z_{1-2} P. occ. et c. ad rupes schistosas umbrosas, haud infrequens. In rupium madidarum fissuris faucium *Gorge de Cauterets* dict., pulcherrime!

295. *Rh. denticulata,* Brid. Suppl. Musc. i. p. 108 (sub *Weisia*); Br. Europ. *l. c.* p. 5. t. 2. *Dicranum denticulatum,* M. P. 212.

Hab. Z_{1-2} in rupium fissuris P. c. circa *B.-de-Luchon,* locis *V. du Lys, Bois de Gouerdère* et *Lac de Séculéjo.*

55. *Weisia,* Hedwig.

296. *W. cirrhata,* Hedw. Sp. Musc. p. 69. t. 12; Br. Europ. *Weisia,* p. 9. t. 6; M. P. 230.

Hab. Z_0 P. occ. in *Pini Piceæ* trunco in Agro Syrtico loco *Landes de Mugriet. Les Terres des Landes* (Grateloup).

297. *W. crispula,* Hedw. Sp. Musc. p. 68. t. 12; Br. Europ. *Weisia,* p. 9. t. 7; M. P. 231.

Hab. Z_{2-5} per Pyrenæos in saxis graniticis et schistosis, e subalpinis usque ad nives æternas.

Var. *β. atrata,* Br. Europ. *l. c.* (= *β. nigrescens* et *γ. atrata,* Br. Germ. p. 67. t. 30); M. P. 232.—*Hab.* in rupium subhumidarum fissuris loco *Port de Bénasque.*

This moss is equally alpine and arctic, and there is scarcely any other which flourishes and fructifies in such high latitudes and altitudes. It was gathered abundantly in Captain Parry's northern voyages, and Wahlenberg remarks of it, "in alpibus omnibus altius ascendit prope nivem perennem, quam quis alius muscus (excepto forsan *Polytricho juniperino*)."

298. *W. viridula,* L. Sp. Pl. p. 1584 (sub *Bryo*); Brid. Br. Univ. 1. p. 334; Br. Europ. *Weisia,* p. 5. t. 2, 3. *W. controversa,* Hedw. Musc. Frond. iii. t. 5; M. P. 233.

Hab. Z_{0-2} in terra ubique.

" Var. foliis *nervo crasso* instructis ; capsula inclinata, ovali et ovali-cylindrica, *stomate subobliquo* rubello ; peristomii *dentibus brevibus,* irregularibus, *albidis* ; floribus masculis gemmiformibus in ramis propriis terminalibus : *rarissime antheridiis* 1–2 *in perichætio fœmineo* ;" M. P. 235.—*Hab.* in muris prope *Pau,* socio *Hymenost. tortili.*

This seems to be the var. δ. *amblyodon* of the 'Br. Europ.'; *W. amblyodon,* Brid. Br. Univ. i. p. 805 ; *W. amblyodon, gymnostomoides* and *microdonta,* Br. Germ. t. 25 et 37. In the rigid habit and in the form of the leaves it precisely resembles *Hymenost. tortile,* along with which it grew.

299. *W. Wimmeriana,* Sendtner in Denkschr. d. Regensburg. (sub *Gymnostomo*) ; Br. Europ. *Weisia,* p. 4. t. 1. " *W. controversa* var. 2, antheridiis 2–3nis in axillis fol. superiorum dispositis ;" M. P. 234 ; et *Hymenostomum murale,* M. P. 236 (*forma hymenostomoidea*).

Hab. Z_1 P. occ. in arenosis circa *Pau* et *Oloron* ; No. 236. M. P. in muris prope *Ste. Marie d'Oloron.*

The moss published in 'Musci Pyrenaici' as *Hymenostomum murale* (n. sp.) I have ascertained to be a form of *Weisia Wimmeriana.* Not one of the capsules I at first examined showed the least trace of peristome, but by renewed search I have at length found a capsule in which there are a few pale rudimentary teeth, scarcely rising above the annulus. As some excuse for this, it may be mentioned that *Weisia Wimmeriana* was originally referred to *Gymnostomum* by both Sendtner and Schimper.

56. *Hymenostomum,* R. Brown.

300. *H. microstomum,* Hedw. Musc. Frond. p. 71. t. 30 (sub *Gymnostomo*) ; Br. Europ. *Hymenost.* p. 4. t. 1.

Hab. Z_1 ad terram, rarissime ! *B.-de-Bigorre. Pyrénées Orientales* (Montagne !).

301. *H. tortile,* Schwgr. Suppl. t. 10 (sub *Gymnostomo*) ; M. P. 237.

Hab. $Z_{1\ \mathrm{inf.}}$ P. occ. in muris prope *Pau.* P. c. in rupibus calcareis juxta thermas dict. *de Salut, B.-de-Bigorre.* Circa *Montpellier* et *Vaucluse* (Arnott !).

57. *Gymnostomum,* Hedwig.

302. *G. calcareum,* H. et N. Bryol. Germ. p. 183. t. 10 ; Br. Europ. *Gymnostomum,* p. 6. t. 3, 4 ; M. P. 239.

Hab. Z_1 in calce arenato murorum ad pedem Pyr. occidentalium.—Var. β. *tenellum,* Br. Europ. *l. c.* ; *Pau, Jurançon,* &c.—Vars. γ. *viridulum* (= *G. viridulum,* Brid.) et δ. *gracillimum* (= *G. gracillimum,* Br. Germ.) ; *Rontignon* et *Pau.*

This species varies exceedingly in the length of the leaves and in the form of their apices. A small variety on walls at Pau has the leaves shortly ligulate, mostly widest above the middle, and often quite rounded at the summit. In the village of Rontignon, which is seven or eight miles higher up the banks of the Gave de Pau, the varieties γ. and δ. grow intermixed, both having the leaves for the most part subacute. All the forms observed in the Pyrenees have far wider and shorter leaves than specimens I have received from the Alps, and I never once met with the form considered by Bruch and Schimper as the type of the species. [Confer 'Bryol. Europæa,' monogr. *Gymnost.* p. 7; where however it is said by mistake that my specimens were gathered "in schisto micaceo;" but it is nevertheless true that the mortar used in the neighbourhood of Pau, being made of lime mixed with the sand of the Gave de Pau, contains particles of mica, granite, &c. brought down from the mountains by this stream and its tributaries.]

303. *G. rupestre,* Schwgr. Suppl. t. 10; H. et T.! Musc. Brit. ed. 2. p. 19. t. Suppl. 2; M. P. 238.

Hab. Z_{1-2} in rupibus humidis tam calcareis tam argillaceo-schistosis, frequens. *Pierrefitte*; *Penticosa*; *Gavarnie,* &c. *V. d'Eynes* (Arnott!).

304. *G. curvirostrum,* Hedw. Musc. Frond. ii. t. 24; Br. Europ. *l. c.* p. 8. t. 7, 8; M. P. 240.

Hab. Z_{2-3} in rupibus humidis præcipue argillaceo-schistosis. P. occ. circa thermas *les Eaux Bonnes* et *les Eaux Chaudes* dictas. P. c. circa *B. de Luchon,* locis *Esquierry* et *Lac de Séculéjo**.

* In the Supplement to the 1st volume of Bridel's 'Bryologia Universa' the two following gymnostomous mosses are described, and said to grow near Dax:—

"*Gymnostomum homomallum,* Brid.; caule erecto simplicissimo, foliis lanceolatis acutis integerrimis supremis e nervo crasso excurrente longissime subulatis secundis, thecæ oblongæ operculo conico-rostrato incurviusculo.

"Circa *Dax* ad terram cæspitosam legit D. Grateloup; clar. Candolleus communicavit.

"A *Didymodonte homomallo,* quem habitu proxime refert dignoscitur statura duplo minore, caule simplicissimo, foliorum supremorum longitudine et areolatione, præprimis stomate nudo."—Br. Univ. i. p. 757.

May not this be *Trichostomum subulatum,* Bruch, with which it agrees well enough except as to the peristome, which may have been overlooked?

"Entosthymenium, Brid.

"*Caracter essentialis.* Stoma externe nudum; interne membrana angusta annulari margine tandem lacinulata instructum. Calyptra cuculliformis. Theca subinæqualis, apophysata.

"*E. tristichum,* Brid.; caule erecto ramosiusculo, foliis patentibus siccitate incurvis subtristichis ovato-lanceolatis acutiusculis solidinerviis, thecæ ovatæ subinclinatæ apophysi basilari parva.

"In Gallia australi circa *Dax* D. Grateloup detexit; Candolleus communicavit. Cæspitibus fastigiatis vivit.

"*Barbulam* e toto habitu, foliorumque forma et areolatione diceres, at

58. *Anœctangium,* Schwaegr.

305. *A. compactum,* Schwgr. Suppl. t. 11; Br. Europ. *Anœctangium,* p. 5. t. 1; M. P. 241.

Hab. Z_2 P. c. ad rupes irroratas circa *Bagnères-de-Luchon,* locis *Lac de Séculéjo, Cascade du Cœur* et *Superbagnères*: plerumque fertile.

Tribus 24. ZYGODONTEÆ, Bryol. Europ.

59. *Zygodon,* Hooker et Taylor.

306. *Z. Mougeotii,* B. et S.! Br. Europ. fasc. iv. p. 7. t. 1; M. P. 242.

Hab. Z_{1-2} per Pyrenæos sylvaticos, rupestris, frequens sed rarissime fructificans; juxta lacum *Séculéjo* capsulis deoperculatis, 22 Sept. 1845, legi.

307. *Z. viridissimus,* Smith, Fl. Brit. p. 1224 (sub *Dicrano*); Br. Europ. *l. c.* p. 7. t. 1; M. P. 243.

Hab. Z_1 ad arbores circa *Pau* et *Bagnères,* plerumque sterilis.

308. *Z. conoideus,* Schwgr. Suppl. 2. p. 138. t. 137; Br. Europ. *l. c.* p. 8. t. 2.

Hab. Z_1 P. c. in truncis populi vetustis juxta pagum *Pouzac*! (Philippe!). *Estafforte, Hte. Garonne* (Brondeau in hb. Dufour).

In these specimens the leaves are often nerved throughout, and the nerve even excurrent into a short mucro. The sporular sac rises *above the mouth of the capsule* before it is divided into cilia, which are two cellules in breadth near the base, *sometimes sixteen in number,* the intercalary cilia being far shorter than the others.

Tribus 25. PTYCHOMITRIEÆ.

60. *Ptychomitrium,* Bryol. Europ.

309. *P. polyphyllum,* Dicks. Crypt. fasc. 3. p. 7 (sub *Bryo*); Br. Europ. *Ptychom.* p. 4. t. 1; M. P. 244.

Hab. Z_{1-3} in saxis graniticis regionum sylvaticarum: e vulgatissimis.

310. *P. incurvum,* Muehl. Cat. Plant. Amer. Sept. p. 98 (sub *Grimmia*). *Weisia incurva,* Schwgr. Suppl. 2. p. 51. t. 116. *Grimmia Muehlenbergii,* Brid. Br. Univ. i. p. 181. *Ptychomitrium pusillum,* B. et S.! Br. Europ. *Ptychom.* p. 5. t. 1; Sullivant! Musci Allegh. n. 135.

Hab. Z_1 P. occ. in muro prope *Oloron.* Cæspitem unicum inveni.

membrana annularis et apophysis proprium genus declarant."—Br. Univ. i. p. 761.

I confess myself unable to form a probable guess as to what this moss really is: the possessors of the Bridelian herbarium must decide.

Leaves composed of *two layers of cellules* except near the base; the margins often thickened (=2 cellules); the nerve=3–5 cellules; the obtuse apex *cucullate.*

Tribus 26. ORTHOTRICHACEÆ, Bryol. Europ. (ex parte).

61. *Orthotrichum,* Hedwig.

Obs. This genus includes but few rupestral species, and only two of these (*O. anomalum* and *cupulatum*) have their normal station on calcareous rock. Of the species which inhabit the bark of trees, it is remarkable that those with an *exserted* capsule (*Ulota,* Bridel) prefer *young oaks,* while those with an *immersed* capsule prefer *poplars.*

§ 1. (= ULOTA, Bridel.)

311. *O. crispulum,* Bruch. Mst. in Brid. Br. Univ. i. p. 793; Br. Europ.! *Orthotrichum,* p. 23. t. 12; M. P. 245.

Hab. $Z_{1\,\text{inf.}}$ ad arbores in sylvis Pyren. occidentalium, locis *Jurançon, Gan,* &c.

312. *O. crispum,* Hedw. Musc. Frond. ii. t. 35; Br. Europ.! *l. c.* p. 23. t. 12; M. P. 246.

Hab. Z_{1-2} ad arborum truncos. In monte *Lhieris* peristomio interno 16-ciliato occurrit.

313. *O. Bruchii,* Brid. Br. Univ. i. p. 744 (sub *Ulota*). *O. coarctatum,* Br. Europ. *l. c.* p. 21. t. 11 (non P. Beauv.).

Hab. Z_1 P. occ. ad arborum truncos in valle *d'Ossau* prope *Gan,* rarissime!

314. *O. Hutchinsiæ,* Smith, E. Bot. t. 2523; H. et T.! Musc. Brit. p. 131. t. 21; Br. Europ. *l. c.* t. 10; M. P. 247.

Hab. $Z_{1\,\text{sup.}}$ ad saxa granitica per Pyrenæos occidentales, in vicinia *Cauterets* et *Pierrefitte* præcipue.

315. *O. coarctatum,* Pal. Beauv. Prodr. p. 80. *O. Ludwigii,* Schwgr. Suppl. t. 51; Grev.! Scot. Cr. Fl. t. 133; Br. Europ. *l. c.* t. 4; M. P. 248.

Hab. Z_{1-2} P. occ. et c. ad fruticum ramulos, frequens. *Mte. Verte; V. du Lys; Labassère,* &c.

316. *O. anomalum,* Hedw. Musc. Frond. ii. t. 37; Br. Europ. p. 10. t. 3; M. P. 249.

Hab. Z_1 in saxis calcareis; in arborum truncis ad viam quæ ducit a pago *Loudervielle* ad *Port de Peyresourde* in Pyr. centralibus.

§ 2. (=ORTHOTRICHUM, Bridel.)

317. *O. leiocarpum,* B. et S. Br. Europ. *l. c.* p. 28. t. 15; M. P. 250. *O. striatum,* Schwgr. Suppl. t. 54 (vix Hedwigii); H. et T. Musc. Brit.! p. 128. t. 21.

Hab. Z_1 ad arborum corticem, frequens.

318. *O. Lyellii*, Hook. et Tayl.! Musc. Brit. p. 76. t. 22; Br. Europ. *l. c.* p. 27. t. 16.

Hab. Z_1 in arboribus, rarius. P. occ. *V. d'Ossau.* P. c. *B.-de-Bigorre.*

319. *O. diaphanum*, Schrad. Spicil. Fl. Germ. p. 69; Br. Europ. *l. c.* t. 14; M. P. 251.

Hab. Z_{0-1} ad arbores præcipue populos.

320. *O. patens*, Bruch in Brid.; Br. Europ.! *l. c.* p. 17. t. 7.

Hab. $Z_{1-\text{inf.}}$ ad populorum truncos, rarissimum. P. occ. *Pau*; *Jurançon.* P. c. *B.-de-Bigorre* (Philippe!).

321. *O. stramineum*, Hsch.; Brid. Br. Univ. 1. p. 789; Br. Europ.! *l. c.* p. 23. t. 13; M. P. 252.

Hab. Z_{0-2} ad truncos, vulgatissimum. *Oloron*; *Cauterets*; *V. de Campan*, &c.

"Var. 2, collo capsulæ longioris sporangium æquante, ciliis 8, vaginula vix pilosa;" M. P. 253.—*Hab.* ad populorum truncos in valle *d'Ossau* prope *Louvie.*

I am not certain that the authors of 'Bryol. Europ.' would not refer this to their *O. fastigiatum* (*l. c.* t. 8): the vaginula is however always slightly hairy.

322. *O. pallens*, Bruch in Brid. Br. Univ. i. p. 788; Br. Europ. *l. c.* p. 24. t. 13. "*O. stramineum*, var. 3. foliis capsulisque tenerioribus, vaginula nuda, ciliis semper 16;" M. P. 254.

Hab. Z_1 P. occ. ad arbores campestres prope *Louvie* et *Cauterets.*

323. *O. speciosum*, Nees in Sturm. Deut. Fl. Crypt. hft. 16; Br. Europ.! *l. c.* p. 19. t. 9; M. P. 255.

Hab. Z_1 ad frutices in sepibus, rarissimum. P. occ. *Luz.* P. c. *Vallée d'Aure*; *B.-de-Bigorre* (Philippe!).

324. *O. affine*, Schrad. Spicil. Fl. Germ. p. 67; Br. Europ. *l. c.* p. 17. t. 7; M. P. 256.

Hab. Z_{0-2} ad arborum truncos.

325. *O. tenellum*, Bruch in Brid. Br. Univ. i. p. 786; Br. Europ.! *l. c.* t. 6; M. P. 257.

Hab. Z_{0-1} ad arborum truncos. P. occ. *St. Sever*; *Pau.* P. c. *B.-de-Bigorre.*

Var. capsula *emersa*, subclavata; calyptra *magna*, capsulam totam obtegente, straminea.—*Hab.* prope *St. Sever.*

326. *O. pumilum*, Schwgr. Suppl. t. 50; Br. Europ.! *l. c.* p. 14. t. 5; M. P. 258.

Hab. $Z_{1\ \text{inf.}}$ P. occ. et c. ad populos prope *Pau* et *B.-de-Bigorre.*

327. *O. rupestre*, Schleich.; Schwgr. Suppl. t. 53; Br. Europ.!

l. c. p. 19. t. 9; M. P. 259. *O. rupincola,* Funck.; Grev.! Scot. Cr. Fl. t. 105.

Hab. Z_{1-2} in saxis præsertim graniticis, frequens. *Les Eaux Chaudes*; *Pierrefitte*; *V. du Lys,* &c. In arborum cortice supra *Cauterets.*

328. *O. urnigerum,* Myrin Cor. Flor. Upsal. p. 71; Br. Europ.! *l. c.* p. 29. t. 17; M. P. 260.

Hab. Z_1 in arboribus et saxis graniticis prope *Pierrefitte* et *Cauterets,* socio *Leskea nervosa*: rarissime.

329. *O. Sturmii,* H. et H. Bot. Zeit. 1819, p. 89; Br. Europ. *l. c.* p. 9. t. 2.

Hab. P. or. *St. Martin du Canigou* et in convalle *d'Eynes* (Montagne, *l. c.*).

330. *O. cupulatum,* Hoffm. Deutsch. Flor. ii. p. 26; Br. Europ. *l. c.* t. 2; M. P. 261.

Hab. Z_1 in saxis calcareis, haud vulgatum. *Les Eaux Bonnes,* &c.

331. *O. obtusifolium,* Schrad. Crypt. Germ. p. 14; Br. Europ. *l. c.* p. 13. t. 1; M. P. 262.

Hab. $Z_{1\ \mathrm{inf.}}$ P. occ. et c. circa *Pau* et *B.-de-Bigorre* in populorum truncis.

Tribus 27. ENCALYPTEÆ, Bryol. Europ.

62. *Encalypta,* Schreber.

332. *E. streptocarpa,* Hedw. Sp. Musc. t. 10; Br. Europ. fasc. 4. p. 15. t. 7; M. P. 295.

Hab. Z_1 in calce arenato murorum et ad terram calcaream in sylvis omnium Pyrenæorum, plerumque fertilis. *Forêt de Lhieris; Les Eaux Bonnes,* &c.

333. *E. rhabdocarpa,* Schwgr. Suppl. t. 17; Br. Europ. *l. c.* p. 13. t. 6; M. P. 296.

Hab. Z_{3-5} in rupibus schistosis, rarissime. P. occ. *V. de Combascou,* ut et in summo montium jugo loco *Port de Cauterets.* P. c. *Lac Lehou.*

334. *E. ciliata,* Hedw. Sp. Musc. p. 61; Br. Europ. *l. c.* p. 10. t. 3; M. P. 297.

Hab. Z_2 in rupibus umbrosis, ad viarum latera, &c. passim.

335. *E. vulgaris,* Hedw. Sp. Musc. p. 60; Br. Europ. *l. c.* p. 9. t. 2.

Var. *β. gymnostoma,* Br. Europ.—*Hab.* Z_1 in solo calcareo prope *Les Eaux Chaudes,* rarissime.

Var. *γ. mutica,* Brid. et Br. Europ.; M. P. 298.—*Hab.* ad viarum latera prope *Gavarnie.*

Var. ε. Br. Europ. (=*E. pilifera,* Funk).—*Hab. Forêt de Transoubât,* socio *Grimmia anodonte* (Philippe !).

336. *E. commutata,* N. et H. Br. Germ. 2. t. 15 ; Br. Europ. ! *l. c.* p. 8. t. 1 ; M. P. 299.
Hab. Z_{2-4} in terra denudata rupium. P. occ. *Mt. Lizé.* P. c. *Gavarnie* ; *Lac Lehou* ; *Lac de Séculéjo.*

337. *E.* ? *ligulata,* Spruce in Musci Pyr. n. 331 : dense cæspitosa; caule erecto, simplici dichotomove, tenui, *fragili* ; foliis confertis, e basi suberecta patulo-subreflexis, *lineari-spatulatis, obtusis, acute carinatis,* margine inferiori recurvis, *nervo paulo ante apicem evanido,* areolatione præter ad basin (ubi laxiori) minutissima, obscura.
Hab. Z_1 sup. in rupibus humidis præsertim ophiticis, locis *Labassère, Superbagnères* et *Gorge de Cauterets.*

Planta tota tenerrima, $\frac{1}{4}$–1 unc. longitudine. *Caulis* dense foliosus et inter folia radiculis propriis pallidis tenuissimis ramosis flexuosis vestitus. *Folia* lurido-rufescentia, chlorophyllo destituta, terminalibus pallido-viridibus chlorophyllosis exceptis, hic illic confertiora majora subcomantia, e basi angusta sensim et usque ad $\frac{4}{5}$ folii latiora, longitudine tota = 4–5 latitudinem ubi latissima, apice ipso rotundato-obtusa, *carinata, inferne complicata,* superne subexplanata ; *cellulæ omnes subparallelogrammæ, parietibus crassis, inferiores magnæ* longitudine = 2 lat., *superiores* 4–6*ies breviores* subæquilateræ, *versuum* 3–4 *marginalium crassiores* et ex eo *folia inferiora rufo-marginata, superiora pallido-marginata.*

Tribus 28. Hedwigiaceæ, Bryol. Europ.

63. *Hedwigia,* Ehrhart.

338. *H. imberbis,* Smith, E. Bot. t. 2237 (sub *Gymnostomo*) ; M. P. 263. *Hedwigidium imberbe,* Br. Europ. p. 3. t. 1.
Hab. Z_1 P. occ. ad saxa granitica prope *Laruns.* P. c. in rupibus schistosis prope *Pouzac* et *Gazos* (Philippe !).

339. *H. ciliata,* Hdew. Musc. Frond. i. t. 40; Br. Europ. *Hedwigia,* p. 5. t. 1, 2 ; M. P. 264.
Hab. Z_{1-4} in saxosis, ubique vulgata. " *Pic du Midi vers* 2600 *mètres d'altitude* " (Desmoulins).

Tribus 29. Grimmiaceæ, Bryol. Europ.

64. *Schistidium,* Bridel (ex parte).

340. *S. apocarpum,* L. Sp. Pl. p. 1579 (sub *Bryo*) ; Br. Europ. ! p. 7. t. 3, 4 ; M. P. 265.
Hab. Z_{0-5} in saxis, passim.

341. *S. confertum,* Funk, Moos-Tasch. t. 12 (sub *Grimmia*) ; Br. Europ. *l. c.* p. 7. t. 2. *S. apocarpum* var. *confertum,* M. P. 266.

Hab. Z_{1-5} P. c. in rupibus humidiusculis graniticis et argillaceo-schistosis. *Vallée de Castelloubon. Port de Bénasque!* (Arnott!). *B.-de-Bigorre* et *Labassère* (Philippe!).

†*S.? recurvifolium,* Wils. in litt. ad R. S.

Hab. $Z_{1\ sup.}$ P. occ. in rupibus argillaceo-schistosis vallis *d'Ossau* supra *Béost,* sterile.

This moss has been found in a barren state in several parts of England. It approaches very closely to *S. apocarpum,* yet it may be a *Tortula* or a *Didymodon.*

65. *Coscinodon,* Sprengel.

342. *C. cribrosus,* Hedw. Musc. Frond. iii. t. 31 (sub *Grimmia*); M. P. 267. *Coscinodon pulvinatus,* Spreng.; Br. Europ. *Coscinodon* (cum ic.).

Hab. Z_{1-2} P. occ. in rupibus schistaceis prope *Pierrefitte.* P. c. locis similibus vallis *Castelloubon* loco *les Scieries de Gazos,* etiam in mortario murorum ad pagum *Asté,* ubi am. Philippe detexit. P. or. locis *Bellegarde* et *Concampa* (Arnott!).

"Folia nonnunquam *trinervia,* i. e. plicis lateralibus e strato duplici cellularum constitutis." M. P. *l. c.*

On the mountain (*Superbagnères*) which rises at the back of the town of *Bagnères-de-Luchon,* I gathered a *Coscinodon,* which differs considerably in the foliage from my specimens of *C. cribrosus,* but the fruit is too immature to afford any character. The leaves are smaller, *erect at the base, then widely spreading,* and finally *incurved at the summit,* strongly keeled, but *quite destitute of plicæ: those of the perichætium remarkably large,* three times the length of the stem-leaves.

66. *Grimmia,* Ehrhart.

Obs. The species of this genus are in the Pyrenees perhaps more conspicuous than those of any other. *G. orbicularis* and *crinita* were observed only on calcareous formations, and the latter only on mortar in walls: both in exposed sunny situations*, not rising to the region of coniferous trees. *G. sulcata* was noticed only on argillaceous schist. The only species which never descend into the woody region are *G. sulcata* and *atrata.* The following species are subalpine or alpine: *G. patens, elatior, funalis, spiralis, incurva, Doniana, alpestris* and *ovata*; but nearly all of these are occasionally seen below the coniferous region, or towards the upper limit of Z_1. The following species are characteristic of the lower mountains, namely *G. leucophæa* on granite or schist, and *G. orbicularis* on limestone. The region of coniferous trees (Z_2, Z_3) is marked by the frequent occurrence of *G. ovata, commutata* and *elatior.* The essentially alpine

* In the Eastern Pyrenees, Dr. Arnott observed walls covered on the *south* side with *G. orbicularis,* and on the *north* side with *G. pulvinata.*

species (above-mentioned) are too sparingly distributed to impart any peculiarity to the vegetation.

343. *G. anodon*, Br. Europ. *Grimmia*, p. 8. t. 1.
Hab. Z_2 P. c. *V. du Lys* in saxis graniticis; in rupibus micaceo-schistosis sylvæ *Transoubât* supra *Oubat* (Philippe!).

344. *G. crinita*, Brid. Mant. p. 32; Br. Europ.! *l. c.* p. 10. t. 2; M. P. 268.
Hab. Z_{0-1} P. occ. in muris prope *Pau.* P. c. ad casarum muros in pago *Pouzac* prope *B.-de-Bigorre*! (Philippe!).

Specimens communicated by Dr. Arnott from Montpellier have the perichætial leaves alone piliferous, even the terminal ones of the sterile branches being muticous. In this character it precisely agrees with *G. plagiopodia*, Hedw.; yet the calyptra is dimidiate, not mitriform as in that species.

345. *G. pulvinata*, L. Sp. Pl. p. 1586 (sub *Bryo*); Br. Europ. *l. c.* p. 12. t. 4; M. P. 269.
Hab. Z_{0-1} in muris rupibusque umbrosioribus.

346. *G. orbicularis*, B. et S.! Br. Europ. *l. c.* p. 13. t. 5; Wilson! in E. Bot. Suppl. t. 2888; M. P. 270. *G. africana*, Arnott! Disp. Meth. p. 21; Duby, Bot. Gall. p. 574.
Hab. Z_{0-1} in muris rupibusque calcareis apricis circa *Pau* et *B.-de-Bigorre. Pyrénées Orientales* (Arnott!). Circa Burdigalam (Grateloup!).

347. *G. spiralis*, H. et T. in Drumm. Musc. Scot. ii. n. 29; Grev.! Scot. Cr. Fl. t. 203; Br. Europ. *l. c.* p. 14. t. 7; M. P. 271.
Hab. Z_{2-4} P. occ. in saxis graniticis circa *Cauterets*, locis *Mt. Lizé, Source de la Raillère* et *Lac de Gaube*, pulcherrime! P. c. *Lac Lehou* (Philippe!). P. or. *V. d'Eynes* (Arnott!).

348. *G. torta*, H. et Nees, Br. Germ. ii. t. 22. *G. torquata*, Hook.; Grev.! Scot. Cr. Fl. t. 199. *G. spiralis* var. *torta*, M. P. 272.
Hab. Z_{2-3} in rupibus udiusculis. P. occ. secus rivuli *Gave de Marcadaou* ripas, socio *Zygodonte Mougeotii.* P. c. *Lac de Séculéjo.*
Zygodon species vult cel. Schimper.

349. *G. incurva*, Schwgr. Suppl. 1. § 1. p. 9; § 2. t. 97. "*G. trichophylla*," M. P. 273.
Hab. Z_{1-2} P. occ. in saxis graniticis vallis *Combascou*, ut et prope *Pierrefitte.*

350. *G. trichophylla*, Grev. Scot. Cr. Fl. t. 100; Br. Europ. *Grimmia*, p. 16. t. 9.
Hab. P. or. ad *St. Antoine de Galamus* in montibus Corbariis (Montagne, *l. c.*).

351. *G. funalis,* Schwgr. Suppl. 1. § 1. p. 150. t. 37 (sub *Trichostomo*); Br. Europ. *Grimmia,* p. 17. t. 11.

Hab. $Z_{1\ sup.}$ P. c. in rupibus argillaceo-schistosis, locis *Labassère* et *V. de Castelloubon.*

352. *G. elatior,* B. et S.! Br. Europ. *l. c.* p. 17. t. 10; M. P. 274.

Hab. Z_{2-3} in saxis graniticis secus rivulos Pyrenæorum totorum, sed nusquam copiosa. *Cauterets. Penticosa. Ruisseau d'Ardalos,* &c. *Mont Louis* et *Seo d'Urgel* (Arnott!). In summo monte *Canigou* (Montagne!).

353. *G. patens,* Dicks. Crypt. fasc. 2. p. 6 (sub *Bryo*); Br. Europ. *l. c.* p. 18. t. 10 *bis.*

Hab. Z_{2-4} ad rupes madidas regionum sylvaticarum alpinarumque. *Pont d'Espagne. Port de Cauterets,* &c.

354. *G. commutata,* Hueben. Musc. Germ. p. 185; Br. Europ.! *l. c.* p. 25. t. 19; M. P. 276. *Dicranum ovale,* Hedw. Sp. Musc. p. 140.

Hab. Z_{2-3} in rupibus graniticis secus rivulos. *Gave d'Ossau. Pont d'Espagne. Penticosa. Mont Louis* (Arnott!).

355. *G. leucophæa,* Grev.! Act. Soc. Wern. iv. t. 6; Br. Europ. *l. c.* p. 23. t. 20; M. P. 277.

Hab. Z_1 in saxis graniticis schistosisque montium humiliorum, frequens. *Cauterets. B.-de-Bigorre. Seo d'Urgel* (Arnott!). In tepidariis *Vernet les bains* (Montagne!).

356. *G. ovata,* W. et M. Iter Suec. t. 2; Br. Europ.! *l. c.* p. 21. t. 17; M. P. 278.

Hab. $Z_{1\ sup.-3}$ in saxis graniticis Pyrenæorum totorum sylvaticorum.

Var. δ. *cylindrica,* Br. Europ. *l. c.* t. 18; M. P. 279. *G. cylindrica,* Br. Germ. *Hab.* ad lacus Séculéjo ripas.

357. *G. Doniana,* Smith, Fl. Brit. p. 1198; H. et T.! Musc. Brit. p. 72. t. 13; M. P. 280. *G. obtusa,* Schwgr.; Br. Europ. *l. c.* p. 20. t. 13.

Hab. Z_{2-3} P. c. in saxis graniticis vallis *Castelloubon,* loco *les Scieries de Gazos*; *Vallon du Peyrosse* (Philippe!); *Mt. Maladetta* (DeC. in Fl. Française).

Var. *curvula,* M. P. 281. *Grimmia curvula,* Br. Europ. *l. c.* p. 11. t. 3. *Hab. V. de Castelloubon,* cum forma normali; *Gorge de Labassère*; *Port de Bénasque* (Arnott!).

"Pedicellus in statu etiam normali *curvulus* est;" M. P. *l. c.*

358. *G. alpestris,* Schleich. Pl. exsic. Helvet.; Br. Europ.! *l. c.* p. 27. t. 15; M. P. 282.

Hab. Z_3 P. occ. circa *Cauterets,* in saxis graniticis ad marginem lacus *Lac de Gaube* dicti, etiam in monte *Lizé* et secus ripas *Gave de Marcadaou.* P. c. *derrière le Pic Montaigu à côté de Gazos* (Philippe!). P. or. *Mt. Canigou* (Arnott!).

359. *G. sulcata,* Sauter, Br. Europ.! *l. c.* p. 27. t. 16; M. P. 283.

Hab. Z_4 in rupibus udis argillaceo-schistosis loco *Port de Bénasque.* In summis Pyrenæis sine loco designato (Endress in Br. Europ.).

Folia in parte superiore e serie duplici triplicive cellularum constituta.

360. *G. atrata,* Mielich. Bot. Zeit. 1819, p. 85; Br. Europ.! *l. c.* p. 30. t. 24; M. P. 284.

Hab. Z_4 P. c. in rupium schistosarum fissuris ad marginem lacus dict. *Lac Lehou*; *Pic de la Peyre* (Philippe!); *Port de Bénasque* (Arnott!). P. or. *Pic de Crabère* (Arnott!).

67. *Racomitrium,* Bridel.

361. *R. fasciculare,* Schrad. Spicil. Fl. Germ. p. 61 (sub *Trichostomo*); Br. Europ. *Racomitrium,* p. 8. t. 4; M. P. 285.

Hab. Z_{2-3} in rupibus udis regionis arborum conifer., frequens. *Pont d'Espagne.* *V. de Lesponne,* &c.

362. *R. lanuginosum,* Hedw. Musc. Frond. iii. p. 3. t. 2 (sub *Trichostomo*); Br. Europ. *l. c.* p. 11. t. 6.

Hab. Z_{1-2} per Pyrenæos, fere semper sterile, fertile tamen juxta *les Eaux Bonnes* legit am. Southby.

According to the 'Bryologia Europæa' this species is never fertile in the plains, but in England I have gathered well-fruited specimens on moors in the vale of York, at an elevation of not more than 50 feet above the sea.

363. *R. canescens,* Hedw. Musc. Frond. iii. t. 3 (sub *Trichostomo*); Br. Europ. *l. c.* p. 12. t. 7; M. P. 286.

Hab. Z_{1-2} in sylvis terrestre et rupestre, haud raro fertile.

364. *R. sudeticum,* Funk. Crypt. n. 670 (sub *Trichost.*); Br. Europ.! *l. c.* p. 7. t. 1; M. P. 287. *Trichostomum microcarpon,* Hedw.; H. et T.! Musc. Brit. p. 107. t. 19.

Hab. Z_{2-4} in rupibus graniticis schistosisque humidiusculis. P. c. *V. de Castelloubon*; *Ruisseau d'Ardalos*; *Route du Lac Lehou* (Dufour!); *Base du Pic du Midi* (Philippe!). P. or. *Cambrédazes* (Arnott!).

Var. minus, habitu *Grimmiæ ovatæ*; foliis plerumque muticis; *dentibus peristomii* 16 *subintegris bifidisve,* nunquam usque ad basin partitis. *Hab.* in loco alpino *Port de Bénasque* dicto.

The teeth of the peristome are united at the base into a membrane rising above the mouth of the capsule, by which this variety is distinguished from *Grimmia ovata.* The basal cellules of the leaf have three or four marked indentations on each side, and the margins are slightly incrassated upwards.

365. *R. heterostichum,* Hedw. Musc. Frond. 2. t. 25 (sub *Trichostomo*); Br. Europ. *l. c.* p. 9. t. 2 *bis* et 3; M. P. 288.
Hab. $Z_{1\ sup.-3}$ in saxis rupibusque, vulgatissimum.

366. *R. protensum,* Al. Braun; Br. Europ. *l. c.* p. 6, t. *Drypt.* 2; M. P. 289. *Dicranum aciculare γ,* Turn.! Musc. Hibern. p. 67.
Hab. Z_2 in rupibus udis secus rivulos. P. occ. *Mte. Verte.* P. c. *Labassère*; *V. de Castelloubon*; *Forêt de Transoubât.*

367. *R. aciculare,* Hedw. Musc. Frond. iii. t. 33 (sub *Dicrano*); Br. Europ. *l. c.* p. 6, t. *Drypt.* 1; M. P. 290.
Hab. Z_2 in saxis rivulorum, frequens.

Tribus 30. Ripariaceæ, Bryol. Europ.

68. *Cinclidotus,* Pal. Beauv.

368. *C. riparius,* W. et M. Bot. T. p. 120 (sub *Trichostomo*); Br. Europ.! *Cinclidotus,* p. 10. t. 2; M. P. 291.
Hab. Z_{1-2} P. occ. et c. (*forma typica*) in rivulo *Gave d'Ossau* dicto prope *Gabas.*
Var. *β. terrestris,* Br. Europ.! *l. c.* p. 11. t. 2; M. P. 292.—*Hab.* ad saxa arborumque radices prope *Narcastet* et *Jurançon. Montgaillard,* secus ripas fl. *Adour* (Philippe!).

369. *C. fontinaloides,* Hedw. Musc. Frond. 3. t. 14 (sub *Trichostomo*); Br. Europ. *l. c.* p. ? t. 3; M. P. 293.
Hab. Z_{1-2} in saxis demersis rivulorum.

370. *C. aquaticus,* Hedw. Musc. Frond. 3. t. 11 (sub *Hedwigia*); Br. Europ.! *l. c.* p. 8. t. 1; M. P. 294.
Hab. Z_1 P. c. prope *B.-de-Bigorre,* in flum. *Adour* ut et in rivulo juxta monasterium *Médous,* saxis demersis adhærens: planta ♂ sola. *Rivière du Hérault, Vaucluse* (Arnott!).

Tribus 31. Fontinaleæ, Bryol. Europ.

69. *Fontinalis,* Dillenius, Linnæus.

371. *F. antipyretica,* L. Sp. Pl. p. 1571; Br. Europ. *Fontinalis,* t. 2.
Hab. Z_1 in aquis fluentibus Pyrenæorum, haud vulgaris. P. occ. prope *les Eaux Bonnes* (Dufour!) etiam juxta pagum *Bétharam* pulchre fructiferum (Grateloup!).

Tribus 32. Fissidenteæ, Bryol. Europ.

70. *Fissidens*, Hedwig.

372. *F. grandifrons*, Brid. Suppl. Musc. i. p. 170 (1806); Br. Europ. fasc. 17, *Fissidens*, p. 11. t. 6; M. P. 311. *Dicranum adiantoides β. atrovirens*, DeCand. Fl. Fr. *D. palmiforme*, Ramond, Pyr. ined. (1815).

Hab. Z_1 per totos Pyrenæos in rupibus tophaceis irroratis, præcipue secus cataractas: semper sterilem vidi. Prope *B.-de-Bigorre*, in vallecula *Elysée Cottin* dicta, floribus masculis detexerunt Philippe et R. S.

Flores masculi medio caule positi, in foliorum duplicatura nidulantes, raro proxime sequentes foliis caulinis autem 2–3 inanibus inter singula folia florigera, iis *F. adiantoidis* similes, 5–8-phylli. *Folia floralia* propria 2–3, ovata, concava, dorso haud alata apice tamen laminula parva ($= \frac{1}{4}$ folii) instructa. *Antheridia* 4–9, oblongo-cylindrica, paraphysibus destituta.

373. *F. adiantoides*, L. Sp. Pl. p. 1588 (sub *Hypno*); Br. Europ. *l. c.* p. 10. t. 5; M. P. 312.

Hab. Z_{1-3} in scaturiginosis pratisque humidis, frequens.

374. *F. taxifolius*, L. Sp. Pl. p. 1587 (sub *Hypno*); Br. Europ. *l. c.* p. 9. t. 4; M. P. 313.

Hab. Z_{0-1} in sylvaticis, terrestris.

375. *F. osmundioides*, Hedw. Sp. Musc. t. 40; Br. Europ. *l. c.* p. 8. t. 3; M. P. 314.

Hab. Z_2 P. c. in saxis irroratis cataractæ dict. *Cascade du Cœur.*

376. *F. incurvus*, Schwgr. Suppl. t. 49; Br. Europ.! *l. c.* p. 6. t. 1; M. P. 315.

Hab. $Z_{1\ inf.}$ P. c. in terra arenosa. P. occ. prope *Gélos*. P. c. prope *B.-de-Bigorre.*

Along with the usual state of the species at Gélos grows a delicate form which I am undecided whether or not to regard as a distinct species. It has the calyptra conico-subulate, *quite entire, barely sheathing the operculum.* The antheridia are enclosed in a bud springing from the base of the stem, precisely as in *F. taxifolius*: I have not seen one terminating a branch, as in *F. incurvus.*

377. *F. fontanus*, Schimper; M. P. 316. *F. incurvus* var. *fontanus*, Br. Europ. *l. c.* t. 1. f. β. 1.

Hab. Z_1 ad saxa emersa rivuli *Adour de Lesponne* prope *B.-de-Bigorre.*

378. *F. bryoides*, Hedw. Musc. Frond. iii. t. 29; Br. Europ. *l. c.* t. 2; M. P. 317.

Hab. Z_{0-1} ad terram arenosam et argillaceo-arenosam.

"Var. *rivularis*, foliis 12–20 jugis, *elongatis, limbo valde incras-*

sato circumductis, capsula plerumque horizontali ;" M. P. 318.—*Hab. B.-de-Bigorre* in lapidibus rivuli supra fontem *la fontaine ferrugineuse* dictum.—An species propria? (*F. Pyrenaicus,* mst.)

71. *Conomitrium,* Montagne.

379. *C. Julianum,* Savi, Poll. Fl. Veron. iii. p. 385 (sub *Fontinali*) ; Mont. in Ann. des Sc. nat. viii. p. 250. t. 4. *Octodiceras Julianum,* Brid. Br. Univ. ii. p. 678 ; Br. Europ. fasc. 17 (cum icone).

Hab. Z_0 P. occ. *Dax,* in fontibus tepidis (Dufour ! Grateloup !).

Tribus 33. Leucobryaceæ, C. Muell. Syn. Musc.

72. *Leucobryum,* Hampe in Linnæa, 13. p. 42.

380. *L. glaucum,* L. Sp. Pl. p. 1582 (sub *Bryo*) ; C. M. Syn. Musc. p. 74. *Dicranum glaucum,* Hedw. ; Schwgr. Suppl. t. 48 ; M. P. 204.

Hab. Z_{0-1} in sylvis Pyrenæorum humiliorum ut et Agri Syrtici, truncos Castanearum decurtatarum cariosos pulcherrime vestiens.

Nothing can exceed the beauty of this moss when in a state of luxuriant fructification, as it is seen in the forests at the foot of the French Pyrenees. There it spreads over fallen timber and the decaying trunks of polled chestnut-trees, and the rich brown capsules, each half-enveloped in its silvery calyptra, stud its swelling and snowy tufts as with so many gems. The structure of its leaves is very remarkable and appears not to have been well understood by bryologists. I consider the leaves to be as *truly nerved* as those of *Dicranum longifolium, Campylopus fragilis,* e. a., where the existence of a nerve is now generally admitted. The nerve, in fact, occupies nearly the whole of the leaf, with the exception of a narrow limb on each side, of one cellule in thickness and 10 or 12 cellules in breadth near the base, which disappears about half-way up the leaf, or a little beyond where the margins begin to be strongly inflexed : this is quite analogous to what is observed in the species just referred to. [See Plate XII., where figures 1 and 2 represent transverse sections of the leaf, the former made near the apex and the latter near the base ; *a b* the nerve, *a a* and *b b* the limb on each side : magnified about 240 times.] The nerve consists of only two layers of cellules, towards the apex, and on the axis down to the very base ; but in its lower half one or two additional layers are imposed on both the upper and under surfaces, the greatest thickness being about midway between the axis and the limb on each side (fig. 2), in consequence of which the leaf is usually somewhat channeled on the back towards the base. The cellules composing the nerve are elongated prisms, quadrangular on the longitudinal and 5–7-gonal on the transverse section. Their *internal* walls exhibit large circular perforations (see figs.), one in each end and 1–3 in each side of every cellule. I have been unable to detect any openings whatever in the *external* walls of those cellules which constitute the upper and under surfaces of the nerve; the foramina, which appear in great numbers on regarding a leaf with a tolerably high power, being proved, by accurately adjusting the lens, and especially by cutting various sections of the leaf, to belong, *not to the external surface,* but to the walls separating contiguous cellules; so that, while there is ample provision for *a free communication between the cellules of the nerve,* there is none whatever for their communicating with the external medium, or at least none but what exists in all cellular tissue, which is at variance with what we observe in the genus *Sphagnum,* to which *Leucobryum* is often (and not inaptly) compared, as to its mode of growth and general aspect*. In the cellules of the limb I have been unable to detect either external or internal perforations. A transverse section is seen to be traversed by a tolerably regular medial line, which indicates the junction of the two principal layers of cellules, and is marked by a series of *lozenge-shaped openings* at the cellular angles. These openings are the sections of *slender chlorophyllose cellules, running in lines from the base to the apex of the leaf,* and having no communication by pores with the perforated tissue in which they are interposed. [See fig. 3, which represents part of a longitudinal section through one of these series of chlorophyllose cellules, magnified about 600 times.] These at once suggest the slender vermiform cellules similarly interposed in the prosenchymatous tissue of the *Sphagna,* of which the office is precisely the same, namely to contain the grains of chlorophyll†.

Tribus 34. Sphagnaceæ, C. Mueller.

73. *Sphagnum,* Dillenius.

381. *S. acutifolium,* Ehrh. Crypt. exsicc. n. 72; Schwgr. Suppl. t. 5; M. P. 325.

Hab. Z_2 P. c. in rupibus humidis vallis *Lesponne* et secus lacum *Séculéjo.*

382. *S. cuspidatum,* Ehrh. Crypt. 251; Schwgr. Suppl. t. 6.

Hab. Z_0 P. occ. in turfosis prope *Dax* (Grateloup !).

383. *S. squarrosum,* W. et M. It. Suec. t. 2. f. 1; Schwgr. Suppl. t. 4; M. P. 326.

Hab. Z_{2-3} P. occ. et c. in rupibus humidis, locis *Lesponne, Labassère* et *Mt. Crabioules.*

384. *S. cymbifolium,* Ehrh. Hann. Mag. 1780, p. 235; M. P. 327. *S. obtusifolium,* Ehrh.; H. et T. Musc. Brit. p. 13. t. 4.

* It is worthy of remark, that the cellules of some *Sphagna,* e. g. *S. cymbifolium, communicate laterally with each other by means of pores in the adjacent walls.*

† Since this account was drawn up, *Leucobryum glaucum* has appeared in the 'Bryologia Europæa' under the name of *Oncophorus glaucus,* and a description is given of its structure differing I believe in some slight particulars from what is here stated.

Hab. Z_{0-1} P. c. in rupibus humidis faucis *Gorge de Labassère* dictæ. P. occ. in palude turfaceo montis *Goursi*. Nusquam alias in montibus Pyrenæis mihi notum! In turfosis Agri Syrtici (Grateloup!).

385. *S. compactum*, Brid. Suppl. Musc. i. p. 18; Schwgr. Suppl. t. 3; M. P. 328.
Hab. Z_0 P. occ. in Agro Syrtico, loco *Landes de Mugriet*, copiose.

Tribus 35. ANDRÆACEÆ, C. Mueller.

74. *Andræa*, Ehrhart.

386. *A. Rothii*, W. et M. Cr. Germ. p. 386. t. 11; Schwgr. Suppl. t. 106; M. P. 329.
Hab. Z_{2-4} P. c. in rupibus graniticis juxta lacum *Séculéjo*, necnon in valle *Castelloubon*; in rupibus micaceis ad marginem lacus *Lehou* (Philippe!).

Florescentia monoica: *flores fœminei* constanter *trigyni*; *flores masculi polyandri, paraphysibus claviformibus* prædite. *Folia* in dimidio superiori plerumque (in varietate *Grimsulana* præcipue) *e seriebus cellularum duabus* conflata.

M. Philippe's specimens have the terminal leaves distinctly repando-dentate, and thinner than in the ordinary form of the species.

387. *A. rupestris*, L. Sp. Pl. p. 1601 (sub *Jungermannia*); Hedw. Sp. Musc. t. 7; M. P. 330.
Hab. Z_{2-4} P. c. cum priore; etiam in rupibus dict. *Chaos* prope *Gavarnie*.

Florescentia monoica: *flores fœminei di-trigyni*; *flores masculi tetrandri, paraphysibus carentes,* nonnunquam in planta propria pseudo-alares.

Ordo HEPATICÆ.

Tribus 1. JUNGERMANNIEÆ, Nees ab E.

Hemicyclum 1. *Foliosæ*.

Subtribus 1. GYMNOMITRIA, N. ab E.

1. *Gymnomitrium*, N. ab E.

1. *G. concinnatum*, Lightf. Fl. Scot. ii. p. 786 (sub *Jungermannia*); Gottsche, Lindbg. et Nees, Syn. Hepat. p. 3; H. P. 1.
Hab. Z_{2-4} in rupibus humidis P. occ. et c., locis *Pont d' Espagne* et *Port de Bénasque*.

2. *Sarcoscyphus*, Corda.

2. *S. adustus*, N. ab E. Europ. Leberm. i. p. 120 (sub *Gymnomitrio*); Syn. Hep. p. 4.
Hab. Z_1 P. c. ad saxa in monticulo *Olivet* prope *B.-de-Bigorre*, socio *S. Funckii*.

The habit of this species, the difficulty with which it is distinguished from small forms of *S. Funckii*, and above all the structure of the perianth, demand that it should be removed to the genus *Sarcoscyphus*. I find in all cases a *true perianth* present, the origin of which is derived from the union of two leaves quite concealed by the perichætial leaves, with which it is *concrete* for nearly half its length: it is pale and of very delicate texture (cellules three times as large as those of the perichætium), erose and inflexed at the summit and sometimes 2-lipped. The perianth of *S. Funckii* is formed on the same type. In some true *Gymnomitria* (e. g. *G. concinnatum*) I observe within the perichætium two leaves (rarely only one) which are much shorter, wider and more tender than the perichætial leaves, and unequally trifid with toothed segments; but these are neither *connate* with each other nor *concrete* with the perichætium, hence they cannot be called a *perianth*, although obviously supplying the place of one. Still it would perhaps be more logical to consider *Gymnomitrium* as only a section or subgenus of *Sarcoscyphus*. I am happy to add that Dr. Gottsche quite concurs with me in the removal of *Gymnomitrium adustum* to *Sarcoscyphus*.

3. *S. Funckii*, W. et M. Bot. p. 422 (sub *Jungermannia*); Syn. Hep. p. 8; H. P. 3.

Hab. Z_{0-1} locis umbrosis ad terram saxaque. P. occ. *St. Sever*; *Jurançon*; *Val de Jéret*. P. c. *Bagnères-de-Bigorre*; *Vallée du Lys*.

4. *S. emarginatus*, Ehrh. Beitr. iii. p. 80 (sub *Jungermannia*); H. P. 2; Hook. Br. Jung. t. 27. *Sarcoscyphus Ehrharti*, Syn. Hep. p. 7.

Hab. Z_{0-5} ad rupes humidas Pyrenæorum totorum; ad terram in sylvis Agri Syrtici.

3. *Alicularia*, Corda.

Obs. The two European species of this genus are both found in the Pyrenees, where *A. compressa* attains its southernmost recorded limit.

5. *A. compressa*, Hook. Brit. Jung. t. 58 (sub *Jung.*); Syn. Hep. p. 12; H. P. 4.

Hab. Z_1 P. occ. locis scaturiginosis faucis *Gorge de Cauterets* dictæ.

6. *A. scalaris*, Schrad.; Hook. Br. Jung. t. 61 (sub *Jung.*); Syn. Hep. p. 10; H. P. 5.

Hab. Z_{0-5} in rupibus, ad terram, &c., a planitie usque ad summos Pyrenæos ascendens.

4. *Southbya*, nov. gen.*

Char. essent. Perianthium terminale, involucro *emersum*, cum

* To no one can I with more propriety dedicate a new genus of Pyrenean Cryptogamia than to Dr. Southby, my companion in so many interesting excursions in those mountains, and a gentleman accomplished in almost every branch of natural history.

eodem *ab inferiori parte concretum,* primitus cylindricum dein *a lateribus subcompressum,* breviter *bilabiatum,* labiis subconniventibus, haud plicatum *suturis* tamen *duabus,* altera ventrali altera dorsali, notatum.

Genus inter *Alicularium* et *Jungermannias integrifolias* medium locum tenens.

7. *S. tophacea.* (*Jungerm. tophacea* nobis in Hep. Pyren. n. 23.)

Hab. $Z_{1\ \mathrm{inf.}}$ in imis Pyrenæis occidentalibus, supra pagos *Jurançon* et *Gélos* in rupibus topha obtectis, cæspites *Weisiæ verticillatæ* marcidos haud raro vestiens; immo ad muros subhumidos in ipsa urbe *Pau.* E Lusitania sine nomine missa in herbario beati Taylor nuperius vidi.

Plantæ pusillæ, tenerrimæ, $\frac{1}{4}$–$\frac{3}{4}$ unc. longæ, cæspitosæ, matrice arcte adfixæ, instar *Jg. bicrenatæ* suaveolentes. Caulis simplex, rarius furcatus, e perianthii basi innovationes 1 vel 2 ante capsulæ maturationem involucro inclusas semper proferens, prostrata, apice fertili tamen assurgens, longis radiculis pallidis radicans. *Folia* pallide viridia, *inferiora* semiverticaliter affixa, subopposita, angulis dorsalibus subcontiguis nonnunquam connatis, reflexo-patula, ovata vel ovali-oblonga, apice rotundata, integerrima; *superiora* verticalia, plerumque conferta, *basi dorsali per paria conjuncta,* apice margineque ventrali solis reflexa, raro apice retusa, obtuse emarginata vel angulato-repanda; *involucralia* caulinis superioribus simillima, paulo majora, apice eroso-denticulata, cum perianthio ad basin concreta. *Amphigastrium* involucrale, ovato-lanceolatum, obtusum, nonnunquam adest; cæterum caulis omnino examphigastriata est. *Perianthium* terminale involucrum subæquans (in plantis minoribus densifoliis nonnunquam involucrum vix æquat, in elatioribus autem sparsifoliis involucrum plus minus superat), e foliis duobus plus minus alte connatis conflatum et ex eo compressum bilabiatumque, labiis subconniventibus, post capsulæ emissionem haud raro collapsis, ore tametsi apertum, eroso-denticulatum rarius subincisum. *Textura* foliorum et perianthii est laxa, subpellucens, e cellulis majoribus in reti typice sexangularibus, limitibus angustis, intercalaribus nullis, granis chlorophyllicis magnis haud numerosis. *Calyptra* obovata, pallida, membranacea. *Capsula* fusca, subglobosa, tenera, laxe areolata, ad basin usque 4-valva aut, valvula una alterave bifida, 5–6-valva, pedicello pallido exserta. *Semina* grandiuscula, globosa, granulosa. *Elateres* torti, bispiri, apicibus subobtusi.

Florescentia dioica videtur. *Plantæ masculæ* fœmineis tenuiores, tota fere longitudine staminiferæ. *Folia perigonialia* minora, semper per paria connata, basi ventricosa, apice patula, stamina singula binave brevi-pedicellata circumscissim rumpentia in axillis foventia.

Plate XIV. Fig. 1, *plantæ nat. magn.*; fig. 2, *surculus sterilis a dorso visus*; fig. 3, *planta fertilis al atere visa*; fig. 4, *apex plantæ masc.*; fig. 5, *folia inferiora*; fig. 6, *folia superiora*; fig. 7, *apex folii*; fig. 8, *perianthium cum involucro a dorso visum*; fig. 9, *perianthium* (*effœtum et collapsum*) *a latere, cum folio involucrali arcte retroflexo*: *omnia aucta.*

Obs. A first glance at this pretty species reminds one of *Alicularia scalaris,* but important differences are disclosed on a nearer examination; still, an extensive comparison of apparently cognate forms has convinced me that the *Aliculariæ* are in truth its closest allies. If a perianth of *Southbya* and one of *Alicularia scalaris* be vertically divided, and laid side by side, the relationship will be clearly obvious: the involucre is alike in both, and in both is it concrete below with the perianth, which also is formed on the same type in each. Could we now suppose the perianth of *A. scalaris* to be a little elongated, or that of *Southbya* to be a little abbreviated, the sole important difference would vanish. In reality, small forms of *Southbya* have the perianth sometimes barely visible beyond the involucre.

There is also a section of *Jungermannia,* consisting entirely of exotic species, which approaches *Southbya,* though more remotely. The type of this section is *Jg. turgescens,* Tayl. et Hook. fil. in Crypt. Antarctica, p. 38, t. 64, which has the *perianth slightly compressed laterally and truncate, but quite discrete from the involucre.* The habit too is widely different, the *stems being much divided,* scarcely radiculose, the *leaves very concave,* with a *minute guttulate areolation* (the cellules round, separated by wide interstices), and there are *bifid stipules* present. *Alicularia strongylophylla,* T. et H. *l. c.* p. 34, t. 62, has *the perianth exactly as in Jg. turgescens,* quite free and sometimes *twice as long as the involucre*; the chief differences being the *less concave leaves* and the wider areolation (yet still equally guttulate): *it is therefore not an Alicularia,* and with *Jg. turgescens* might well constitute a new genus, of which other species are probably *Jg. æquata* and *humilis* of the same authors. Possibly their *Alicularia occlusa* and the *Jungermannia Liebmanniana* of Lindenberg and Gottsche may go into the same genus, but of these I have not seen specimens. These species seem all intermediate between *Southbya* and the true *Jungermanniæ,* which they approach through *Jg. Taylori* and its allies.

On another side, *Southbya* has some affinity with a small group, of which *Jungermannia hyalina* is the European representative; but these differ from it in the *red radicles,* and in the *perianth* being *contracted* and *numerously plicate* towards the mouth.

Subtribus 2. JUNGERMANNIDEÆ, N. ab E.

5. *Plagiochila,* Nees et Mont.

-8. *P. asplenioides,* L.; Hook. Br. Jung. t. 13 (sub *Jung.*); Syn. Hep. p. 49.

Hab. Z_{0-3} in umbrosis per montes totos. In Pyrenæis tres præprimis formas innotavi: sunt—

1. *minor*; H. P. 6: caule gracili, squamis minutissimis (ne amphigastriis dicam) in ventre adsperso vel nudo; foliis subse-

cundis, margine dorsali valde reflexis et ex eo ad *P. porelloidem* appropinquans.—*Hab.* in sylvis Pyren. centralium.

2. *major*; H. P. 7: foliis maximis, confertis, patulis; squamis caulinis obviis, plerumque amorphis, nonnullis bifidis, nonnullis lineari-digitatis.—*Hab.* in valle *du Lys.*

3. *heterophylla,* N. ab E.? Syn. Hep. p. 50; H. P. 8: caule flagellifero, squamis minutis subulatis prædito; foliis repandis, retusis emarginatisve.—*Hab. Val de Jéret* et *Bois de Gouerdère,* in rupibus umbrosissimis.

9. *P. Pyrenaica,* Spruce in Hep. Pyren. n. 9: *caule horizontali in planum ramoso;* foliis imbricatis, plano-distichis aut adscendentibus, subconvexis, ovato-subquadratis, *apice variis,* oblique unidentatis, truncato-bidentatis, denticulatis, retusis vel obtusis omninoque integerrimis: involucralibus majoribus, subverticalibus, arcte adpressis, ovato-linguæformibus, repandis subdenticulatisve; *perianthio obovato-oblongo,* compresso, incurvo, *ore spinuloso-dentato* hinc plerumque fisso.

Hab. Z_{1-2} ad rupes humidiusculas Pyren. centralium (*Superbagnères*; *Grottes de Bédat* prope *B.-de-Bigorre*; *V. de Gazos*) et occidentalium (*Mont Goursi*; *Gave de Valentin*).

Caules intertexti, fertiles $\frac{1}{2}''$–$1''$, steriles $2''$–$3''$ longi. *Folia* ramorum fertilium plerumque integra retusave, sterilium contra vario modo incisa rarius integra et integerrima. Retis areolæ 6-angulares, subcontiguæ. Color viridi-olivaceus sicco statu in lutescentem vergens. *Perianthium* superne ampliatum. Capsulas maturas non habui.

Florescentia monoica: perigonia spiciformia: folia lobulo involuto spinuloso vel laciniato-dentato stamina obtegente prædita.

Plagiochila interrupta, N. ab E. Syn. Hep. p. 48, planta plerumque humilior, *folia semper integerrima* et *perianthium ore repando-crenulatum* habet. *P. porelloides* N. ab E., *caulibus adscendentibus* et *foliis gibbis, flaccidis, integerrimis,* sat superque distincta.

Although I have lately had Dr. Gottsche's sanction for retaining *Plagiochila Pyrenaica,* I think it not improbable that it may one day be proved a variety of *P. interrupta,* a striking one certainly, and perhaps confined to the Pyrenees. The *Plagiochilæ* are so liable to variation in the toothing of the leaves, that it is scarcely possible to suppose all the generally received species genuine. I have seen no specimens of *P. porelloides* which I can safely separate from *P. asplenioides.*

6. *Scapania,* Lindenberg.

10. *S. compacta,* Roth, Fl. Germ. iii. p. 375 (sub *Jung.*); Syn. Hep. p. 63. *Jung. resupinata,* Hook. Br. Jung. t. 23.

"Var. 1, foliis in duplicatura sæpius alatis, ala repando-dentata, lobo ventrali *convexo*;" H. P. 10.—*Hab.* Z_0 in Agro Syrtico circa *St. Sever* et Aquas Tarbellicas. "*Collines de St. Pandelon, de Tercis*;" Grateloup in 'Cryptogamie Tarbellienne.'

"Var. 2, foliis ut plurimum inæqualiter bilobis, lobo ventrali *concavo*;" H. P. 11.—*Hab.* Z_1 P. c. in arenosis supra pagum *Gerde* prope *B.-de-Bigorre.*

Possibly a distinct species from the foregoing. The segments of the leaves are *subtrapezoidal, quite entire,* the *sinus gibbous,* the areolation rather closer and subguttulate. I have, however, only the sterile plant.

11. *S. undulata,* L. Sp. Pl. p. 1598 (sub *Jung.*); Hook. Br. Jung. t. 22; Syn. Hep. p. 65; H. P. 12.
Hab. Z_{0-3} in umbrosis humidis ad saxa. *Pont d'Espagne. Mt. Crabioules. V. de Courbettes* (Philippe!). "In Agro Syrtico prope *Dax*" (Grateloup, *l. c.*).

12. *S. nemorosa,* L. Sp. Pl. p. 1598 (sub *Jung.*); Hook. Br. Jung. t. 21. f. 1–4; Syn. Hep. p. 68; H. P. 13.
Hab. Z_{0-3} locis sylvaticis, frequens.

13. *S. umbrosa,* Schrad. Samml. ii. p. 5; Hook. Br. Jung. t. 24; Syn. Hep. p. 69; H. P. 14.
Hab. Z_{2-3} P. occ. ad saxa prope pontem dict. *Pont d'Espagne.* P. c. in monte *Crabioules* ad ligna putrida. E rarioribus.

14. *S. apiculata,* Spruce in Hep. Pyren. n. 15; caule brevi simplice, infra perianthium innovante, e basi flexuosa repente adscendente; foliis pallidis vel fuscescentibus, infimis minimis, bidentatis, vix complicatis, superioribus majoribus, *usque ad* $\frac{1}{3}$ *bifidis,* conduplicatis, *lobis oblique rhomboideis, apiculatis, subrepandis, haud arcte adpressis,* ventrali plerumque concavo, dorsali paulo minori, convexo, margine tamen sæpius reflexo, sinu depresso, *guttulato-areolatis,* cellulis discretis; involucralibus conformibus, deflexis; perianthio oblongo-clavato, compresso, subdeflexo, ore repando.
Hab. Z_2 supra ligna putrida in sylvis editioribus. P. occ. *Vallée de Béost.* P. c. *Cascade du Cœur* prope *B.-de-Luchon.*
S. umbrosa, proxima, *colore specioso albo roseove,* caule subramoso, *foliis homomallis, argute serratis, usque ad* $\frac{2}{3}$ *bifidis,* lobo dorsali ventrali 3–4plo minori, diversa est. *S. curta* N. ab E. *foliorum forma, perianthio ciliato,* &c. distinctissima.

7. *Jungermannia,* Linnæus.

Obs. Of the *Jungermanniæ* observed in the Pyrenees, *Jg. acuta* and *Wilsoniana* have their normal station on calcareous rock; *Jg. exsecta, ventricosa, curvula, incisa, divaricata, reclusa, curvifolia* and *setacea* were gathered *only on decayed wood*; the remainder are chiefly glareal or viatical, and some of them were also occasionally seen on decayed wood. It will be remarked that those species which in the Pyrenees occupy semiputrid trunks are the same which inhabit heaths on the plains and hills of the north of Europe. The species which approaches nearest the snow-line is *Jg. julacea.*

§ 1. Complicatæ, Syn. Hep.

15. *J. albicans,* Linn. Sp. Pl. p. 1599; Syn. Hep. p. 75.
Hab. Z_{0-4} terrestris et rupestris, fere ubique.

16. *J. obtusifolia,* Hook. Br. Jung. t. 26; Syn. Hep. p. 76; H. P. 16.
Hab. Z_{0-2} in viarum cavarum parietibus solo arenoso. P. occ. *St. Sever; Cauterets.* P. c. *B.-de-Bigorre; Port de Portillon.*

17. *J. exsecta,* Schmid. Ic. p. 241. t. 62; Hook. Br. Jung. t. 19; Syn. Hep. p. 77; H. P. 17.
Hab. Z_2 in truncis putrescentibus. Fructiferum legi in monte *Pic de Ger,* P. occ.

The fructification in my specimens differs somewhat from the description in 'Synopsis Hepaticarum'; it is as follows:—Involucral leaves with very acute segments, otherwise not differing from the cauline ones, with the exception of the innermost, which is rather shorter and terminated by several unequal apiculate teeth: it is accompanied by a lanceolate very acute stipule. Perianth oblongo-cylindrical, compressed, with four obtuse angles or plicæ, the mouth ciliate.

§ 2. Integrifoliæ, Syn. Hep.

18. *J. Schraderi,* Mart. Fl. Erlang. Cr. p. 180. t. 6. f. 55; Syn. Hep. p. 83; Sullivant! Musci Allegh. n. 235; H. P. 18.
Hab. Z_2 P. c. ad saxa in umbrosissimis secus cataractam *Cascade du Cœur* dictam.

19. *J. hyalina,* Lyell in Hook. Br. Jung. t. 63; Syn. Hep. p. 92; H. P. 21.
Hab. Z_{1-2} P. c. in rupibus secus rivulos, rarius ad terram. *Vallée de Castelloubon; Gorge de Labassère,* &c.

20. *J. nana,* N. ab E.; Syn. Hep.! p. 91; H. P. 20.
Hab. Z_{1-3} per Pyrenæos occ. et centr. in viis cavis, sed nusquam copiosa. *Col de Louvie; Bois de Lagaillaste; Esquierry,* &c.

21. *J. Genthiana,* Hueben. Hep. Germ. p. 107; Syn. Hep. p. 94. "*J. crenulata,* Sm., var. foliis caulium fertilium *minus compresso-contiguis, vix marginatis, perianthio* (*haud compresso*) *obovato,* submucronato, *plicato-4-angulo, angulis papilloso-alatis;*" H. P. 19.
Hab. Z_{1-2} P. c. ad viarum parietes. *Bois de Gerde* prope *Bagnères,* pulcherrime! *Port de Portillon,* &c.

The characters quoted above from 'Hepaticæ Pyrenaicæ' correctly indicate the differences of this plant from *Jg. crenulata,* and I am now quite satisfied of their being specific.

22. *J. crenulata*, Sm.! E. Bot. t. 1463; Syn. Hep. p. 90.

Hab. Z_{0-1} in arenosis turfosisque Agri Syrtici et P. centr., rarior. *St. Sever; B.-de-Bigorre.*

23. *J. sphærocarpa*, Hook. Br. Jung. t. 74; Syn. Hep. p. 93; H. P. 22.

Hab. Z_{1-2} P. occ. et c. locis similibus ac *Jg. hyalina* (n. 19). *Gorge de Cauterets; Labassère; Forêt de Transoubât* (Philippe!).

The black crumbling schist at *Labassère*, on which *Jg. sphærocarpa* and *hyalina* occur intermixed, is precisely of the same nature as the alum-shale in Eskdale near Whitby, Yorkshire, and it is remarkable that there also the same two species grow together in considerable quantity.

24. *J. cordifolia*, Hook. Br. Jung. t. 32; Syn. Hep. p. 95; H. P. 24.

Hab. Z_{1-3} P. c. in fontibus profundis secus ripas flum. *Adour*, in pagi *Asté* conspectu; necnon in humidis montis *Crabioules.*

Dr. Gottsche informs me that this species does not differ from *Jg. tersa γ. rivularis* of German authors.

25. *J. riparia*, Tayl.! in Annals of Nat. Hist. xii. p. 88; Syn. Hep. p. 97; H. P. 25.

Hab. Z_{1-3} in rupibus irroratis, rarius ad terram, frequens.

This species is often mixed with *Jg. acuta*, but it is not, like that species, confined to calcareous rock.

26. *J. pumila*, With. Arrang. iii. p. 866; Hook. Br. Jung. t. 17.

Hab. Z_2 P. c. ad saxa in sylva *Bois de Sajust* dicta: aliubi haud visa.

I cannot distinguish authentic specimens of *Jg. Zeyheri*, Hueben, from this. Both are remarkable for the perianth terminating in a cone, which is not plicate, but has *a furrow on each face*, that on the dorsal being most evident, and along this the dehiscence takes place for the emission of the capsule.

§ 3. Bidentes, Syn. Hep.

27. *J. acuta*, Lindbg.; Syn. Hep.! p. 103. *J. Muelleri*, N. ab E.; Syn. Hep.! p. 99; H. P. 26, 27, 28*.

Hab. Z_{1-2} locis calcareis subhumidis terrestris et saxatilis, rarius lignicola, per Pyrenæos frequentissima.

In 'Hepaticæ Pyrenaicæ' I gave three forms of this species, scarcely differing from each other except in *size*; the third form (No. 28) attains a length of 3 or 4 inches, and forms closely-tufted

* *Jg. acuta* and *Muelleri* are now ascertained to be absolutely identical, the former having the stipules nearly or altogether obsolete.

patches on the nearly vertical faces of rocks watered by the spray of rivulets in the upper part of the *Vallée d'Ossau* and the *Gorge de Labassère.* I there considered *Jg. Bantriensis*, Hook. Mst., which I gathered abundantly in Teesdale in 1843, as belonging to the same species, but at Dr. Gottsche's suggestion I have reconsidered this opinion, and I now think that the two may in all cases be safely distinguished. The differences are these:—in *Jg. Bantriensis* the leaves are always more or less erect, and in the large form they are *secund*, the two rows being contiguous by their upper surfaces, which I have never seen to be the case in *Jg. acuta*; they are also less undulate, *the sinus not gibbous*, though from the incurvation of the apices there is sometimes the appearance of it. Perianth when *young* (and in all stages when *unfertile*) *pyriform or broadly clavate*; while *the perianth of Jg. acuta*, in all states and at every age, even when quite short and half-developed, is of equal width from a little above the base to the summit, i. e. *cylindrical**.

28. *J. Lyoni*, Tayl.! Trans. Bot. Soc. p. 116. t. 7; H. P. 29.

Hab. $Z_{1\ \mathrm{sup.}-2}$ inter muscos ad saxa sylvarum, haud rara. *Val de Jéret*, &c.

The authors of 'Synopsis Hepaticarum' had surely never seen correct examples of this when they referred it to *Jg. socia*, N. ab E., and their description of it, "foliis laciniis obtusis," is quite at variance with specimens I possess from Messrs. Lyon and Taylor. It is singular that its near ally, *Jg. barbata*, Schreb., one of the commonest species in our mountains, should never have been observed in the Pyrenees. Dr. Grateloup indeed mentions it in his list as growing at the extreme western angle, "in montibus petrosis *Cambo* prope Bayonam," but without seeing his plant I dare not say that it is different from *Jg. Lyoni*†.

29. *J. Wilsoniana*, N. ab E.; Syn. Hep. p. 103; H. P. 30. *J. turbinata*, Wils.! in E. Bot. Suppl. t. 2744. *J. inflata*, E. Bot. t. 2512.

Hab. Z_1 in rupibus calcareis subhumidis. *Gélos* prope *Pau. B.-de-Bigorre.*

30. *J. ventricosa*, "Dicks."; Hook. Br. Jung. t. 28; Syn. Hep.

* The plant alluded to at the close of my description of *Jg. Bantriensis* ('Annals,' 1844) as gathered by Mr. Ralfs at Dolgelley, is possibly distinct from both the above. The three perianths in my possession are all subtriangular on the section, the dorsal face being the narrowest, and in one perianth the two lateral angles are winged and toothed. If it must be referred to one of the two, it will be to *Jg. acuta*, as it has the gibbous sinus of the leaves characteristic of that species. Mr. Wilson, to whom I am indebted for the specimens, has called it *Jg. culearis.*

† Dr. Grateloup mentions in his list "*Jg. setiformis*, Ehrh. Hab. in sylvis ad terram et ad arb. truncos. *Dax. Lésperon. Saubagnac*;" but as I searched for it in these stations without success, I cannot include it in my enumeration. It would be indeed remarkable to find in the *plains* of the south of Europe a species which grows most profusely in Lapland (Wahlenberg), and which when it extends farther south is uniformly *alpine.*

p. 108. *J. porphyroleuca,* N. ab E.; Syn. Hep. p. 109. "*J. alpestris,* Schleich.;" H. P. 31.

Hab. Z_{2-3} ad terram et truncos putridos. P. c. *Ruisseau d'Ardalos.* P. occ. *Val de Jéret.*

I am doubtful whether Dickson meant this species by his *Jg. ventricosa,* Fasc. 2. p. 14. He gives no figure, but cites figures of Micheli and Dillenius, which are certainly little like our plant, and adds, "*Folia in nostra profundius fissa,* quam in figuris Michelii et Dillenii depinguntur," which is still more at variance with the species as figured by Hooker. Dr. Gottsche informs me that when this plant grows on rotten wood, where it often assumes a purplish tinge (as in some of my Pyrenean specimens), it is the *Jg. porphyroleuca* of Nees. In 'Hepaticæ Pyrenaicæ' I had considered this form as possibly *Jg. alpestris,* Schleich., but specimens of the latter from Dr. Gottsche differ in having the leaves *roundish-ovate* (not quadrate as in *Jg. ventricosa*), the *sinus small,* and the *segments unequal, oblique.*

Var. *minor.* "*Jg. excisa,* Dicks.? var. foliis e basi cuneata ovato-quadratis obovatisve, marginibus inflexis, sinu triangulari lunatove, involucralibus bifidis, integerrimis; perianthio oblongo, ore obtuse plicato;" H. P. 32.

I believe I am correct in regarding this a minute form of *Jg. ventricosa*; the leaves are usually more deeply cloven, the sinus triangular, the segments often divaricating; and yet stems of the large, ordinary form may be found having the same characters.

31. *J. curvula,* N. ab E.; Syn. Hep. p. 115; H. P. 33.

Hab. Z_2 P. occ. in valle *Combascou* supra ligna putrida.

32. *J. capitata,* Hook. Br. Jung. t. 80; H. P. 34. *J. excisa β. crispata,* Hook. *l. c.* t. 9. ff. 2, 11, 12. *J. intermedia,* Lindbg. Hep. Europ. p. 83; Syn. Hep. ! p. 116.

Hab. Z_{0-2} P. occ. in arenosis *Sti. Sever.* P. c. in truncis putridis secus cataractam *Cascade du Cœur* dictam: rarior.

I am quite of opinion that the original name of Hooker should be retained for this species. Lindenberg was evidently not aware that his own *Jg. intermedia* and Hooker's *Jg. capitata* were forms of one species; from his description it is probable that he did not clearly distinguish it from some forms of his *Jg. bicrenata,* as he cites for it Hooker's tab. Suppl. 2 (Synopsis, p. 11), which exactly resembles Ekart's figures of *Jg. bicrenata,* and agrees well with specimens of the gemmiferous state of that species in my possession.

33. *J. bicrenata,* Lindbg. Hep. Eur. p. 82; Syn. Hep. ! p. 115; H. P. 35, 36.

Hab. Z_{0-1} in arenosis ad viarum parietes. *St. Sever. Pau. Bagnères.*

Dr. Gottsche has pointed out to me *the remarkable scent of this species,* resembling that of *Jg. acuta* and *Bantriensis,* and *quite want-*

ing in Jg. capitata; by this character, by the deeply and acutely cloven leaves, and especially by the *guttulate areolation, Jg. bicrenata* may always be safely distinguished.

I fear *Jg. excisa*, Dicks. Crypt. 3. p. 11. t. 8. f. 7, will have to be entirely erased from the list of Hepaticæ. I have spent much time in the attempt to ascertain what it really is, but without success; formerly I thought it might be *Jg. bicrenata*, especially as there is a rude attempt in Dickson's figure to represent the guttulate areolation, characteristic of that species; but the larger size, the *branched stem*, and especially the *narrow shallow sinus of the leaves*, seem to disprove such a supposition. Very lately I consulted the Smithian herbarium in the hope of finding an original specimen from Dickson, but even the name does not seem to exist there. I have examined a multitude of specimens from various parts of the British Isles, sent under the name of "*Jg. excisa*:" these belong in nearly equal quantities to three species, viz.:

1. *J. ventricosa*, forma minor = *J. excisa*, Hook. t. 9 (excl. var. β).
2. *J. bicrenata*, Lindbg. = *J. excisa* gemmifera, Hook. t. Suppl. 2.
3. *J. capitata*, Hook. = *J. excisa β. crispata*, Hook. t. 9. ff. 2, 11, 12 = *J. intermedia*, Lindbg.

It is exactly the same with specimens of "*Jg. excisa*" from the continent of Europe, nor have I ever seen a specimen agreeing with the descriptions that have been given of this species. Hooker says of *Jg. excisa*, "foliis *profunde* emarginatis;" of *Jg. ventricosa*, "foliis *obtuse* emarginatis:" Lindenberg says of *Jg. excisa*, "Differt . . . . . foliis *minus profunde* incisis:" lastly, the authors of 'Synopsis Hepaticarum' describe *Jg. excisa*, "foliis . . . *sinu profundo obtuso* excisis." From these and similar discrepancies, I cannot help concluding that these distinguished hepaticologists had under their eyes small forms of *more than one* of the three species above-cited when they drew up their descriptions of the supposed "*Jg. excisa*, Dicks." Dr. Gottsche has even admitted to me that he is unable to determine *Jg. excisa* if given to him without a name. He adds, "what I have received from my English and German friends under the name of *Jg. excisa* differ so much from each other, that I confess not to know the species."

34. *J. incisa*, Schrad.; Hook. Br. Jung. t. 10; Syn. Hep. p. 118; H. P. 37.

Hab. Z_{0-2} in truncis prostratis cariosis Pyrenæorum, frequens. "Ad terram humidam ac in rupibus muscosis circa Aquas Tarbellicas" (Grateloup, *l. c.*).

The leaves of this species are normally *conduplicate*; the lowest unequally bidentate with diverging segments, as in many *Scapaniæ*; the upper with very unequal lobes, *the dorsal lobe triangular, undivided, appressed to the stem, the ventral lobe bifid*: both either entire at the margins or with a few spinulose teeth. This is the typical structure, but, very rarely, the dorsal lobe is also bifid, and sometimes the ventral lobe is not bifid, but cut at the margin into several unequal spinulose teeth: sometimes it is trifid. In all cases the complication is discernible, notwithstanding the thickness of the stem, and even when the lobes are squarrosely spreading (as is seen also in some true *Scapaniæ*, e. g. in varieties of *S. nemorosa*). Hooker's figs. 3 and 4, tab. 10, show this quite distinctly.

35. *J. minuta,* Crantz; Hook. Br. Jung. t. 44; Syn. Hep. p. 120; H. P. 38.

Hab. Z_2 P. occ. ad rupes, haud vulgata, locis *Val de Jéret* et *Montagne Verte*.

§ 4. Bicuspides, Syn. Hep. (= Trigonanthus, nob. in hb.).

Obs. This very natural group, resembling *Lophocolea* in the nature of its fructification, may well constitute a separate genus, for which I propose the name *Trigonanthus*. Many of the species are stellatedly branched, and, in all, the branches seem to have the same origin (*e dorso*). In those species which have *the stems exstipulaceous,* there are always *involucral stipules* present, e. g. in *Jg. bicuspidata,* where the *lowest stipule* is lanceolate, the *second* obcordate, the *third* obcordate with a deeper notch, the *fourth* (next the perianth) irregularly trifid, and the perianth itself is composed of a *fifth* stipule connate with two opposite leaves: hence *its trigonous form* and obvious affinity to that of *Lophocolea*. The capsule is always *oblong*, and often remarkably so.

36. *J. divaricata,* Smith! in E. Bot. t. 719. *J. Starkii,* Hb. Funck; Syn. Hep. p. 134; H. P. 39.

Hab. Z_2 P. c. supra ligna putrida in sylva *Forêt de Transoubât* dicta, non procul a *B.-de-Bigorre*.

I have examined the original specimen of *Jg. divaricata,* figured in 'English Botany,' from "Heaths near Holt, Nov. 1798, Rev. Mr. Francis": it possesses very distinct *stipules* (!), and agrees in other respects with what has been called *Jg. Starkii* by German authors, and by Dr. Taylor *Jg. stellulifera*. My own herbarium contains a great many forms, some stipulaceous throughout the length of the stems, others only towards the apex, and some altogether without stipules. Between all these I can draw no certain line of demarcation, and if there be more than one species there must be several. In every form the leaves are nearly of the same width as the stem, roundish in outline or a little quadrate, the segments mostly acute and either diverging or connivent (when the leaves appear subcomplicate), the cellules mostly 4-sided with rounded angles and discrete by narrow interstices. In all there is the same peculiarity of the involucral leaves being united so as to form one or two exterior perianths; all have these leaves toothed and the real perianth more or less ciliated at the mouth.

37. *J. Francisci,* Hook. Br. Jung. t. 49; Syn. Hep. p. 133; H. P. 40.

Hab. Z_0 P. occ. ad fossarum parietes in ericetis Agri Syrtici, loco *Landes de Mugriet.*

38. *J. dentata,* Raddi in Mem. della Soc. Ital. di Mod. xix. p. 32; Syn. Hep. p. 143.

Hab. Z_0 P. occ. *St. Sever,* in arenosis, sociis *J. bicrenata* et *Trichostomo subulato.*

This differs somewhat from the description in 'Synopsis Hepaticarum.' The stems are closely creeping, mostly simple, rarely with one branch. Leaves brownish, crowded and capitate on the flowering shoots, scarcely at all complicate, cloven mostly to below the middle, spinuloso-dentate, the cellules rather small but discrete (not with such wide interstices as in *Jg. Turneri*). Stipules, on the lower part of the stem, minute, irregular in form, usually lanceolate or subulate and toothed; towards the apex larger, those of the involucre oval ($= \frac{1}{2}$ leaf) and as well as the involucral leaves deeply toothed or even laciniate.

The stems of *Jg. Turneri,* Hook., are much longer, more slender, and branched as in *Jg. bicuspidata*; the leaves are smaller and *more complicate,* and there are *no stipules.*

39. *J. reclusa,* Tayl.! in Annals of Nat. Hist. xii. p. 89; H. P. 41.

Hab. Z_2 in truncis putridis. P. occ. *Pic de Ger.* P. c. *V. de Castelloubon.*

I consider this quite distinct from *Jg. bicuspidata* (with which Dr. Gottsche unites it as var. *ericetorum*), and in some respects more nearly allied to *Jg. connivens.* In 1846 Mr. Jenner showed me magnificent patches of it, growing with *Jg. connivens,* &c., on sand-rocks in Eridge Park, Tunbridge Wells.

40. *J. bicuspidata,* L.; Hook. Br. Jung. t. 11; Syn. Hep. p. 138; H. P. 42.

Hab. Z_{0-4} ubique.

41. *J. connivens,* Dicks. Cr. fasc. 4. p. 19; Syn. Hep. p. 141.

Hab. Z_2 P. c. loco *Hourquette d'Aspin,* lignicola. Semel visa!

42. *J. curvifolia,* Dicks.; Hook. Br. Jung. t. 16; Syn. Hep. p. 142; H. P. 43.

Hab. Z_2 in truncis putridis, frequens.

§ 5. ÆQUIFOLIÆ, N. ab E.

43. *J. setacea,* Web.; Hook. Br. Jung. t. 8; Syn. Hep. p. 144; H. P. 44.

Hab. Z_{2-3} supra ligna putrida, rarior. *Val de Jéret. Mt. Crabioules.*

44. *J. trichophylla,* L.; Hook. Br. Jung. t. 7; Syn. Hep. p. 145; H. P. 45.

Hab. Z_{2-4} ad saxa, truncos putridos, inter muscos, &c., vulgata.

45. *J. julacea,* Lightf.; Hook. Br. Jung. t. 2; Syn. Hep. p. 146; H. P. 46.

Hab. Z_{4-5} in rupibus humidis. P. c. *Mt. Crabioules*; *Lac Lehou.* P. or. "in convalle *Eynes*" (Montagne, *l. c.*).

8. *Sphagnoecetis,* N. ab E.

46. *S. communis,* N. ab E.; Syn. Hep. p. 148; H. P. 47. *Jung. Sphagni,* Dicks.; Hook. Br. Jung. t. 33.

Hab. $Z_{0-1 \text{ inf.}}$ ad arborum excisarum truncos cariosos in imis Pyrenæis. "*Dax,* in paludibus spongiosis turfosisque inter Sphagnum palustre" (Grateloup, *l. c.*).

9. *Liochlæna,* N. ab E.

47. *L. lanceolata,* L. (sub *Jung.*); Hook. Br. Jung. t. 18; Syn. Hep. p. 150; H. P. 48.

Hab. Z_{0-2} secus rivulos Pyrenæorum, lignicola, rarius terrestris rupestrisve, frequens; necnon in Agro Syrtico loco *St. Pandelon de Dax.* "In collibus umbrosis et ad rupes cretaceas *Tercis*; necnon rupibus ophiticis *St. Pandelon* prope *Dax*" (Grateloup, *l. c.*).

10. *Lophocolea,* N. ab E.

Obs. The species of this genus may all be considered rare in the Pyrenees. *L. bidentata* I did not once observe in the higher mountains, though it occurred at the foot of the low hills near *Pau,* intermixed with mosses; yet I can hardly persuade myself that it does not ascend higher, and that, being reputed so common a plant, I may have passed it by unnoticed. *L. heterophylla,* another species equally frequent with us, I gathered but once in the Pyrenees.

48. *L. minor,* N. ab E.; Syn. Hep. p. 160; H. P. 49.

Hab. Z_1 P. c. in aggeribus circa *B.-de-Bigorre* (♂) et in valle *d'Aure* dicta.

49. *L. bidentata,* L. Sp. Pl. p. 1598 (sub *Jung.*); Hook. Br. Jung. t. 30.

Hab. $Z_{0-1 \text{ inf.}}$ P. occ. et c. circa *Pau* et *Dax.* In montibus nusquam vidi!

50. *L. heterophylla,* Schrad. (sub *Jung.*); Hook. Br. Jung. t. 31; Syn. Hep. p. 164; H. P. 50.

Hab. Z_2 P. c. *Cascade du Cœur* supra ligna putrida: e rarioribus.

11. *Harpanthus,* N. ab E. (caractere extenso).

51. *H. scutatus,* Web. et Mohr, Taschenb. p. 408 (sub *Jung.*). *J. stipulacea,* Hook. Br. Jung. t. 41.

Hab. Z_2 P. c. in monte *Crabioules* ad truncos putridos, sociis *Scapania apiculata, Jg. Schraderi,* &c.

The fructification of this plant is *truly lateral* (ramulo fertili e ventre caulis exeunte), and not as described in 'Synopsis Hepaticarum,' p. 101, "perianthio terminali, mox dorsali," for an instance of which I have in vain searched perhaps a hundred fertile stems. *The involucral leaves are normally two, with an interposed stipule,* and the uppermost leaf is concrete with the perianth for one-third of its length. *The perianth is very thick below* (= 3–4 cellules), and should perhaps be rather regarded in this part as *a hollowing out of the apex of the stem. The calyptra is concrete with the inner surface of the perianth for more than half its length,* as correctly represented in Hooker's figure, but not alluded to in 'Synopsis Hepaticarum.' All these characters bring this species very close to *Harpanthus Flotovianus*, N. ab E. (Syn. Hep. p. 170), the sole tangible difference being that in the former the perianth is obovate and in the latter fusiform, while they separate it widely from *Jung. acuta* and *Bantriensis*. If we consult now the organs of vegetation, we find the similarity quite as striking. The leaves of *H. Flotovianus* are *bidentate* in the same manner, only with a shallower sinus; the stipules are proportionally narrower, but *equally acuminate,* falcate and slightly *twisted,* and *toothed on each side at the base* just as in the other. With so many points of agreement, and with the same general habit (*H. scutatus* being only a smaller plant), I do not hesitate to place these two species in the same genus, which will still remain equally well distinguished from *Jungermannia* on the one side and from *Chiloscyphus* and *Lophocolea* on the other.

12. *Chiloscyphus,* N. ab E.

52. *Ch. pallescens,* Schrad. Cr. Gew. 2. p. 7 (sub *Jung.*); Syn. Hep. p. 187.

Hab. Z_1 P. c. ad terram in monte *Lhieris.*

53. *Ch. polyanthos,* L. Sp. Pl. p. 1597 (sub *Jung.*); Syn. Hep. p. 188.

Hab. Z_3 P. c. ad rivuli ripas in monte *Crabioules.*

Var. *β. rivularis,* Lindenb. Hep. Eur. p. 30; H. P. 51.—*Hab.* Z_1 in fontibus profundis secus ripas flum. *Adour,* socio *Jg. cordifolia* (n. 24).

Subtribus 3. Geocalyceæ, N. ab E.

13. *Saccogyna,* Dumortier.

54. *S. viticulosa,* L. Sp. Pl. p. 1597 (sub *Jung.*); Hook. Br. Jung. t. 60; Syn. Hep. p. 194; H. P. 52.

Hab. Z_0 P. occ. in rupibus ophiticis *Sti. Pandelon* prope Aquas Tarbellicas. "Les rochers crayeux de *Tercis,* de *Rivière*; les forêts de *St. Vincent,* de *St. Paul,* de *Narrosse*; les côteaux de *St. Pandelon*" (Grateloup, *l. c.*).

Subtribus 4. TRICHOMANOIDEÆ, N. ab E.

14. *Calypogeia,* Raddi.

55. *C. Trichomanis,* L. Sp. Pl. p. 1579 (sub *Mnio*). *Jung. Trichomanis,* Dicks.; Hook. Br. Jung. t. 79. *Calypogeia Trichomanis,* Corda; Syn. Hep. p. 198; H. P. 53.
Hab. Z_{0-2} ubique: fructifera in sylvis prope *Jurançon.*

15. *Lepidozia,* N. ab E.

56. *L. reptans,* L. Sp. Pl. p. 1599 (sub *Jung.*); Syn. Hep. p. 205; H. P. 54. *Jg. reptans,* Hook. Br. Jung. t. 65.
Hab. Z_{0-2} supra ligna putrida, vulgaris.

16. *Mastigobryum,* N. ab E.

57. *M. deflexum,* N. ab E.; Syn. Hep. p. 231; H. P. 55.
Hab. Z_{2-3} in sylvis editioribus, haud rarum. *Mte. Verte*; *V. de Castelloubon*; &c. *Lac Lehou* (Philippe!).

58. *M. trilobatum,* L. Sp. Pl. p. 1599 (sub *Jung.*); Syn. Hep. p. 230; H. P. 56. *Jg. trilobata,* Hook. Br. Jung. t. 76.
Hab. Z_{0-1} P. occ. in arborum excisarum truncis cariosis *Sti. Pandelon* prope Aquas Tarbellicas; locis similibus *Sti. Sever* invenit cl. Dufour! P. c. *Gorge de Labassère* (Philippe!).

Subtribus 5. PTILIDIEÆ, N. ab E.

17. *Trichocolea,* Dumortier.

59. *T. Tomentella,* Ehrh. (sub *Jung.*); Syn. Hep. p. 237; H. P. 57. *Jg. Tomentella,* Hook. Br. Jung. t. 36.
Hab. Z_{0-2} locis humidis, frequens. "In umbrosis humidiusculis, in collibus et ad arb. truncos prope *Dax*" (Grateloup, *l. c.*).

Subtribus 6. PLATYPHYLLÆ, N. ab E.

18. *Radula,* N. ab E.

60. *R. complanata,* L.; Hook. Br. Jung. t. 81 (sub *Jung.*); Syn. Hep. p. 257; H. P. 58.
Hab. Z_{0-2} ad truncos et rupes.

19. *Madotheca,* Dumortier.

61. *M. lævigata,* Schrad.; Hook. Br. Jung. t. 35 (sub *Jung.*); Syn. Hep. p. 276; H. P. 59.
Hab. Z_{0-2} in rupibus: semper sterilem inveni.

62. *M. platyphylla,* L.; Hook. Br. Jung. t. 40 (sub *Jung.*); Syn. Hep. p. 278; H. P. 60. *M. platyphylloidea,* N. ab E.; Syn. Hep. p. 280. *M. navicularis,* N. ab E.? Syn. Hep. p. 277?
Hab. Z_{0-2} in rupibus arboribusque, vulgatissima.

Subtribus 7. Jubuleæ, N. ab E.

20. *Lejeunia,* N. ab E.

Obs. The only species of this genus which attains the alpine region is *L. serpyllifolia,* but it is always unfertile there. *L. ovata* finds in the Pyrenees its only continental station, and but the second known, the first being the south-west corner of Ireland, around Bantry and Killarney. *L. calcarea* is confined to the rock indicated by its name*.

63. *L. serpyllifolia,* Dicks. Crypt. fasc. 4. p. 19 (sub *Jung.*); Syn. Hep. p. 374; H. P. 61.

Hab. Z_{0-3} in rupibus, arboribus imis, supra muscos, &c., frequens.

64. *L. ovata,* Tayl.! mst.; Syn. Hep. p. 376; H. P. 62.

Hab. Z_1 P. occ. inter muscos in rupibus subhumidis faucis *Gorge de Cauterets* dict. repens.

I have sedulously compared this with specimens of *L. ovata* gathered in company with Dr. Taylor at Cromaglown, one of his original stations, and cannot detect the slightest difference. It is a rather larger plant than *L. hamatifolia,* Hook., from which it differs essentially as follows: the leaves are *more lurid and opaque* (more chlorophyllose) and *never serrated,* as they are most frequently in the other; the larger lobe is *oblique, trapezoideo-ovate,* with the *margins convex* nearly to the apex (while in the ovato-acuminate leaves of *L. hamatifolia* the margins of the larger lobe are *concave* above the junction with the involute lobe); the involute lobe is smaller, and has not a projecting tooth near the apex as in *L. hamatifolia.*

65. *L. calcarea,* Libert; Syn. Hep. p. 344; H. P. 63. *Jg. hamatifolia β. echinata,* Hook. Br. Jung. t. Suppl. 3.

Hab. Z_2 P. occ. ad saxa calcarea in regione media montis *Pic de Ger,* ut et in valle *Combascou.*

* I did not observe *Lejeunia minutissima* in the Pyrenees, but it will not be out of place to mention here that I had lately the opportunity of examining Sir J. E. Smith's original specimens of this species, gathered in the New Forest by C. Lyell, Esq. in 1806, and figured on plate 1633 of Eng. Bot., and that they agree *as to the presence of stipules and every other essential character* with Hooker's figure in 'Brit. Jungermanniæ,' t. 52. Dr. Taylor was therefore in error (as I have always suspected) in maintaining Sir J. E. Smith's plant to be the *exstipulaceous* species; but as my distinguished and lamented friend was the first to clearly distinguish the latter, I propose that it shall bear his name, and the amended synonymy will stand thus:

Lejeunia minutissima, Smith! in Eng. Bot. t. 1633 (sub *Jung.*); Hook. Br. Jung. t. 52. *Jungermannia ulicina,* Tayl.! in Trans. of Edinb. Bot. Soc. 1841, i. p. 115. *Lejeunia ulicina,* Syn. Hep. p. 387.

Lejeunia Taylori, Spruce. *Jungermannia minutissima,* Tayl.! *l. c.* (non Smith). *Lejeunia minutissima,* Syn. Hep. *l. c.*

21. *Frullania*, Raddi.

66. *F. dilatata*, L. Sp. Pl. p. 1600 (sub *Jung.*); Syn. Hep. p. 415; Hook. Br. Jung. t. 5; M. P. 64.
Hab. Z_{0-3} in arborum cortice.

67. *F. fragilifolia*, Tayl.! in Annals of Nat. Hist. xii. p. 172; Syn. Hep. p. 437; H. P. 65.
Hab. Z_1 P. occ. in arboris unicæ trunco prope pagum *Gélos*.

68. *F. Tamarisci*, L.; Hook. Br. Jung. t. 6 (sub *Jung.*); Syn. Hep. p. 438; H. P. 66.
Hab. Z_{0-3} fere ubique, arborea et saxatilis.

Hemicyclum 2. *Frondosæ.*

Subtribus 1. Codonieæ, Dumortier.

22. *Fossombronia*, Raddi.

69. *F. pusilla*, L.; Hook. Br. Jung. t. 69 (sub *Jung.*); Syn. Hep. p. 468; H. P. 67.
Hab. Z_{0-1} in fossarum parietibus, haud vulgata. *St. Sever. Dax* (Grateloup). *B.-de-Bigorre.*

Subtribus 2. Haplolæneæ, N. ab E.

23. *Pellia*, Raddi.

70. *P. epiphylla*, L.; Hook. Br. Jung. t. 47 (sub *Jung.*); Syn. Hep. p. 488.
Hab. Z_{0-1} in fossarum marginibus.

71. *P. calycina*, Tayl.! in Mackay, Fl. Hib. Pt. 2. p. 55 (sub *Jung.*); Syn. Hep. p. 490; H. P. 68.
Hab. Z_{0-1} P. occ. et c. in rivulorum ripis udis circa *Dax, Pau* et *B.-de-Bigorre.*

24. *Blasia*, Micheli.

72. *B. pusilla*, L. Sp. Pl. p. 1605; Syn. Hep. p. 491; H. P. 69. *Jg. Blasia*, Hook. Br. Jung. t. 82–84.
Hab. Z_{0-1} P. occ. in rupibus ophiticis *Sti. Pandelon* prope Aq. Tarbellicas. P. c. in humidiusculis montis *Superbagnères.*

Subtribus 3. Aneureæ, N. ab E.

25. *Aneura*, Dumortier.

73. *A. pinguis*, L. Sp. Pl. p. 1602 (sub *Jung.*); Syn. Hep. p. 493.
Hab. Z_0 "in paludibus ac ripis, fontibusque prope Aq. Tarbellicas" (Grateloup, *l. c.*).

74. *A. multifida*, L. Sp. Pl. p. 1602 (sub *Jung.*); Syn. Hep. p. 496.

Hab. Z_0 "ad terram humidam prope fontes ac supra truncos putridos arborum, circa *Dax*" (Grateloup, *l. c.*).

75. *A. palmata,* Hedw. Theor. Gen. (sub *Jung.*); Ekart, Synops. Jung. t. 13. f. 115; Syn. Hep. p. 498; H. P. 70.
Hab. Z_{0-3} in truncis putridis. *Val de Jéret,* &c.

Subtribus 4. METZGERIEÆ, N. ab E.

26. *Metzgeria,* Raddi.

76. *M. furcata,* L.; Hook. Br. Jung. t. 55 et 56 (sub *Jung.*); Syn. Hep. p. 502; H. P. 71.
Hab. Z_{0-3} in saxis, arborum cortice, &c.

77. *M. pubescens,* Schrank; Hook. Br. Jung. t. 73 (sub *Jung.*); Syn. Hep. p. 504; H. P. 72.
Hab. Z_{0-3} in rupibus umbrosis montium frequens, planitiei rarior (*Dax*; Grateloup).

Tribus 2. MARCHANTIEÆ, N. ab E.

Subtribus 1. LUNULARIEÆ, N. ab E.

27. *Lunularia,* Micheli.

78. *L. vulgaris,* Micheli, Nov. Gen. Pl. p. 4. t. 4; Syn. Hep. p. 511; H. P. 73.
Hab. $Z_{0-1\ \mathrm{inf.}}$ in imis muris, viarum umbrosarum lateribus, &c. Pyrenæorum humiliorum ut et Agri Syrtici, frequens.

Subtribus 2. JECORARIEÆ, N. ab E.

28. *Marchantia,* Linnæus.

79. *M. polymorpha,* L. Sp. Pl. p. 1603; Syn. Hep. p. 522.
Hab. Z_{0-1} locis exustis, &c., in planitie vulgatissime, in montibus rarius.

29. *Preissia,* N. ab E.

80. *P. commutata,* N. ab E. Europ. Leberm. 4. p. lxv. et 117; Syn. Hep. p. 539; H. P. 74. *Marchantia androgyna,* Tayl.! in Linn. Trans. 17. p. 380. t. 12. f. 1.
Hab. Z_2 in rupibus humidiusculis. *Mont Lizé*; *Labassère,* &c.

30. *Dumortiera,* Reinwardt.

81. *D. irrigua,* Wils. in Hook. Eng. Fl. v. P. 1. p. 106 (sub *Marchantia*); Syn. Hep. p. 543; H. P. 75. *Hygropyla irrigua,* Tayl.! in Linn. Trans. xvii. p. 390.
Hab. $Z_{1\ \mathrm{inf.}}$ P. c. *B.-de-Bigorre,* ad ripas rivuli qui ad thermas dict. *de Salut* originem suam habet; sociis *Pellia calycina* et *Fegatella conica.*

31. *Fegatella,* Raddi.

82. *F. conica,* L. Sp. Pl. p. 1604 (sub *Marchantia*); Syn. Hep. p. 546; H. P. 76.
Hab. Z_{0-1} locis humidis.

32. *Reboulia,* N. ab E.

83. *R. hemisphærica,* Raddi in Opusc. scient. di Bolon. ii. p. 357; Syn. Hep. p. 548.
Hab. Z_0 *Dax,* in humidiusculis ac umbrosis (Grateloup; R. S.).

33. *Fimbriaria,* N. ab E.

84. *F. fragrans,* Schleich. Cent. exsicc. 3. n. 64 (sub *Marchantia*); Syn. Hep. p. 558.
Hab. Z_0 "ad margines fontium et fossarum ac in rupibus umbrosis prope *Dax*" (Grateloup, *l. c.*).

Subtribus 3. Targionieæ, N. ab E.

34. *Targionia,* Micheli.

85. *T. Michelii,* Corda in Opitz Beitr. i. p. 649; Syn. Hep. p. 574. *Targionia hypophylla,* L. Sp. Pl. p. 1604.
Hab. Z_0 "circa *Dax*" (Grateloup, *l. c.*).

Tribus 3. Anthoceroteæ, N. ab E.

35. *Anthoceros,* Micheli.

86. *A. lævis,* L. Sp. Pl. p. 1606; Syn. Hep. p. 586.
Hab. Z_0 "ad terram, in locis umbrosis humidiusculis, prope Aq. Tarb." (Grateloup, *l. c.*).

87. *A. punctatus,* L. Sp. Pl. p. 1601; Syn. Hep. p. 583; H. P. 77.
Hab. Z_{0-1} locis humidis solo argilloso præcipue. *St. Pandelon. St. Sever. Loucrup* prope *B.-de-Bigorre.*

Tribus 4. Riccieæ, Lindenberg.

36. *Sphærocarpus,* Micheli.

88. *S. Michelii,* Bell.; Mont. in Ann. des Sc. nat. ix. p. 39; Syn. Hep. p. 595.
Hab. Z_0 circa *Dax.* "Elle croît sur la terre humide de quelques landes de *Marensin,* par l'ancienne route de *Bordeaux* à *Bayonne*" (Grateloup, *l. c.*).

37. *Riccia,* Micheli.

89. *R. glauca,* L.; Syn. Hep. p. 599.
Hab. Z_0 "supra terram argillaceam in locis umbrosis *Dax*" (Grateloup, *l. c.*); locis cultis *Sti. Sever.*

90. *R. ciliata,* Hoffm.; Syn. Hep. p. 602.
Hab. Z_0 "ad terram madidam circa *Dax*" (Grateloup, *l. c.*).

91. *R. fluitans,* L.; Syn. Hep. p. 610.
Hab. Z_0 "in fontibus *Sti. Pandelon,* &c." (Grateloup, *l. c.*); *St. Sever* (Dufour !).

92. *R. natans,* L.; Syn. Hep. p. 606.
Hab. Z_0 "in aquis stagnantibus *Sti. Paul,* prope Aq. Tarbellicas" (Grateloup, *l. c.*).

XXI. *On the British species of* Plumbaginaceæ. By Charles C. Babington, M.A., F.L.S., F.G.S.

Read 8th February 1849.

The publication of the 12th volume of DeCandolle's invaluable 'Prodromus,' in which the description of the *Plumbaginaceæ* by M. E. Boissier is contained, has again drawn my attention to our native species included in that order, upon which I formerly bestowed considerable study, but without arriving at any satisfactory result. With the help of Boissier's descriptions I have now re-examined all the British specimens which I have been able to obtain, and although the result is far from being such as I could have wished, still it seems desirable to place it before botanists in order that their attention may be turned towards these plants, and thus some definite conclusion may perhaps be obtained.

1. Armeria, *Willd.*

Boissier does not seem quite satisfied concerning the permanency of some of the characters upon which the species of *Armeria* are founded, and it must be confessed that the result of my examination of our plants has not tended to increase any little dependence that I placed upon them. The characters to which I refer are those taken from the relative lengths of the pedicels and calyx-tubes, and the presence of hairiness upon the angles alone of the latter or over its whole surface.

I have however thought it desirable to characterize the possible species by employing distinctions derived from those parts as well as from others, in order that they may correspond with the species adopted in the 'Prodromus.' I shall then notice two other specimens of which I am in possession; and also make a few remarks upon a possible mode by which the supposed species might be combined if the doubtful characters were neglected.

Armeria, *Willd.*

Sec. 2. Plagiobasis. § 1. Holotrichæ, *Boiss.*

Tubus calycinus totus et ad costas et ad costarum intervalla pilosus.

1. *A. maritima* (Willd.); *foliis* linearibus obtusiusculis uninerviis *planis* glabris vel parce ciliatulis, scapis villosulis, *involucri phyllis*

latis obtusisque, *dorso late herbaceis* exterioribus dorso excurrente acutiusculis, reliquis late scarioso-marginatis muticis, *pedicello calycinum tubum æquante.*

A. maritima, *Willd. En. Berol.* i. 333; *DeCand. Prod.* xii. 677.

The leaves of this plant are numerous, thin, rounded at the end, usually much shorter than the scape, but sometimes of half its length. The outer involucral bracts are ovate, and have on their backs a broad green herbaceous band extending to a little beyond their summit where it forms a strong and short mucro. The inner bracts are also furnished with the dorsal green band, but in them it terminates abruptly at some distance below the end which is similarly scarious with the sides. The calyx-tube is very thickly clothed with hair both on its angles and in the hollows between them; it is about as long as the limb which has short acute lobes each furnished with a slightly excurrent rib forming a short awn.

Boissier states that he has seen specimens of this plant from England and Ireland, and that it inhabits the maritime districts of northern and middle Europe. He does not quote any figure of it, nor am I aware that any exists, for that contained in 'Eng. Bot.' doubtless represents *A. pubescens,* to which also belong most of my specimens preserved under the name of *A. maritima.* The only specimens to which I can satisfactorily apply the name of *A. maritima* were gathered in Jersey in June and July 1837 and 1838 by myself, and near Chichester, Sussex, by the Rev. W. W. Newbould in 1842.

2. *A. pubigera* (Boiss.); *foliis* linearibus obtusiusculis uninerviis *subtriquetris superne subcanaliculatis punctulatis* facie inferiori obtuse carinatis, scapis pubescentibus, *involucri phyllis* pallide brunneis *scariosis* dorso incrassatis exterioribus cuspidatis, reliquis latis obtusis apiceque scariosis, *pedicellis tubo calycis dimidio brevioribus.*

A. pubigera β. scotica, *Boiss. in DeCand. Prod.* xii. 678.

A. maritima, *Bab. Iceland Plants in Ann. Nat. Hist.* xx. 33.

The leaves of this plant are shorter than those of *A. maritima,* and their sides are so far folded together as to cause them to appear to be very narrow. The outer involucral bracts are blunter than those of the preceding plant, but have a more slender and acute point. My specimens do not afford me conclusive evidence of the presence or absence of a dorsal green band, but the bracts are certainly thickened, and were perhaps green in that part similarly to those of *A. maritima.* The calyx-tube is not so thickly hairy as in the preceding plant, but is similarly covered throughout with hairs; it is about as long as the limb, which has very short acute lobes terminating in longer awns than those of *A. maritima.*

Boissier places our plant (which he has seen from the island of Staffa alone) as the variety *scotica* of his *A. pubigera,* with which species, if I am correct in supposing that my specimens are the same plant, it does not very well accord. *A. pubigera* appears to be only known in cultivation and is stated to be "tota dense pubescens," and its involucral bracts are described as "omnino scariosis." In our plant the pubescence is far from being dense, on the leaves it is very thin and scattered, and the involucre is quite glabrous. The latter part also cannot be described as "omnino scariosum," for its bracts are certainly much thickened on the back, and present the appearance of having been green there.

My specimens vary greatly in size, but are doubtless states of one species. They were obtained at Southampton in June 1827, Tintagel, Cornwall, July 1839, by myself; at West Wittering, Sussex, in Nov. 1843, by the Rev. W. W. Newbould; Folkestone, Kent, by Mr. W. Pamplin; and Tenby, Pembrokeshire, by Mr. F. J. A. Hort.

The plant gathered near Reikiavic in Iceland in July 1846 is undoubtedly of this species.

§ 2. PLEUROTRICHÆ, *Boiss.*

Tubus calycinus ad costas tantum pilosus, intervallis costarum glabris.

* Spiculæ intra involucrum sessiles.
a. Folia inter se subconformia.

3. *A. pubescens* (Link); *foliis* linearibus uninerviis *planis* glabris puberulisve, scapis pubescentibus, involucri phyllis dorso late herbaceis exterioribus triangulari-ovatis acutis, reliquis latis obtusis et scarioso-marginatis muticis, pedicello calycinum tubum æquante.

A. pubescens, "*Link in Rep. Nat. Cur. Berol.* i. 180;" *DeCand. Prod.* xii. 680.
Statice Armeria, *Eng. Bot.* t. 226.

Leaves short, usually much shorter than the scape, bluntly pointed or sometimes even on the same plant acute. The outer involucral bracts are different in shape from the others, but do not exceed them in length. The tube of the calyx is perfectly glabrous between the prominent hairy ribs; it is about as long as the limb, and has very broad short and acute lobes with the rib extending to the end, but it can scarcely be considered as excurrent.

I believe this to be a frequent inhabitant of salt marshes and the sea-shore, perhaps more common in Britain than the *A. maritima,* which it very greatly resembles. My low-country specimens (from Montrose and Dolgelly) have scapes of 5 or 6 inches in length and leaves from 1 to 3 inches long. It is also frequently found on mountain tops, and has been mistaken in Britain for *A. alpina,* which is a totally different plant. On mountains the scapes are usually, but not always, considerably shorter than in plants growing near to the sea, and the pedicels are shorter than the calyx-tube, often not above half its length. In other respects they correspond. I possess two curious specimens, gathered upon the exposed summit of Croghan mountain in the isle of Achil in Ireland, in which the leaves are hardly half an inch long and the scapes do not exceed an inch in length.

In addition to the above-mentioned specimens from Achil I have the alpine plant before me from Caernarvonshire (Snowdon and Glyder), Cumberland (Helvellyn), Yorkshire (Wensley Dale), Aberdeenshire (Ben na Bourd), and Orkney.

It may justly be doubted how far this plant has claims to be considered as a distinct species from *A. maritima.* The peculiar clothing of the calyx-tube in each seems to be the only tangible point of difference between them.

4. *A. duriuscula*; *foliis* linearibus obtusiusculis uninerviis *subtriquetris superne subcanaliculatis* facie inferiori obtuse carinatis pilosis, scapis pubescentibus, involucri phyllis dorso late herbaceis exterioribus triangulari-ovatis acutis, reliquis latis obtusis et scarioso-marginatis muticis, pedicello calycinum tubum subæquante.

Leaves short, about half as long as the scape, folded in a similar manner with those of *A. pubigera,* but more slender. The outer involucral bracts are much narrower than the others, and very similar to, but shorter than, those of *A. pubescens.* The tube of the calyx is quite glabrous between the prominent hairy ribs, it is about as long as the limb, and has broad short very acute lobes with the midrib scarcely extending to the end.

I have been unable to identify this plant with any of the species described by Boissier, and am therefore forced to consider it as new. It greatly resembles *A. pubigera,* but its leaves are not punctured on the upper surface, its involucral bracts are broadly herbaceous on the back, its calyx-tube is not uniformly pilose, its calyx-lobes are not awned, and its pedicel is longer. To our other species it bears a very slight resemblance, and is at once distinguished from them by its leaves.

I am indebted for my specimens to my friend Mr. F. J. A. Hort, of Trinity College, Cambridge, who gathered it on the Tors near the sea at Ilfracombe, Devonshire, in July 1848, by whom the specific name was suggested.

5. *A. plantaginea* (Willd.); foliis lineari-lanceolatis 3–5-nerviis margine anguste membranaceis, scapis glabris scabris, involucri phyllis exterioribus triangularibus lanceolatisve cuspidatis in

alabastro juniori capitulum superantibus, reliquis ovatis obovatisque membranaceo-marginatis obtusis, pedicello vix tubo calycis dimidio æquante.

A. plantaginea, *Willd. En. Berol.* i. 334 ; *DeCand. Prod.* xii. 683 ; *Eng. Bot. Suppl.* t. 2928.

The broader leaves furnished with more than one nerve distinguish this plant from our other species. It is remarkable that Boissier describes the pedicel of this species as equalling the calyx-tube, whereas I have never found it to equal the half of that part in length, and that he combines with it the *A. scorzonerifolia* (Willd.), to which Koch awards a pedicel shorter than half the calyx-tube.

Our only station for this plant is the island of Jersey.

Having described all the supposed species which are known to be natives of Britain, I proceed to make a few remarks upon two specimens preserved in my herbarium which I am unable to refer to either of the above, and do not feel myself justified in naming even as probable new species.

1. A plant gathered at Trewavas near Marazion in Cornwall, in July 1839.

This accords in most respects with *A. pubescens*, but has quite glabrous scapes, ovate and scarcely acute outer bracts, and very short petioles. Its heads also are remarkably small. Had not so much stress been laid upon such differences as these by Boissier and others who have a far more extended knowledge of the genus than I possess, I should have unhesitatingly placed this as a form of *A. pubescens*, and it is only a deference for high authorities that even now prevents me from doing so. It exactly resembles some of the smaller states of that plant.

2. A plant found on the shores of the Gare Loch in Dumbartonshire in Aug. 1838 by the Rev. Churchill Babington.

This also agrees very closely with *A. pubescens*, and is probably a variety of it. It differs solely in having its spikelets shortly but distinctly stalked within the involucre. This character is employed to distinguish a subsection by Boissier, and is therefore doubtless deserving of attention.

I may now remark, that of the above supposed species *A. maritima* and *A. pubescens* most closely resemble each other, their outermost bracts differ slightly in form, and the latter has its calyx-tube pilose only upon the prominent angles, the interstices being quite glabrous. As far as I have myself had an opportunity of observing, the latter character appears to be constant ; but should such prove not to be the case, and I beg to call particularly the attention of botanists to it, then they might very well be combined under the name of *A. maritima*, the older although far from being the better name.

If we now consider the other two doubtful species (for *A. plantaginea* cannot be questioned), *A. pubigera* and *A. duriuscula*, we shall find that if the herbaceous back of the bracts, a doubtful point as far as our plant is concerned, be neglected, the latter differs from the former by having longer pedicels and a pilose-striate calyx-tube. The character derived from the length of the pedicels is apparently so far constant as not to allow of its being neglected until greater evidence of its variability is obtained. I trust that I may be allowed to recommend this point also to the attention of botanists who have an opportunity of examining the living plants. On the distinction founded on the calyx-tube no further remark is necessary.

It does not appear that we are in a position to overthrow the characters upon which Boissier has founded his sections, and until such is the case we must recognize these four plants as distinct species, although I have a very strong suspicion that they really constitute only two.

2. Statice, *Linn.*

I now proceed to attempt to bring the nomenclature of our species of *Statice* into conformity with that used in the 'Prodromus.' In accordance with Boissier's views, which I am inclined to adopt, all our species will alter their names with the exception of *S. Limonium*, and one will be added to their number. Our plants form part of the section *Limonium* (Boiss.) and will stand as follows.

1. *S. Limonium* (Linn.); foliis elliptico-oblongis mucronatis uninerviis venosis basi in petiolum attenuatis, scapo subtereti superne corymbosis, *spiculis* 1–3-floris ascendentibus *in spicas* secundas *patentes vel recurvas* distiche et *dense congestis*, calycis limbo propter denticulos minutos inter lobos majores integros acutos sitos subdecemlobo, bractea exteriori parva dorso herbaceo carinato excurrente.

S. Limonium, *Eng. Bot.* t. 102; *DeCand. Prod.* xii. 644.
S. Behen, *Drej. Fl. Hafn.* 122; *Fries, Summa Plant. Scand.* 200.
S. Limonium, 1. Scanica, *Fries, Nov. Fl. Suec. Mant.* i. 10; *Mant.* ii. 17.

Scape usually not branching in its lower half, often not until near the corymbose summit. Spikes short. Spikelets densely imbricated. Outer bract acute, with an excurrent herbaceous point and a white or brownish membranous margin; inner twice or three times as long, white and membranous at the sides and blunt or emarginate or split summit. Leaves blunt with a mucro and wavy at the edges, or acute and mucronate and scarcely at all wavy.

Muddy salt marshes on the English coasts. Is it found in Scotland or Ireland?

2. *S. Bahusiensis* (Fries); foliis oblongo-lanceolatis mucronatis uninerviis venis inconspicuis in petiolum decurrentibus, scapo subangulato ramosissimo paniculato, *spiculis* 1–3-floris secundis distantibus *in spicas arrectas vel incurvatas laxe dispositis*, calycis limbo propter denticulos minutos inter lobos majores denticulatos acutos sitos subdecemlobo, bractea exteriori parva dorso herbaceo subexcurrente.

S. Bahusiensis, *Fries*, "*Herb. Normale*, iii. 18;" *Summa*, 200; *DeCand. Prod.* xii. 644.

S. Limonium, 2. Bahusiensis, *Fries, Nov. Fl. Suec. Mant.* i. 10; *Mant.* ii. 17 (excl. syn.).

S. rariflora, *Drej. Fl. Hafn.* 121; *Reich. Fl. exsic.* 2200; *Eng. Bot. Suppl.* t. 2917.

Scape nearly always branching from near its base, not at all corymbose, and although much divided below, the ultimate subdivisions (or spikes) are long and simple. Spikelets often only 1-flowered, quite distinct, not imbricated. Outer bract broad, cuspidate or acute, with a slight mucro and a white membranous margin usually deeply tinged at its base with pink; inner twice as long, very blunt. Leaves usually blunt with a mucro from, or from just beneath, the extremity, nearly even at the edges.

Inhabiting less muddy places than *S. Limonium*, and found throughout the United Kingdom.

A few observations upon the name of this plant are necessary. Boissier has adopted that employed here, owing probably to Fries's observation in his 'Summa Plant. Scand.' (200): "*e prioritatis lege* hæc species *S. Bahusiensis*, sub quo nomine sex annos ante Dreyerum descripsi et in H. N. distribui, dicenda est." At a first view this would seem most conclusive, but on a more careful examination it appears that the name was given in the 'Mantissa altera' (anno 1839) to the plant as a species having been used for the sake of distinction, but apparently not specifically, in the 'Mant. prima' (1832). As unfortunately I am not in possession of the 'Herb. Normale,' iii., I do not know if the plant was there considered as a species or variety (although from the remark already quoted probably as the former), nor the date of its publication. Drejer published his 'Flora Hafn.' in 1838, and has therefore the priority if the second 'Mantissa' is the origin of the name *S. Bahusiensis* used specifically; but if it was so used in the 'Herb. Norm.' it is then probable that it is the older name, and its use there is a sufficient publication to give it the claim "prioritatis lege."

3. *S. Dodartii* (Gir.); foliis obovato-spathulatis basi trinerviis et in petiolum alatum decurrentibus, scapis rigidis rectis alternatim ramosis, *ramis sterilibus nullis*, spiculis 2–4-floris in *spicas* lineares *crassas* subverticales distiche et dense imbricatis, calycis limbo 5-lobo denticulis intermediis nullis: lobis obtusis integris.

S. Dodartii, *Girard in Ann. Sc. Nat.* ser. 2. xvii. 31. t. 4; *DeCand. Prod.* xii. 648.

Limonium minus bellidis minoris folio, *Dodart, Mem.* ed. 1676, p. 95.

Scape usually not branched in its lower half in our plant; branches often simple, short. Outer bract acute; inner twice as long, obovate-elliptical, obtuse; both with white diaphanous margins faintly tinged with pink. Leaves blunt with a small mucro usually from just below the extremity.

Rocky shores. Berry Head, Devon, *Miss A. Griffiths.* Langland Bay and Pennard, Glamorganshire. Giltar Head, Pembrokeshire.

4. *S. occidentalis* (Lloyd); foliis lanceolato-spathulatis acutiusculis basi obscure trinerviis et in petiolum alatum longe attenuatis, scapis gracilibus flexuosis fere a basi dichotome ramosissimis, *ramis inferioribus nonnullis sterilibus,* spiculis 2–4-floris in *spicas tenues* suberectas lineares distiche imbricatis, calycis limbo 5-lobo denticulis intermediis nullis: lobis obtusis integris.

S. occidentalis, *Lloyd, Fl. Loire inf.* 212; *DeCand. Prod.* xii. 648.
S. Dodartii β. humilis, *Gir. Ann. Sc. Nat.* ser. 3. ii. 326.
S. lanceolata, *Reich. Iconog.* t. 719. f. 961.
S. cordata, *G. E. Smith, Pl. of S. Kent,* 18. t. 2.
S. reticulata, *Hook. Fl. Scot.* i. 97.
S. binervosa, *G. E. Smith in Eng. Bot. Suppl.* t. 2663.

Scape usually branching quite from its base; branches repeatedly forked, elongated. Outer bract acute; inner twice as long, obovate-cuneate, obtuse; both with a deep pink band at the base of the white diaphanous margin. Leaves often rather acute, with a small mucro usually from below their extremity.

On the chalk cliffs of Kent. Shingly places near Cley next the sea, Norfolk. Cliffs at the Mull of Galloway. Near Dublin, *Dr. Tyacke.* Cliffs near St. Helier's, Jersey; and in Alderney. St. Martin's, Guernsey, *Rev. W. W. Newbould.*

This is doubtless the *Limonium minus* of Ray (Syn. ed. 3. 202), the *L. parvum* of Gerard (Herb. 332; Em. 411) as supposed by the Rev. G. E. Smith, for the figure given by the latter author after Lobel (Icon. 291) can represent no other known British species. The sterile branches show that it is not intended for any variety of *S. Limonium,* as was supposed by Smith. It is much to be wished that some competent botanist would inform us what is the *Statice* which grows "upon the chalkie cliffe going from the towne of Margate downe to the sea side, upon the left hand," for that is the only place where Gerard found his plant. Dillenius (Ray's Syn. ed. 3. 202) adds Ramsgate and Harwich as stations for it.

It seems clear that the *S. spathulata* (Desf.) obtained "in rupibus maritimis Barbariæ ad la Calle," of which Boissier has seen an authentic specimen, is quite distinct from the *S. spathulata* of British authors (see DeCand. Prod. xii. 649); and after a careful examination of our plants I am satisfied that Boissier is correct in supposing that two species are included under the *S. spathulata* of Hooker, and that they are the *S. Dodartii* (Gir.) and *S. occidentalis* (Lloyd). I have not seen French specimens of the former, but can have no doubt of its identity with our plant after comparing it carefully with M. de Girard's elaborate description (Ann. Sc. Nat. ser. 2. xvii. 31), although there are a few slight discrepancies. I am possessed of a good specimen of the *S. occidentalis*, through the kindness of M. Lenormand of Vire, and find it to accord precisely with the other form called *S. spathulata* by us. As also I am possessed of an authentic specimen of the *S. binervosa* (G. E. Sm.), which is doubtfully referred to *S. occidentalis* by Boissier, I am enabled to state that they are undoubtedly the same plant, although no sterile branches are represented on the plate in 'Eng. Bot. Suppl.' As that name was published in 1830 it has the priority of the one here adopted, which dates only from 1844. The high authority deservedly awarded to the 'Prodromus,' which will doubtless cause the use of Mr. Lloyd's name universally on the continent, seems a sufficient reason for not attempting to replace it by one which we could scarcely, under the circumstances of the case, expect to be adopted out of Britain. I trust therefore that my friend Mr. Smith will excuse my not following his nomenclature in this case.

5. *S. caspica* (Willd.); foliis obovato- vel lanceolato-spathulatis in petiolum attenuatis, scapis a basi ramosissimis granulato-scabris, *ramis inferioribus capillaceo-multifidis sterilibus : axillis acutangulis*, spiculis 2–3-floris in spicas ad ramorum extremitatem confertas densissime congestis, calycis limbo 5-lobo denticulis intermediis nullis : lobis ovatis cuspidatis denticulatis.

S. caspica, *Willd. En. Berol.* i. 336 ; *Bieb. Fl. Tauro-Cauc.* iii. 253 ; *Bert. Fl. Ital.* iii. 530 ; *Reich. Iconog.* ii. t. 194 ; *DeCand. Prod.* xii. 660.

S. reticulata, *Bieb. Fl. Tauro-Cauc.* i. 250; *Sm. Eng. Bot.* t. 328 ; *Eng. Fl.* ii. 116. not *Linn.*

S. bellidifolia, *DeCand. Fl. Fr.* iii. 421.

S. dichotoma, *Duby, Bot. Gall.* i. 388. not *Cavan.*

Scape often simple for about an inch from its base, but afterwards repeatedly forked with acute-angled axils. Outer bract almost wholly diaphanous, bluntly pointed; inner twice as long, blunt, upper half wholly diaphanous. Leaves short, variable in breadth and often rather acute, usually with a small mucro from below their extremity; the point sometimes so strongly recurved as to cause the leaf to appear retuse.

Muddy shores of Norfolk and Suffolk. Jersey, *Dr. Jos. Dickson.*

British botanists will doubtless complain that the name usually employed by them for this plant is here replaced by one nearly or altogether a stranger to them, and which certainly seems far from appropriate when applied to an English plant; but it may be remarked that the name *S. reticulata* has been attached to so many quite different species as to make its retention a source of confusion and difficulty rather than of use. The remark of Boissier seems very just when, after stating that the Linnæan plant is probably that now called *S. cancellata* (Bernh.), he adds, "hoc nomen cæterum multis plantis attributum omnino rejiciendum." The Linnæan specific character is short, but to my mind conclusive against our plant being his *S. reticulata*. His words are, "S. scapo paniculato prostrato, ramis sterilibus retroflexis nudis, foliis cuneiformibus" (Sp. Pl. 394); and it is curious to observe how Smith, when publishing the supposed *S. reticulata* in 'Eng. Bot.' (t. 328), slightly altered that character by the addition of the words "a little pointed" to the description of the leaves: in the 'Eng. Fl.' (ii. 116) he has omitted the term "ramis retroflexis" of Linnæus, but still says "leaves wedge-shaped" in the specific character, but alters it to "spathulate" in the description. Our plant certainly cannot be correctly described as having "ramis sterilibus retroflexis," for they are all ascending or even erect, forming very acute angles at their bifurcations; neither are its leaves at all "wedge-shaped," but may be correctly designated obovate-spathulate. The remark in 'Eng. Bot.,' that the "bark in our specimens is a little crisped and tuberculated, which we do not observe in the Linnæan ones," shows that Smith was not altogether satisfied of the identity of the plants.

Let us now turn to the *S. cancellata* (Bernh.), a specimen of which (the *S. furfuracea*, Reich. Fl. exsic.) is now before me, and we shall find the "ramis retroflexis" of Linnæus, or as Boissier says, "scapis ramosissimis rectangule-infracto-flexuosis," and also the "foliis cuneiformibus," or as he describes them, "obovato-cuneatis retusis."

Having I think disposed of the name *S. reticulata* as applicable to our plant, we now come to the proof of its identity with the *S. caspica* (Willd.), and here it may be remarked that Sir W. J. Hooker (Br. Fl. ed. 5. 272) states that he is satisfied that "the *S. caspica* of Willdenow is the same as" the *S. reticulata* of Smith. I have now before me an extensive series of specimens of the European forms of *S. caspica*, viz. of the *S. dichotoma* of Duby, *S. bellidifolia* of DeCandolle, and *S. caspica* of Reichenbach. All of them are unquestionably the same species as our *S. reticulata* from Norfolk, indeed I do not find that they differ in any respect. In none of them are the leaves at all retuse, as seems sometimes to be the case with the Taurian plant described by Bieberstein, and originally called *S. reticulata* by him, but afterwards identified with the *S. caspica* of Willdenow, the Linnæan synonym being excluded. Can it be that the falsely retuse appearance occasionally put on by the leaves, as noticed in the above description of our plant, has deceived him?

Having now noticed all our known species of *Plumbaginaceæ*, I submit these remarks to the consideration of botanists, in the hope that they will be received with those allowances for their imperfect character which an attempt to elucidate so difficult a tribe of plants seems to require, and that they may lead to a more complete knowledge of this beautiful portion of our flora than we as yet possess.

St. John's College, Cambridge, Jan. 18, 1849.

XXII. *Algæ Orientales:—Descriptions of new Species belonging to the genus* Sargassum. By R. K. Greville, LL.D. &c.

[Continued from p. 102.]

Read 12th April 1849.

At the moment when I have brought these descriptions of *Sargassa* to a close, I have learned that the first volume of the 'Genera et Species Algarum' by the younger Agardh, has appeared. This I was, of course, unprepared for, having never, in fact, even seen the work advertised. I would gladly have deferred bringing forward my present series of papers until I could have had the benefit of consulting that work, but it is now too late, and some confusion in nomenclature will be the probable result. It will be remembered that in commencing these descriptions I stated, that with few exceptions the subjects had been transmitted to me by my friend Dr. Wight for publication in the second volume of the 'Prod. Fl. Ind. Orientalis,' and that the interruption which had occurred in the continuation of that undertaking had induced me, after retaining my notes and drawings for many years, to publish them in a modified form through the medium of the Botanical Society. It is quite possible that during such an interval of time the author of the 'Genera et Species Algarum' may have received from other travellers some of the species discovered by Dr. Wight, in which case there will inevitably be a collision of names; and although my manuscript has been lying by me for a long period, M. Agardh will have the unquestionable right which priority of publication confers. Where, however, we may have unfortunately described under different names the same plant, I may be allowed to hope that the figures which I have given will assist in removing the confusion.

19. *Sargassum gracile* (nob.); caule teretiusculo, filiformi; foliis linearibus, utrinque attenuatis, remote subdenticulatis, uninervibus; vesiculis parvis, subsphæricis, muticis, petiolatis, petiolis planis, dilatatis; receptaculis ramosis, axillaribus, lineari-cuneatis, ad apicem compressis, acute et grosse dentatis.

Hab. in mari Peninsulæ Indiæ Orientalis; Wight.

Root I have not seen. *Plant*, as far as I can judge from the mutilated specimens before me, 2 or 3 feet in length or more. *Stem* cylindraceous, filiform, giving off numerous spreading branches at intervals of about one inch, and which are 6 inches to a foot or more long. These branches are clothed with others several inches in length, produced at shorter intervals, on which are situated the fruit-bearing ramuli. *Leaves* an inch long or more, about a line broad, linear, acuminate, almost entire, or remotely denticulate, furnished with a nerve and pores, and attenuated below into a very slender petiole. *Vesicles* about a line in diameter, subspherical, sometimes slightly pyriform, destitute of apiculus, supported on flat, foliaceous, dilated stalks, 1–1½ line in length, and produced from the raceme of fructification. *Receptacles* axillary, and occasionally also terminal, 1–2 lines long, linear-cuneate, cylindraceous and unarmed below, compressed and dilated above, and furnished at the margin and apex with large, sharp, often curved teeth. The receptacles form a sparingly divided raceme, one of the lower branches of which often terminates in a vesicle. Occasionally a receptacle becomes triquetrous in the upper part, in which case every angle is toothed: sometimes receptacles appear to be proliferous, suggesting the idea of a microscopic *Cactus*; at others they are long and slender to the apex which suddenly expands into a broad mass or crown of foliaceous teeth. *Colour* reddish brown. *Substance* slightly cartilaginous.

The habit of the entire plant is lax and slender.

20. *Sargassum leptophyllum* (nob.); caule brevi, tereti, tuberculato; ramis primariis compressis; foliis integerrimis, angustissime linearibus, attenuatis; vesiculis parvis, ovalibus, muticis, tuberculatis; receptaculis minutis, racemosis, axillaribus, cylindraceis, oblongis vel oblongo-cuneatis.

Hab. in mari Peninsulæ Indiæ Orientalis; Wight.

Root a small callous disc. *Stem*, in the single example before me, scarcely half an inch long, about as thick as a sparrow's quill, tuberculated. The very young branches which arise from this are quite flat and foliaceous, the young leaves having at first the character of pinnatifid expansions of the frond, afterwards becoming ovate or elliptical. The old branches are 1–2 feet long, compressed, about half a line broad, and begin to give off secondary branches several inches in length almost immediately, which in their turn bear a third series half an inch to an inch and a half long on which are produced the very short fertile ramuli. *Leaves* on the mature plant very numerous, an inch long or more, linear, attenuated, not half a line broad, quite entire, with a faint nerve and a few pores. *Vesicles* very numerous, oval, tuberculated with the prominent pores; those at the base of the small branches about a line in diameter; the rest much smaller; all supported on stalks 1–2 lines long, flat and very slender. *Receptacles* numerous, axillary, less than a line long, cylindraceous, oblong or somewhat cuneate, or partly divided, forming along with the vesicles a minute, considerably branched raceme.

A slender species, but well-clothed with branches, leaves, vesicles and fructification. It has a great resemblance in habit to *S. concinnum*, but differs widely in the fructification.

21. *Sargassum flexile* (nob.); caule tereti, filiformi; foliis caulinis linearibus, inciso-serratis, ramis angustissime linearibus, serrato-dentatis; vesiculis sphæricis, petiolatis, petiolis filiformibus; receptaculis cylindraceis, lineari-clavatis, in racemo laxo dispositis.
Sargassum angustifolium, Ag. Sp. Alg. vol. i. p. 32?
Hab. in mari Peninsulæ Indiæ Orientalis; Wight.

Root a callous disc, throwing up several stems, three feet or more long, terete, in my specimens not thicker than a sparrow's quill, giving off branches 3–12 inches in length at intervals of 1–2 inches. These branches bear a second series at short intervals, on which are situated the fruit-bearing ramuli. *Leaves*; those arising from young shoots close to the root, sessile, oblong or linear-lanceolate, obtuse, quite entire, furnished with a strong nerve reaching to the apex, and very minute pores. The *cauline leaves*, or those produced at the base of the primary branches, linear, an inch or more long, and above a line broad, somewhat acuminate, irregularly inciso-serrate, those towards the base of the stem more or less sessile. On the branches the leaves are about three-fourths of an inch long, a third of a line, or even still less, in breadth, attenuated below into a capillary footstalk; the margin so finely toothed as to appear spinulose under a lens. There is a faint nerve, and notwithstanding the small space, scattered pores on each side. *Vesicles* spherical, about a line in diameter, on short filiform stalks, and found either at the base of the small branches or accompanying the racemes. *Receptacles* axillary, and occasionally terminal, cylindraceous, linear-clubshaped, smooth, a line or more long, forming a lax raceme with 2–5 branches, sometimes solitary. *Colour* pale reddish brown. *Substance* between cartilaginous and membranaceous.

As I do not possess an authentic specimen of *Sargassum angustifolium*, and as my copy of Turner's 'Historia Fucorum' is not at hand, I can only consult the character and description of that plant given by Agardh. And I find there so much that agrees with the Alga I have now before me, as to make me very doubtful whether the latter be really distinct. At the same time there are considerable discrepancies. No reference is made to the cauline leaves of my plant, which are very conspicuous. The leaves on the branches, which resemble those of *S. angustifolium* in their extreme narrowness, are not sessile as described by Agardh, but pass insensibly into long and very slender footstalks. The vesicles are *not* mucronate, nor are their little stalks dilated. Lastly, the receptacles are not "*subsolitaria,*" but in racemes of several branches, and instead of being linear-lanceolate, are linear-clavate, obtuse and rounded at the apex. Under these circumstances I have thought it best to separate it in the meantime, and to give a figure which may assist in its ultimate determination.

EXPLANATION OF PLATE XV.

Sargassum gracile.

Fig. 1. Summit of a branch.
— 2. Receptacles and vesicle.
— 3. Receptacle crowned with a tuft of large semifoliaceous teeth.
2 & 3 magnified.

Sargassum leptophyllum.

Fig. 1. A small branch.
— 2. Leaves on very short young shoots, springing from the root.
— 3. A leaf from the branches, with raceme of receptacles and vesicles.
— 4. Raceme.
— 5. Vesicles.
— 6. Do. with long foliaceous stalks.
— 7. One of the same. 3, 4 and 7 magnified.

Sargassum flexile.

Fig. 1. Summit of a branch.
— 2. Cauline leaf.
— 3. Leaves on very short young shoots, springing from the root.
— 4. Portion of a branch from near the summit of the frond, with racemes.
The last magnified.

XXIII. *On the Chemical Composition of the Fluid in the Ascidia of* Nepenthes. By Dr. A. Voelcker of Frankfort.

Read 12th July 1849.

The watery secretions of certain plants belonging to the genera *Nepenthes, Cephalotus,* and *Sarracenia,* have long attracted the attention of botanists; but whilst the secreting organs of these plants have been minutely described, the chemical nature of the fluid itself has been but very imperfectly examined. That these liquids have not met with the attention to which their importance entitles them, may be accounted for by the circumstance that few chemists have an opportunity of obtaining the unaltered fluids, and that even those who are fortunate enough to procure them, seldom can command a sufficient quantity to enable them to investigate their nature. With the exception of Dr. Turner's analysis of the fluid in the ascidia of *Nepenthes,* I know of no other analysis of this fluid or of similar secretions. The botanists who have given attention to the subject of the watery secretions of the leaves of plants have found these secretions to consist in most cases of nothing but pure water, and have only occasionally discovered in them some vegetable matter. Treviranus for instance observed a tasteless water in the corolla of *Maranta gibba,* which he however did not further examine; the same gentleman examined the watery secretion of *Amomum Zerumbet,* and caused Dr. Göppert to subject it to chemical analysis, from which it resulted that the fluid between the scales of the spikes consisted of almost pure water, containing a small quantity of vegetable fibre and mucus.

The most remarkable instance of a watery secretion from the leaves of plants is recorded in the 'Annals of Natural History' for 1848, in a paper by Mr. Williamson, who observed that the leaves of *Caladium destillatorium* had the peculiar power of exhaling watery fluid from a point near the apex on the upper side. Each full-grown healthy leaf, according to Mr. Williamson's observation, produced about half a pint of water during the night, which, on being analysed, was found to contain a very minute portion of vegetable matter.

It appeared to me highly improbable that these fluid secretions should consist of pure water with merely a trace of vegetable matter, and no inorganic substances whatsoever. If they are to be regarded as true secretions, we naturally should expect them to contain some of the salts which we find in all juices of plants. I was therefore anxious to examine this point, and I am glad that I have an opportunity of bringing the results of my analysis of the fluid in the ascidia of *Nepenthes* before the notice of the Botanical Society. It is through the kindness of Prof. Balfour, Mr. Evans of the Experimental Gardens, Messrs. Jas. Dickson and Sons, and Sir W. Hooker, that I have obtained the materials for the following analysis, and I consider it my duty to express here publicly my deep sense of gratitude for the kindness and liberality with which the above-named gentlemen have assisted me in carrying on this inquiry. I have also to express my obligations to Dr. George Wilson for kindly allowing me the use of his laboratory.

Linnæus regarded the ascidia of *Nepenthes* as a natural reservoir for rain, and thought that the water found in them was introduced from without, and was not secreted by the plant itself. His opinion however has been contradicted already by many botanists, especially Treviranus, who observed that the water in the pitchers of *Nepenthes destillatoria* is always clear, and that there exists a distinct secreting apparatus. Treviranus says, in an article which appeared in the 'Edinb. New Philosoph. Journal' for Oct. 1832—April 1833:—"The parietes of the leaf of *Nepenthes destillatoria* are traversed by a multitude of proportionally large anastomosing veins, which contain many true spiral vessels. The upper half of its inner surface is covered with a blue rind, as parts often are which require to be protected from the action of water; the under half is, on the contrary, shining and full of gland-like eminences directed downwards, and having a hole almost visible to the naked eye, which is uncovered by the cuticle which the remainder possesses." The watery secretion reaches generally to the level of these glands in the middle of the ascidium, and he thinks that they are true secreting organs. This peculiar structure alone gives a strong reason for thinking that the water in the ascidia of *Nepenthes* is supplied by the plant itself, and the circumstance that water is found in pitchers which have never been opened is another argument against the supposition that it comes from without. The subjoined analysis of the fluid moreover leaves no doubt that it is a true secretion.

Before I enter into the particulars of my experiments I will mention that I could not detect any oxalic acid in the fluid of *Nepenthes*. It is stated in Lindley's 'Vegetable Kingdom' that Dr. Turner found this acid in combination with potash, and that he also detected a trace of organic matter, which caused the watery fluid when boiling to emit an odour of boiled apples. Though I have examined the water of many pitchers from four different localities, and paid particular attention to the detection of oxalic acid, I have failed in finding a trace of it, and I am therefore inclined to believe that Dr. Turner, on account of the minute quantity of solid matter which he must have got on evaporation of the water, was unable to subject the minute crystals which he took for superoxalate of potash to a further examination, which would have shown him that the crystals were not superoxalate of potash, but chloride of potassium. The proportion of chloride of potassium which I found in the fluid is considerable; it is deposited from the liquid after evaporation in the form of minute but very regular cubes. The odour of boiled apples which Dr. Turner observed I found very distinct when the water was heated to the boiling-point. Besides chloride of potassium I found malic and a little citric acid, in combination usually with soda, lime and magnesia, and a small quantity of another organic matter which gave a yellow tint to the water during its evaporation. The quantity of the latter was too minute to enable me to ascertain its chemical nature.

I will now proceed to describe the experiments with the different fluids in the ascidia of *Nepenthes* :—

1. Fluid from an unopened pitcher-plant grown in the Botanical Garden, Edinburgh.

The water which I got on the 12th of June, 1849, was perfectly colourless and clear; it had an agreeable, not very pronounced smell and a refreshing taste. Though its taste was not sour, litmus paper showed the presence of an acid or an acid salt by the red colour it assumed when dipped in the water. When heated it remained clear, and only assumed a slightly yellow colour when the liquid became very concentrated. The residue which remained on evaporation was cream-coloured, very hygroscopic, and dissolved entirely in a small quantity of distilled water. Litmus paper plunged in this solution was turned red immediately; the acid which is present in the water therefore was not volatilized during the evaporation.

The quantity of the water from one pitcher amounted to

17·41 grains,

which gave on evaporation

0·16 of dry residue, dried at 212° F.

100 parts of the fluid consequently contained

0·92 per cent. of solid matter.

2. Water from unopened pitcher-plants grown in the Botanical Garden, Edinburgh, June 13th, 1849.

The physical characters were the same as those of the preceding liquid. Litmus paper likewise was turned red when dipped in the water.

The behaviour of the water towards chemical tests was as follows :—

Ammonia produced no change.

Carbonate of ammonia produced no change.

Lime-water produced no change.

Chloride of calcium and ammonia produced no change.

Nitrate of barytes produced no change.

Nitrate of silver gave a white voluminous precipitate, insoluble in nitric acid, but soluble in ammonia.

Acetate of lead produced a white precipitate soluble for the greater part in boiling water.

Basic acetate of lead gave a white voluminous precipitate in the clear liquid filtered from the precipitate which was caused by neutral acetate of lead.

Oxalate of ammonia produced a small white precipitate of oxalate of lime.

Phosphate of soda and ammonia, added to the concentrated liquid filtered from the oxalate of lime, gave a crystalline white precipitate of phosphate of magnesia and ammonia.

Chloride of platinum, added to the water after having been evaporated to a small bulk, produced a crystalline yellow precipitate.

The residue left on evaporation of the water coloured the alcohol flame yellow.

These reactions indicate the presence of chlorine, potash, soda, magnesia, lime and organic acids, and prove the absence of other bases and of sulphuric acid, tartaric acid, racemic acid, oxalic and phosphoric acid.

3. Fluid from unopened pitcher-plants grown in the Experimental Gardens, Edinburgh, June 13th, 1849.

The water was perfectly clear and colourless, had an acid reaction on litmus paper, and exhibited the same physical and chemical characters as the fluid from the pitcher-plants of the Botanical Garden.

63·21 grains of water left on evaporation a residue which, dried at 212° F., amounted to

0·58 grain.

100 parts of the fluid therefore contained

0·91 per cent. of dry residue.

Exposed to a red heat the residue (0·58 gr.) turned black, and gave off pungent fumes, and left a white ash after all the charcoal was completely burnt away, the weight of which was 0·42 of a grain.

The loss by burning therefore was 25·86 per cent.

The residue left on evaporation of this fluid was slightly coloured, and gave an almost colourless solution with water. A portion of this solution was kept in a closed bottle. After the lapse of a fortnight the water in the bottle became turbid and deposited some light white flakes. The acid reaction, which was very distinct before, had now disappeared entirely.

4. Fluid from opened pitcher-plants grown in the Experimental Gardens, June 14th, 1849.

The fluid in the open pitchers was coloured yellow, but otherwise perfectly clear. The reactions with chemical tests were the same as the preceding.

97·74 grains of water left on evaporation 0·85 of a grain of dry residue.

100 parts therefore contained 0·87 per cent. of solid matter.

This residue was coloured yellow, but redissolved entirely in a little water.

5. Fluid from unopened pitcher-plants grown in Messrs. Dickson's nursery, June 17th, 1849.

Fluid perfectly clear and colourless, reactions the same as above.

319·48 grains left a residue which, dried at 212° F., was found to weigh 1·88 grain; or

100 parts of the liquid contained 0·58 per cent.

6. Liquid from unopened pitcher-plants grown in Messrs. Dickson's nursery, June 21st, 1849.

Physical and chemical characters of the liquid the same as above.

193·82 grains of water left on evaporation 1·22 grain of dry residue, or 0·62 per cent.

When burnt the 1·22 grain lost in weight 0·44 of a grain, or 100 parts of the residue lost 36·06 per cent.

The solid matter of this liquid was very hygroscopic, and coloured more yellow than that of the Botanical and Experimental Gardens. I found that the total weight of the solid matter in this fluid was not so large as in that of the Experimental Gardens, but that the proportion of organic matter in the residue was larger than that in the residue of the fluid procured from the Experimental Gardens.

7. Water from opened pitcher-plants grown in Messrs. Dickson's nursery, June 24th, 1849.

This fluid was yellow-coloured and not quite clear. Litmus paper was turned red when moistened with the water. The reactions were the same as above, with the exception that nitrate of barytes produced a slight turbidity, indicating the presence of sulphuric acid. As I found no sulphuric acid in the liquid from the unopened pitchers of the same plants, nor in any of the liquids I examined, I think the sulphuric acid which I found must have resulted from the water with which the plants had been watered which had found its way into the open pitchers*. In order to see if the liquid contained any volatile acid, I subjected about half an ounce of it to distillation. The distillation was continued till the residue in the glass retort was evaporated

* The water in this instance was procured chiefly from the Water of Leith.

to dryness, and the generated steam carefully condensed in a glass receiver. The distilled portion was perfectly pure water, and experienced no change by any reagent.

It results from this experiment that the liquid in the ascidia of *Nepenthes* does not contain any volatile acids, such as acetic or formic acid.

8. Fluid from unopened pitcher-plants grown in the Royal Gardens, Kew.

Having been unable to detect any oxalic acid in the above-mentioned fluids, I was anxious to ascertain whether or not the fluid of plants grown in other localities contained oxalic acid. I therefore applied to Sir W. Hooker, who with great liberality directed some liquid of unopened pitcher-plants grown in the Kew Royal Botanical Gardens to be sent to me. The physical and chemical characters of this fluid were precisely the same as those of the previously examined liquids. The proportion of solid matter it held in solution however was much smaller.

299·87 grains of the liquid left on evaporation only
0·82 of a grain of dry residue.

100 parts of the liquid therefore contained
0·27 per cent. of solid matter.

On burning, the 0·82 of a grain lost 0·27 of a grain, or
100 parts lost 32·92 per cent.

All the liquids from the different localities above-mentioned which were left over I mixed together and evaporated the mixture to dryness. One-half of the dry residue I exposed to a red heat, and used the remaining white ash for the determination of the inorganic salts of which it was composed.

The other half I dissolved in water and precipitated with basic acetate of lead, in order to obtain the organic acids in combination with lead. This precipitate I collected on a filter and washed with cold distilled water. It was then removed from the filter and suspended in water, through which a current of sulphuretted hydrogen was passed. By this means I separated the lead as sulphuret, and obtained the organic acids free dissolved in water. This solution was colourless and very acid; evaporated to a small bulk in a water-bath it assumed a yellow colour, and dried at last to a yellow crystalline mass, which deliquesced in the air and dissolved readily in water and alcohol, leaving behind a trace of a brown organic matter.

Lime-water added in excess to a portion of the acid solution produced no precipitate in the cold, but on boiling a small white precipitate fell down which redissolved entirely in sal ammoniac.

Chloride of calcium and ammonium left the liquid unchanged in the cold, but on boiling a precipitate was formed which was soluble in sal ammoniac.

Acetate of lead gave a white precipitate insoluble in ammonia, soluble in acetic acid.

Basic acetate of lead added to the liquid filtered from the precipitate caused by neutral acetate of lead produced another abundant white precipitate. From these reactions it appears that the precipitate with lime-water was caused by citric acid and not by tartaric or racemic acid, the reactions of which acids are similar to those of citric acid, for tartrate of lime is not soluble in sal ammoniac, whilst tartrate of lead redissolves readily in ammonia. Tartaric acid moreover is sufficiently characterized by the sparing solubility of its acid potash salt, and as the acid liquid did not give rise to the formation of such a salt with potash, we have another indirect proof of the presence of citric acid. A little tartaric acid added to the liquid in which tartaric acid was sought in vain, after a few minutes produced the sparingly soluble potash salt.

Racemic acid is thrown down both by lime-water and by a solution of gypsum; the acid liquid of *Nepenthes* remained unchanged by either reagent, hence it cannot have contained any racemic acid.

The precipitate caused by chloride of calcium and ammonia and boiling was filtered hot, and alcohol and ammonia added to the clear liquid. The addition of alcohol produced a voluminous white precipitate, a reaction which indicates the presence of malic acid. The quantity of this precipitate was much larger than that of the lime precipitate which citric acid gave. The formation of a precipitate, upon addition of alcohol to the liquid from which the first had been separated by filtration, is characteristic of the presence of malic acid, for no other lime-salts were present; for instance, no sulphate of lime was present which could have produced a precipitate. But I thought it nevertheless necessary to examine the precipitate caused by the addition of alcohol further. When burnt it turned black, gave off pungent vapours, and was converted into carbonate of lime. The solution of chloride of calcium and ammonia used for the experiment remained clear after the addition of alcohol; the acid liquid likewise remained clear when alcohol was added; both put together immediately produced a white voluminous precipitate.

Basic acetate of lead, as already mentioned, throws down from the solution a white precipitate. I could not observe that this precipitate melted below the boiling-point of water, as pure malate of lead does, but it must be remembered that this reaction is distinctly marked only when the malate of lead is pure; admixtures of other salts of lead prevent it altogether; and as I have shown the presence of citric acid and another organic substance which is thrown down by basic acetate of lead, there can be no doubt that this was the reason why the precipitate did not dissolve in boiling water.

Though I have not been able to obtain a sufficient quantity of the acids of *Nepenthes* for an elementary analysis, I think the above reactions prove the presence of malic and citric acid. Oxalic acid, which is readily detected, as the weakest solution of an oxalate is thrown down by lime-water, I failed to discover; on the contrary, I have shown that the water contained lime, which excludes the co-existence of oxalic acid in a clear liquid. I have found that the smallest quantity of oxalic acid immediately caused the water of *Nepenthes* to become turbid.

The second half of the residue left on evaporation of the mixed fluids I exposed to a red heat in a platinum capsule. It turned black, gave off pungent fumes, and left a white salt after all the charcoal was burnt off.

On analysis this residue was found to consist of

Chloride of potassium	76·31
Carbonate of soda	16·44
Lime	3·94
Magnesia	3·94
	100·63

The unburnt residue left on evaporation of the fluid in the ascidia of *Nepenthes* therefore consists, if we take the average of the loss of the three determinations at 31·61 per cent. and reject the carbonic acid of the ash, of—

Organic matter, chiefly Malic acid and a little citric acid	38·61
Chloride of potassium	50·42
Soda	6·36
Lime	2·59
Magnesia	2·59
	100·57

It is remarkable that none of the fluids which I examined contained any sulphuric acid, which acid has been found in all juices of plants, and which I do not doubt also exists in the sap of *Nepenthes*. An ash analysis of this interesting plant would show the proportion of sulphuric acid at once; and as we are not in possession of an analysis of the ash of *Nepenthes*, which in other respects might be of interest, I take the liberty of asking those gentlemen who are in the possession of *Nepenthes'* plants to preserve the clippings of branches, &c., which I shall be glad to receive as materials for an ash analysis.

XXIV. *On the Mode of Growth in* Calothrix *and allied Genera.* By JOHN RALFS, M.R.C.S.

READ 8TH MARCH 1849.

IN my former communication I remarked that in *Oscillatoria* the division of the filament is accompanied by that of its sheath, whilst in *Microcoleus* the sheath is so inflated as not to interfere with the process of division. I shall now endeavour to prove that the appositional branches in *Calothrix* and other genera are the results of modifications of that mode of division which we see in *Oscillatoria* and *Microcoleus.*

In *Scytonema, Calothrix, Arthronema,* &c. the sheath is somewhat cartilaginous and closely surrounds the contained filament. As its texture is comparatively firm, it admits only a slight degree of dilatation: it neither separates as in *Oscillatoria,* nor allows the bundling of the filaments as in *Microcoleus.*

In all these genera the structure of the filament, irrespective of the sheath, is alike, and consists of a single, longitudinal series of disciform cells which are often confluent or have indistinct dissepiments.

If a specimen of *Calothrix* or *Cænocoleus* be examined we may frequently observe, especially near the extremities of the branches, short separated portions of filaments in every respect similar to those which sometimes occur in *Oscillatoria.* At first such a portion is separated from the original filament by a short interval; but as there is no division of the sheath and both portions continue to elongate, they are soon in contact again. In the act of passing each other the extremities sometimes become attenuated. In this state the filament looks as if it had divided obliquely, and the upper portion becoming impacted between the filament and the sheath presents the appearance of a branch. From this explanation it will be evident that the branches in these genera are produced, not by an adhesion of other filaments, but by a dislocation of the filament itself.

Both portions continue to elongate upwards, and branches are thus repeatedly formed by dislocation. The upper portions or branches, however, always retain their original advantage and extend beyond the trunk. This fact seems to me a strong proof of the correctness of the view I have given, for it could scarcely be constant if the branches originated in any other manner.

The frond or sheath is itself truly branched or divided in the ordinary way. Sometimes, as in *Calothrix*, it is forked as soon as the upper portion becomes impacted, and the plant presents no peculiarity to the eye in its mode of branching except that the branches at the base are not united to the trunk.

In *Cænocoleus* the branching of the sheath does not occur at the same spot as the dislocation of the filament. Upon this circumstance depends the peculiar character of the genus, for after the dislocation the inferior portion as it elongates necessarily pushes itself up by the side of the superior one. Sometimes the filaments are again branched by dislocation before the sheath divides, and thus from two to four (or even more) filaments pass up side by side within a common sheath. Where the sheath forks the filaments are in general equally distributed between its branches.

From what I have stated it will be seen that in *Calothrix* and *Cænocoleus* the dislocated ends pass each other without any alteration of their direction. This is not the case in *Scytonema myochrous*, which acquires a very different habit owing to the variation in the direction of the dislocated extremities. In that plant the new ends are curved towards the same side of the sheath; they do not pass each other, but issue from the side together and at right angles to its axis. As both portions encounter equal resistance they elongate equally, and consequently the branches are said to be in pairs. Sometimes the dislocation does not take place until after a loop has been formed by a lateral protrusion. Occasionally also the dislocation occurs without any curvature of the newly formed ends, which then pass each other as they do in *Calothrix*; but this rarely happens except in the case of lower or basal dislocations. The presence in the same specimen of both modes of branching proves that they depend on modifications of the same law, notwithstanding their very different appearance.

Calothrix mirabilis presents another variation in the direction of the dislocated ends. At first sight the mode of branching appears similar to that of *Scytonema myochrous*, and different only in having more frequent divisions; but closer examination detects an essential difference. The filament indeed separates as in *Calothrix* and the ends pass each other; but instead of remaining within the same sheath, they immediately pass out obliquely in opposite directions; consequently as both portions are free and continue to elongate, they seem merely to anastomose by cohesion at the convexities of their sheaths. As this plant divides at short intervals, it has the appearance of intricate network.

In *Rivularia* also the branches are the result of dislocation, but in that genus a globule is formed at the base of the branch at the time of dislocation.

A similar globule is present in the lower branches of some species of *Calothrix* and *Cænocoleus*; in these however it is usually developed only after the impaction of the branch, but sometimes during the division of the filament. If the lower portion of the filament elongates and passes the vesicle, its appearance does not differ from one formed after dislocation. If the lower portion ceases to grow at the time of division, the plant is like a simple filament here and there interrupted by a vesicle or sporangium.

In this group, however, the branching of the filament is not invariably accompanied by dislocation: in *Stigonema* I believe it never occurs, and even in *Scytonema* I have seen some species allied to *myochrous* in which the branches were apparently produced in the usual manner by lateral protrusion without interruption of continuity.

END OF VOLUME III.

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TRANSACTIONS

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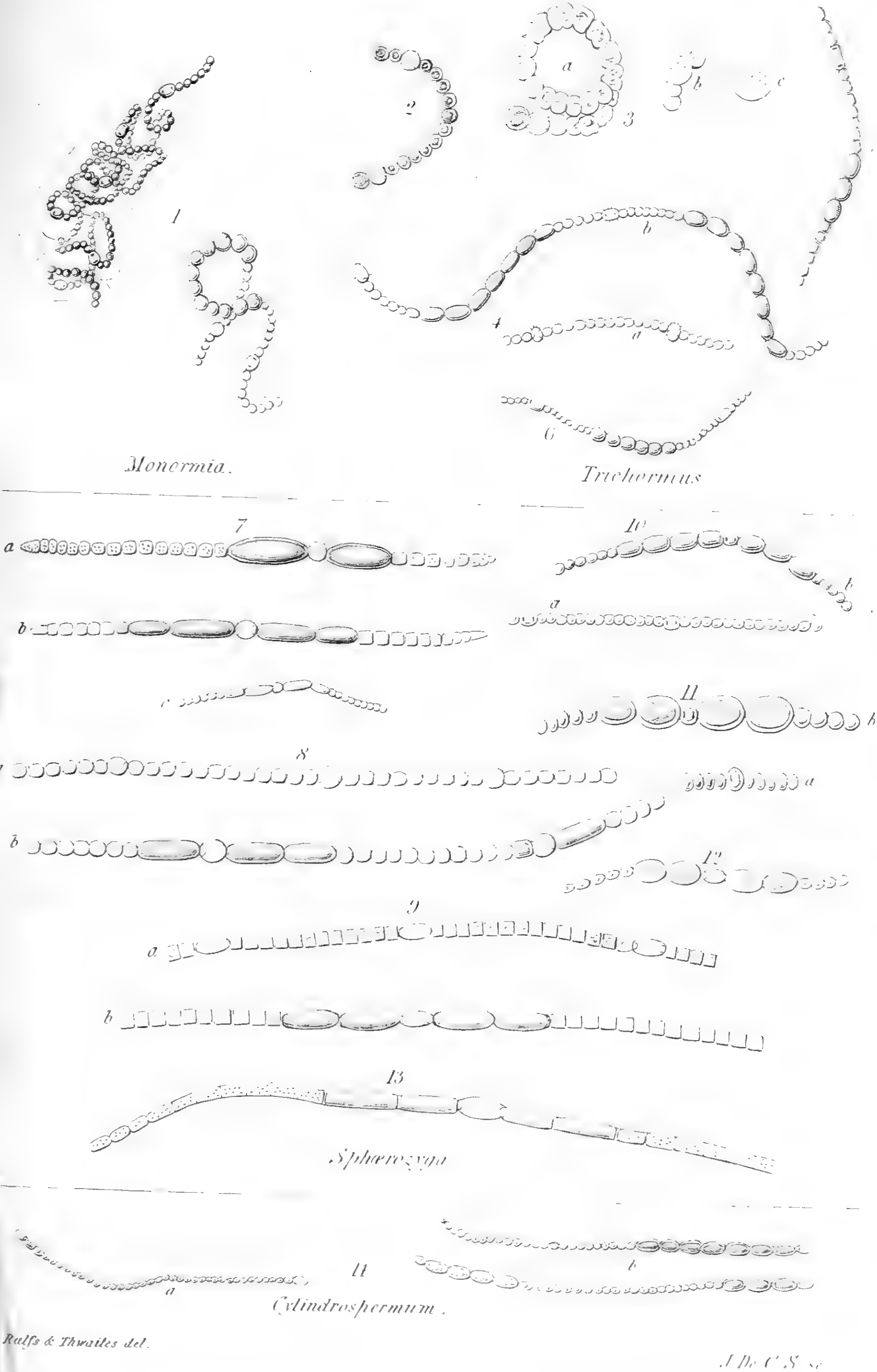

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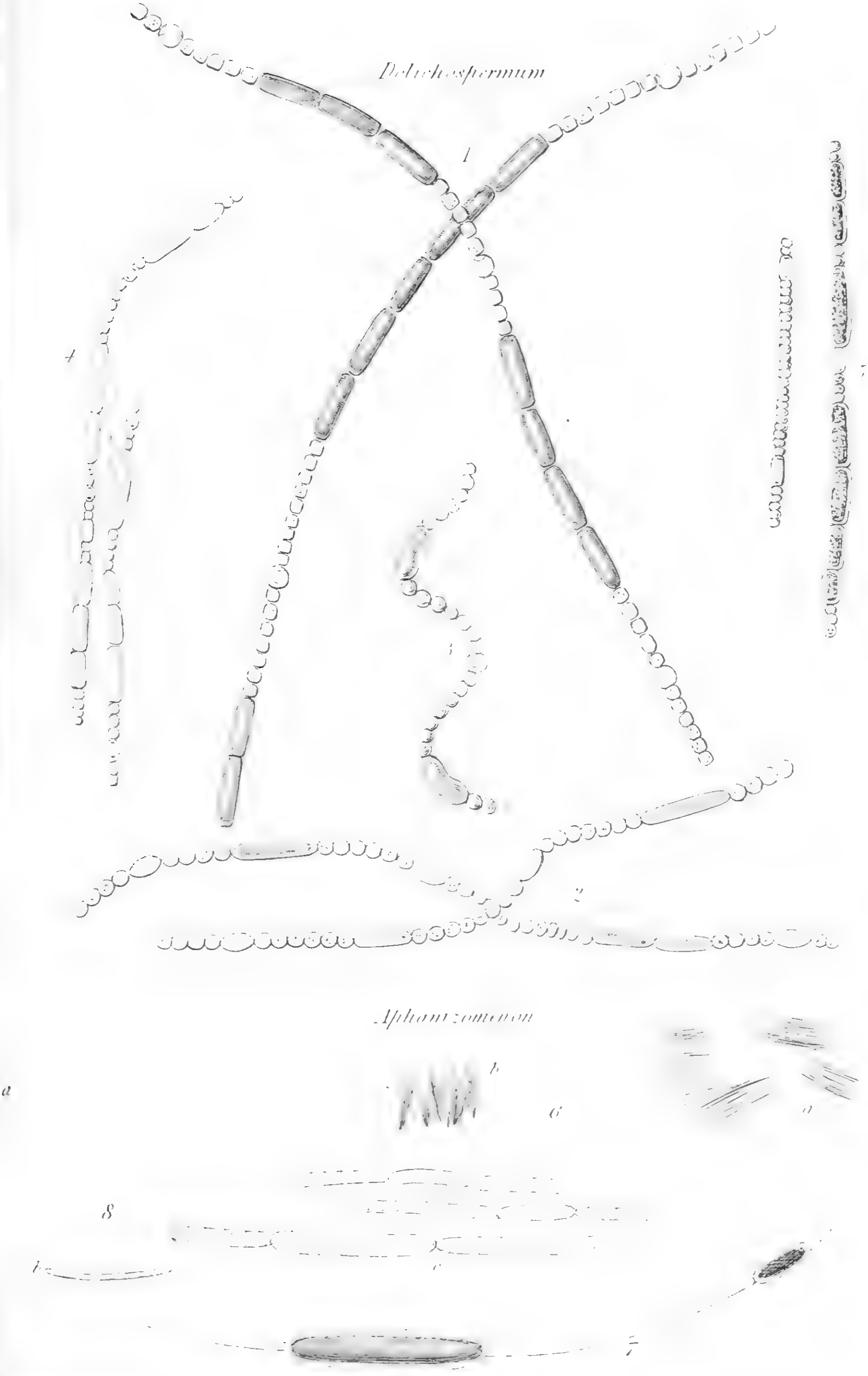

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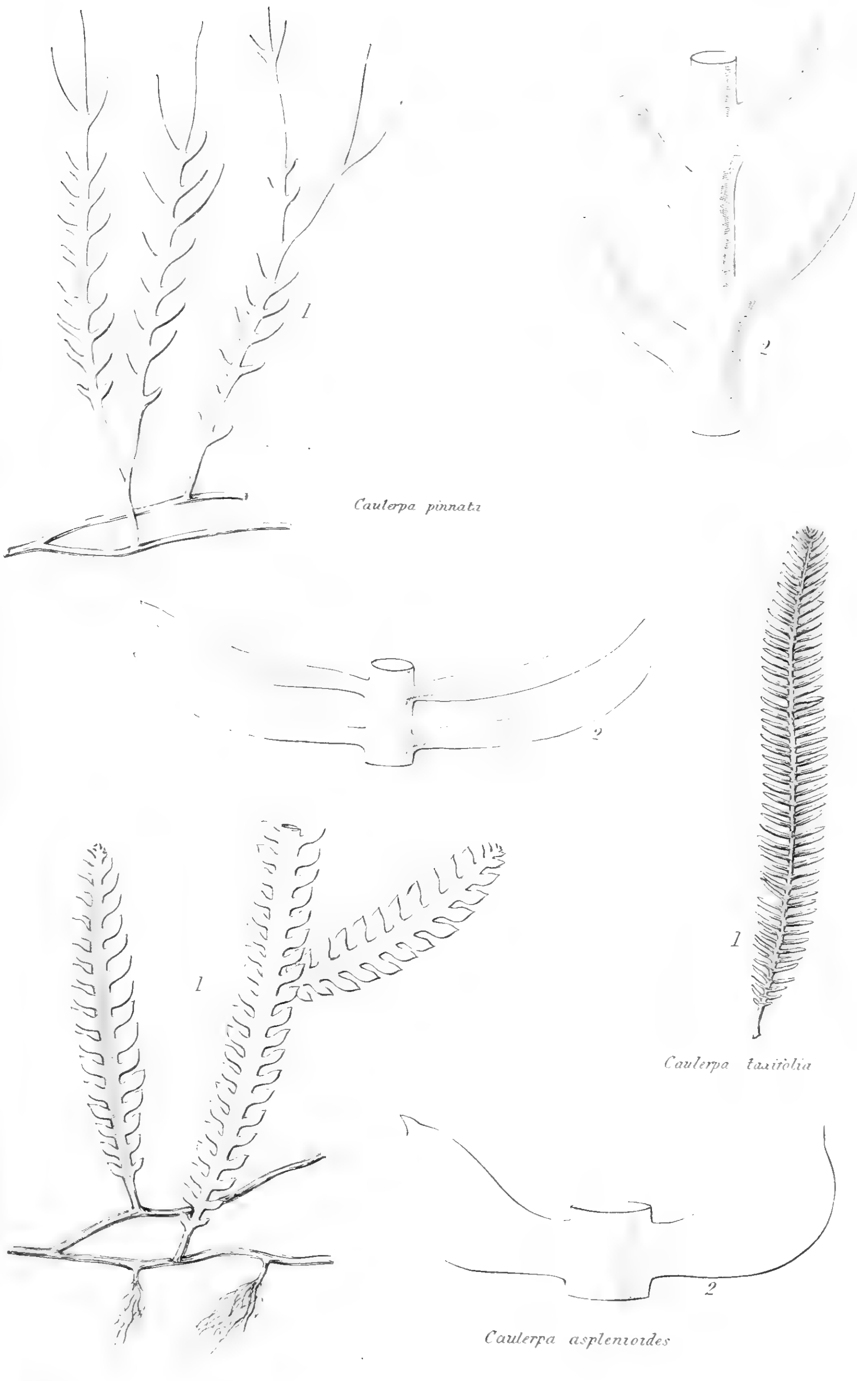

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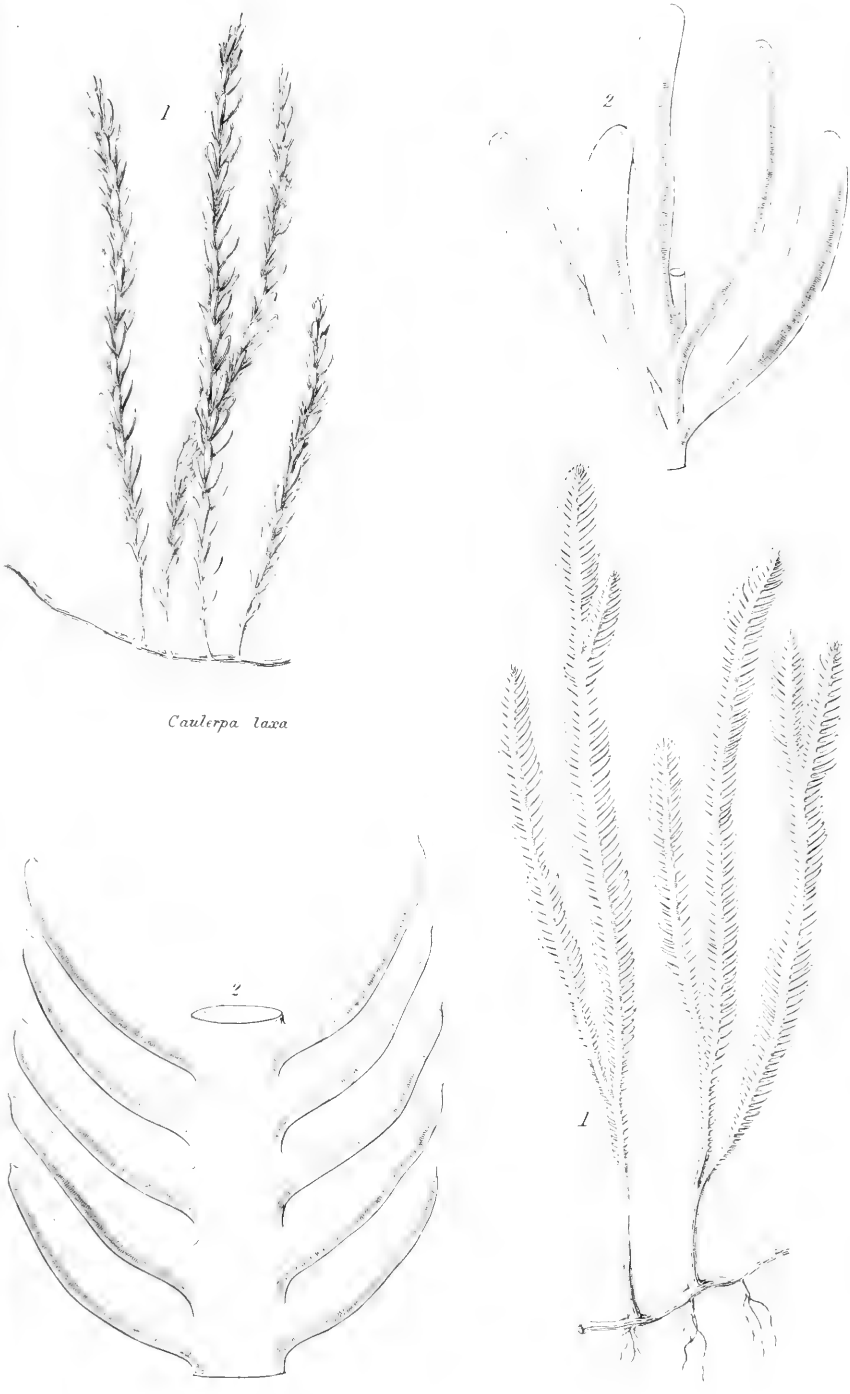

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Caulerpa fissidentoides

R. K. Greville del. J. De C. Sowerby sc.

TRANSACTIONS

OF THE

BOTANICAL SOCIETY.

I. *On the* Nostochineæ. By John Ralfs, M.R.C.S.

Read April, May, June, and July 1849.

Frond gelatinous, containing simple, jointed, generally moniliform filaments. Some joints enlarged, all finally separating.

The *Nostochineæ* may be regarded as a tribe of freshwater and terrestrial Algæ, for only a very few of its species are either littoral or inhabitants of brackish waters. They are allied on the one hand to the *Oscillatoriæ* and on the other to the *Palmelleæ*; but I consider they have a closer affinity to the former than to the latter. Some species of *Nostoc*, to the naked eye, have considerable resemblance to fronds of *Rivularia*. Without the use of the microscope we are sometimes unable to distinguish *Trichormus* and *Sphærozyga* from *Oscillatoria*, and even with its assistance the young filament in *Spermosira* is liable to be regarded as an *Oscillatoria*. So closely too is this family allied to the *Palmelleæ*, that some distinguished naturalists have united them. *Hormospora* in the latter scarcely differs from it except by its uniform and more distant cells.

In the *Nostochineæ* the filaments are always imbedded in gelatine. In *Nostoc* and *Hormosiphon* this gelatine is very evident, and, especially in the young plant, is comparatively firm. It is, indeed, often fleshy or even cartilaginous, and externally is always condensed so as to form a distinct covering or epidermis (generally smooth and glossy) which limits the frond and gives it a definite form. In *Trichormus* and the remaining genera the plant forms a stratum of no determinate form or extent.

In all the genera the filaments are simple, jointed and usually moniliform, and finally break up into single joints. Their joints often rendered useless by the separation of the filament into single cells. The destruction of the filament is attended by the escape of the colouring matter, which stains the water or whatever is in contact with the mass, and is usually the first sign of that destruction.

I find the best method of preserving specimens is to dry them as quickly as possible on talc or glass. Specimens preserved on paper can rarely be removed without injury. In examining specimens that have been dried, it is necessary to bear in mind, that although, when revived by adding a little water, they present characters apparently but little altered from their recent ones, yet their joints are then more distinct and orbicular from contraction at their junction; hence a cell quadrate in the recent plant will be orbicular in the revived one. I have elsewhere mentioned that from a similar cause the dried frond in *Closterium* appears more attenuated at the extremities than is natural, and I fear that from inattention to this fact descriptions taken from dried specimens are sometimes faulty.

Until the publication of Professor Kützing's 'Phycologia Generalis,' the described species belonging to this group were few in number, and usually retained in a single genus either as *Anabaina*, Bory, or *Sphærozyga*, Ag. Professor Kützing has now determined upwards of thirty species, which he has distributed in four genera*.

Attempts to ascertain the earlier synonyms in tribes which require the aid of the microscope to detect the generic and specific differences are necessarily attended with much difficulty. Not only are our present instruments far superior to those used a few years ago, but when natural history began to take its proper rank in science, the higher tribes sufficiently taxed the time and skill of collectors and writers; it is therefore not surprising that the more minute Cryptogamia should have been comparatively neglected. The descriptions were chiefly taken from characters obvious to the naked eye, and besides were often so brief and at the same time so vague, that they were equally applicable to members of very different genera; hence authors, unable to determine with certainty the species of their predecessors, were frequently compelled either to depend on chance in

* I take this opportunity of directing attention to his 'Tabulæ Phycologicæ,' now publishing in numbers in a cheap form, and containing magnified figures of every species known to him. To those who wish to identify our British freshwater Algæ it is indispensable. Of British species of *Oscillatoria* we have no figures of the slightest value, for unfortunately Mr. Hassall, many of whose figures in other genera are very useful, has, in every figure which he has given of that genus, omitted to give the ends of the filaments, though they are often essential to the determination of the species.

the employment of old names, or, renouncing the task as hopeless, to invent new ones. In the present group all these difficulties have been experienced, and unless authentic specimens, in a fit state for examination, exist in the collections of Linnæus and other early botanists, it must in some instances be impossible to affix their names with any certainty. I cannot flatter myself that my nomenclature will be free from error; but I venture to hope that by pointing out the essential peculiarities of these plants, and by more detailed descriptions of the species, I shall facilitate the labour of those who can find opportunity for inspecting the herbaria of original authorities.

Should I succeed in my endeavours to elucidate the British species, the success will be due in a great measure to the kind assistance of my fellow-students. Mr. Thwaites, who in Harvey's 'Phycologia Britannica' was the first to recognize three kinds of cells, has supplied descriptions of some species which I have not met with. Other friends, especially Professor Allman, Mr. Andrews, Mr. Jenner, Mr. Moore, the Rev. T. Salwey, and Mr. W. Thompson, have aided me by specimens accompanied with remarks; whilst Mr. Borrer has enabled me, by means of his rich botanical library, to clear up points on which I must otherwise have remained in doubt*.

* The following synoptical table will, it is hoped, convey a clear idea of the characters distinguishing respectively the various genera proposed to be described. The genus *Nostoc* is not included in the present paper on account of the necessity which exists of a further examination and study of its several species, some of which have been stated by Professor Kützing and M. Fries to be merely a condition of species of *Collema*.

Synoptical Table of Genera.

I. Filaments not included in a membranous sheath.

a. Frond definite.

1. *Monormia*, Berkeley.

b. Frond indefinite.

2. *Trichormus*, Allman. *Vesicular cells* interstitial and terminal. *Sporangia* formed first from the cells at the greatest distance from the vesicular cells.
3. *Sphærozyga*, Ag. *Vesicular cells* interstitial. *Sporangia* formed first from the cells nearest the vesicular cells.
4. *Cylindrospermum*, Kützing. *Vesicular cells* terminal. *Sporangia* as in *Sphærozyga*.
5. *Dolichospermum*, n. gen. *Vesicular cells* interstitial. *Sporangia* without any definite arrangement, and of unequal length.

II. Filaments included in a membranous sheath.

6. *Aphanizomenon*, Morren. *Vesicular cells* none? *Sporangia* usually single and of unequal length.
7. *Spermosira*, Kütz. *Vesicular cells* interstitial, single or sometimes two together. *Sporangia* as in *Trichormus*.

MONORMIA*, *Berkeley*.

Frond definite, gelatinous, elongated, linear, spirally curled and convoluted, inclosing a single continuous moniliform filament.

Monormia is very closely allied to *Trichormus*, Allman, differing principally, if not solely, in its definite linear frond, which incloses a single moniliform filament to be traced throughout all the peculiar convolutions of the frond. The *vesicular cells* are interstitial and occur singly. The *sporangia* are numerous, and are first formed from the cells at the greatest distance from the vesicular cells.

Without due attention *Monormia* might easily be mistaken for a species of *Nostoc*, but the mass formed by its convoluted frond is not inclosed by a common membranous pellicle as in that genus.

Monormia intricata, Berk. Gleanings of British Algæ, p. 46. t. 18 (1832); Harvey, Man. of Brit. Algæ, p. 185; Phycologia Britannica, t. 256; Hassall, Brit. Fresh. Algæ, p. 286. t. 75. fig. 11. *Nostoc intricatum*, Meneghini, Mon. Nostoch. Ital. p. 122 (1842). *Anabæna intricata*, Kützing, Phycologia Germanica, p. 171 (1845); Species Algarum, p. 288; Tabulæ Phycologicæ, p. 50. t. 94. fig. 1.

In ditches of the marsh to the south of Frindsbury Canal, near Gravesend, *Rev. M. J. Berkeley*; in brackish ditches at Shirehampton, near Bristol, *G. H. K. T.*; near Wareham, *Rev. W. Smith*. Germany, *Kützing*.

This species occurs in slightly brackish ditches as floating gelatinous masses, each about as large as a walnut, and usually of a reddish brown colour. When a small portion of the plant is examined with a lens of moderate power, it is seen to consist of an elongated continuous moniliform filament included in a definite linear gelatinous sheath, which is very much curled and convoluted, and the apposed surfaces of which are more or less coherent. The vesicular cells are somewhat oblong, and rather larger than the nearly spherical ordinary cells. The sporangia are numerous, twice the diameter of the ordinary cells, and perfectly spherical.

When the sporangia are mature the definite outline of the linear frond is almost lost, and then there is little to distinguish the plant from *Trichormus* but the peculiar convolutions of the moniliform filament. The original colour of the gelatinous frond has also then disappeared, and the plant has assumed a pale greenish tint.

In drying, the plant stains paper of a deep blue or purplish colour.

PLATE I. fig. 1.

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* The description of this genus is by Mr. G. H. K. Thwaites.

Trichormus, *Allman.*

Filaments simple, moniliform, distinctly jointed, aggregated into an indeterminate gelatinous stratum; sporangia separated from the vesicular cells by the ordinary joints, which they more or less resemble in form.

(*Anabaina,* Bory, Brébisson, Kützing, Montagne and others.)

In *Trichormus* the stratum is indeterminate and very gelatinous; at first it is nearly colourless and transparent, and the filaments are only sparingly scattered through the matrix; but the filaments rapidly increase in number, and the mass, gradually becoming more opake, acquires at length a deep bluish green colour, which is occasionally mottled with brown, especially beneath.

The filaments are mostly short, distinctly moniliform, and frequently as much curved as those of a *Nostoc.* The cells are all more or less orbicular, and the sporangia differ less from the ordinary cells than they do in the following genera. Viewed under the microscope the filaments scarcely differ from those of a *Nostoc.* In both genera they are usually curled, their cells are orbicular, the vesicular ones are interstitial and terminal, and the sporangia are often not apparent, or are known only by their denser endochromes.

In some of the aquatic species the stratum separates into large floating gelatinous masses, and then can only be distinguished from *Nostoc* by the gelatinous portions having no definite form or size, and by the absence of an epidermis.

Professor Kützing refers *Monormia intricata,* Berk., to this genus. I have never gathered that plant, and I was unable to determine the genus from recent specimens sent me by Mr. Thwaites from Bristol; but, judging from Mr. Berkeley's figures and description, I should suppose that the more definite frond and the elongated, solitary and peculiarly convoluted filament are sufficient to sustain the genus.

As Professor Harvey has reminded us in his 'Phycologia Britannica' that Bory's name *Anabaina* has been appropriated to a genus of flowering plants, and it becomes necessary to choose another, I have adopted Professor Allman's name *Trichormus* as next in priority.

Trichormus differs from *Dolichospermum* in its sporangia, which are more or less orbicular, and from *Sphærozyga* and *Cylindrospermum* by the different arrangement of the sporangia and vesicular cells.

1. *T. Flos-aquæ* (Lyngbye). Filaments flexuose or curved, moniliform; cells orbicular, vesicular ones larger, terminal and interstitial. *Nostoc Flos-aquæ,* Lyngbye, Tentamen Hydrophytologiæ Danicæ,

p. 201. t. 68. fig. D (1819). *Anabaina membranina*, Bory, Arthr. fig. 7 *d* (according to Kützing); Mougeot et Nestler, Stirpes Cryptogamiæ Vogeso-Rhenanæ, no. 896. *Anabæna Flos-aquæ*, Trevir. in Linn. 1843, t. 3. fig. 5–7; Kützing, Phycologia Generalis, p. 209; Phycologia Germanica, p. 171; Species Algarum, p. 289. *Sphærozyga membranina*, Endlicher, Mantissa Bot. Alterum Sup. tertium, p. 12 (1843). *Trichormus incurvus*, Allman, Annals of Nat. Hist. vol. xi. p. 163. t. 5 (1843); Hassall, Brit. Freshwater Algæ, p. 285. t. 75. fig. 1.

Stagnant pools and other still waters. Portmore Lough, Antrim, *Mr. W. Thompson*; Ayrshire, *Rev. D. Landsborough*; Dolgelley, *J. R.*; Oswestry, Shropshire, *Rev. T. Salwey*; Grand Canal Dock, Dublin, *Professor Allman*.

Finland, *Lyngbye*; France, *Bory*; Germany, *Kützing*.

Trichormus Flos-aquæ rises to the surface of the water in gelatinous masses of considerable size, and is generally of a rich bluish green colour. Filaments curved and beautifully moniliform. Cells spherical; vesicular ones resembling the ordinary ones, but larger and without granular matter. Sporangia I have not detected, but since cells, not different in form from ordinary ones, are often filled with granular matter, there is probably no very obvious difference between the latter and the sporangia.

Plate I. fig. 2.

2. *T. spiralis* (Thompson). Filaments coiled or spiral; ordinary cells subquadrate or orbicular; vesicular cells and sporangia orbicular. *Anabaina spiralis*, Thompson in Annals and Mag. of Nat. Hist. vol. v. p. 81 (1846). *Spirillum Thompsoni*, Hassall, Brit. Freshwater Algæ, p. 278. t. 75. fig. 7 (1845).

Ballydrain Lake, near Belfast, *Mr. Thompson*; Petersfield, *Mr. Jenner*.

I regret that the specimens Mr. Thompson has sent me are too imperfect to serve for the identification of the species. I am by no means certain that Mr. Jenner's plant is identical with the Irish one, and I have referred it to this species in deference to the opinions of Mr. Thwaites and Mr. Jenner, rather than from my own conviction.

The filament in Mr. Jenner's specimen is somewhat coarse, and coiled rather than loosely spiral. The ordinary joints are more or less quadrate, the vesicular cells orbicular, and the sporangia similar to the ordinary cells, but larger and more orbicular. Mr. Thompson's figure represents his *T. spiralis* with perfectly orbicular ordinary cells, and a slender filament which, except in being spiral, scarcely differs from *Trichormus Flos-aquæ*.

Plate I. fig. 3. *a*, Mr. Jenner's specimen; *b*, fragment of Irish specimen with sporangium between ordinary cells; *c*, mature sporangium.

3. *T. Thwaitesii* (Harv.). Filaments moniliform, slightly flexuose; ordinary cells globular or nearly so; vesicular cells larger, globular when interstitial, ovate when terminal, ciliated; sporangia oval, catenate. *Sphærozyga Thwaitesii,* Harvey, Phycologia Britannica, t. 113 B (1847).

Salt-marshes, Dolgelley, North Wales, and Hayle, near Penzance, *J. R.*; Shirehampton, near Bristol, *Mr. Thwaites*; Portbury, Somersetshire, *Mr. Broome*; near Hastings, *Mr. Jenner.*

Trichormus Thwaitesii forms thin, gelatinous, dark green patches either on the damp soil covered at spring-tides or at the bottom of brackish ditches or pools. Filaments moniliform, elongated, pale bluish green. Ordinary joints nearly orbicular, except when dividing. Vesicular cells interstitial and terminal, ciliated, twice as large as the ordinary ones, ovate when terminal, otherwise spherical. Sporangia oval or nearly globular, larger than the ordinary cells, beginning near the centre of the filament and forming chain-like groups of six or more together.

Mr. Thwaites's specimens vary in some respects from those I have gathered. I find the stratum very thin and tender, and the sporangia rarely produced; but Mr. Thwaites informs me, that at Bristol, on the contrary, it forms, after a time, large, floating, gelatinous masses, and then abounds with sporangia.

Trichormus Thwaitesii is more likely to be confounded with immature specimens of *Sphærozyga Carmichaelii* than with either of the preceding species of this genus, especially as they often grow intermixed. In the present plant however the filament is longer, the ordinary cells are more globular, and the terminal cell either resembles the others or is ovate and vesicular. Its ciliated and globular vesicular cells distinguish it from *T. oscillarioides* and *T. recta.*

A specimen of *Anabaina variabilis* sent me by Professor Kützing is apparently identical with the present species; but, as the former is described as lacustrine, with attenuated ends, I have thought it advisable not to unite them*.

PLATE I. fig. 4. *a,* immature filament; *b,* mature filament.

4. *T. oscillarioides* (Bory). Filaments elongated, flexuose; ordinary joints subquadrate, distinct; vesicular cells barrel-shaped or elliptic, naked; sporangia oval, catenate. *Anabæna oscillarioides,* Bory, Dict. Class. d'Hist. Nat. *Sphærozyga oscillarioides,* Kütz. Species Algarum, p. 291 (1849); Tabulæ Phycologicæ, t. 96. fig. 5. *Trichormus affinis,* Ralfs in lit.

Brackish ditches. Shirehampton, near Bristol, *Mr. Thwaites.*

* "*Anabaina variabilis,* lacustris, mollis, viridi-æruginea; trichomatibus attenuatis, ærugineo-viridibus, laxe implicatis; articulis ellipticis, majoribus, granulosis."—Kützing, Phyc. Gener. p. 210.

Stratum bluish green; filaments elongated, flexuose, moniliform, often attenuated at the ends. Ordinary joints quadrate, with rounded angles, frequently longer than broad, terminal ones conical. Vesicular cells oblong, usually flattened at the ends so as to appear barrel-shaped, broader than the ordinary joints, and, according to Mr. Thwaites, always naked. Sporangia elliptic, catenate, and somewhat larger than the ordinary cells.

Trichormus oscillarioides differs from *T. Thwaitesii* by its more quadrate ordinary cells and by its smooth and elliptic vesicular cells. It may be known from *T. recta* by its elongated filaments and by its more quadrate ordinary cells.

Plate I. fig. 5.

5. *T. rectus** (Thw. MS.). Filaments bright green, straight, short, slightly tapering towards the extremities; ordinary cells subspherical, rather shorter than wide; vesicular cells oblong, smooth, scarcely wider than the ordinary cells, and never terminating the filament; sporangia spherical or oblong, numerous.

Pools. Hanham, near Bristol, August 1847, *G. H. K. Thwaites.*

This little species differs from every other we have seen in its short, straight filaments, which are of a beautiful green colour. The vesicular cells, of which there are seldom more than one or two in each filament, are of a reddish colour, and about half as long again as wide. The ordinary cells are nearly spherical, somewhat compressed, so as to be rather wider than long. The sporangia vary in shape from spherical to oblong.

Plate I. fig. 6.

Sphærozyga, *Ag.*

Filaments simple, generally moniliform, aggregated into a gelatinous stratum; sporangia interstitial, in groups of two or more connected by a vesicular cell.

(*Sphærozyga*, Agardh, Endlicher, Kützing, Montagne. *Anabaina*, Bory, Brébisson.)

Sphærozyga agrees with *Trichormus, Dolichospermum, Cylindrospermum, Aphanizomenon* and *Spermosira* in its mode of growth as well as in the colour and general appearance of its stratum, and differs from those genera solely in the microscopic characters of its filaments.

The filaments are somewhat elongated. The joints, though seldom so orbicular as in *Trichormus*, are usually very distinct. The sporangia are generally elongated and cylindrical; they occur in little groups of two or four, with a vesicular cell interposed at the centre. Sometimes a vesicular cell has a sporangium

* For the description of this species I am indebted to Mr. Thwaites.

on one side and apparently an ordinary cell on the other, but this occurs only when the sporangia begin to be developed, and the individual on one side is more forward than that on the other. In such a case close examination will detect a slight preliminary elongation of the incipient sporangium. The sporangia indeed are always developed, first on one side of the vesicular cell and then on the other, and whatever number may occur together they follow the same rule, and are produced alternately adjacent to those previously formed, and as they are thus produced in succession they all vary in size (except in the mature plant), the inner ones in each group being the largest.

Sphærozyga differs from *Trichormus* and *Dolichospermum* by producing its sporangia adjacent to the vesicular cells; its filaments also are straighter, and its sporangia more elongated than in the former genus. The interstitial position of the sporangia and vesicular cells distinguishes it from *Cylindrospermum*, and the ordinary cells are not disciform as in *Spermosira*.

* *Filaments moniliform; sporangia elongated, not turgid.*

1. *S. Carmichaelii* (Harvey). Filaments moniliform, with tapering extremities; ordinary joints distinct, subquadrate; sporangia oblong; vesicular cells spherical. *Belonia torulosa*, Carmichael, Alg. Appin ined.; Harvey in Hooker's Brit. Flora, vol. ii. p. 379 (1833); Manual of Brit. Algæ, p. 167. *Sphærozyga compacta*, Kützing, Phycologia Generalis, p. 211 (1843); Phycologia Germanica, p. 172. *Anabæna marina*, De Brébisson in Ann. Sc. Nat.!; Kützing, Species Algarum, p. 287; Tabulæ Phycologicæ, t. 92. fig. 111. *Sphærozyga Carmichaelii*, Harvey, Phycologia Britannica, t. 113 A (1847); Kützing, Species Algarum, p. 294; Tabulæ Phycol. t. 99. fig. 4.

β. tenuissima (——). Filaments very slender.

On the damp soil in salt-marshes flooded at spring tides, more rarely in brackish ditches or upon decaying marine algæ. Appin, *Capt. Carmichael.* Anglesea; Barmouth; Penman Pool near Dolgelley; Braunton near Barnstaple; Penzance, *J. R.* Shirehampton near Bristol, *Mr. Thwaites.*

β. Shirehampton, *Mr. Thwaites.*

France, *Brébisson*; Germany, *Kützing.*

Stratum tender, very thin, of a dark or bluish green colour when recent, but opake and glaucous when dry. Filaments short, straight, slender, moniliform, with attenuated ends. Ordinary joints distinct, the terminal ones longer than broad and triangular or conical, the others nearly equal in length and breadth, at first quadrate, finally rounded at their angles, and when dried orbicular. Whilst dividing they are geminate and longer than broad. Vesicular cells orbicular or oval and generally ciliated.

Sporangia oblong, three times longer than broad, much broader than the ordinary cells, one or two on each side of the vesicular cell, the outer ones generally smallest.

The best distinctive mark of this species is the subacute extremities, combined with the short filament and littoral habitat. There are rarely more than one or two groups of enlarged cells; when only one is present it is situated near the centre of the filament. I believe that the attenuated extremities are constant, at least in the young plant, unless the filament has been broken.

The var. β. differs in having much slenderer filaments: I am not sufficiently acquainted with it to determine whether it be, as Mr. Thwaites supposes, a distinct species.

Plate I. fig. 7. *a*, *b*, ordinary form; *c*, var. β.

2. *S. Jacobi* (Ag.). Filaments elongated, their ends usually attenuated; ordinary cells subspherical; vesicular cells spherical; sporangia oblong or cylindrical. *Sphærozyga Jacobi*, Agardh, Icones Algarum Europæarum!; Berkeley in Eng. Bot. t. 2826. fig. 2.

Upper Mill, Dolgelley; near Swansea, *J. R.* Durham Down near Bristol, *Mr. Thwaites*!

Carlsbad, *Agardh*! Madeira, *Rev. T. Salwey*.

Sphærozyga Jacobi occurs in thick bluish green gelatinous masses, from which the filaments issue in long rays. The filaments are moniliform, elongated, and generally taper at their ends. Ordinary joints at first somewhat quadrate but finally orbicular, the terminal one longer than broad and usually conical. Vesicular cells spherical, larger than the ordinary joints, but not so broad as the sporangia. Sporangia oblong or cylindrical, one or two on each side of the vesicular cell.

Agardh's figure represents his *Sphærozyga Jacobi* as having the ordinary joints closely united, in fact separated merely by transverse dissepiments, and consequently so unlike the present plant, that I should scarcely have suspected their identity if Mr. Borrer had not afforded me an opportunity of examining an authentic Carlsbad specimen which he received from Agardh himself.

Sphærozyga Jacobi in some respects agrees with *S. Carmichaelii*; but the filaments are stouter and more elongated, the ordinary cells are more orbicular, its habitat is also different, and the dried plant wants the opake verdigris appearance so usual in the latter. The orbicular ordinary and vesicular cells distinguish it from *S. elastica* and *S. leptosperma*.

Plate I. fig. 8. *a*, immature filament; *b*, mature state.

3. *S. elastica* (Ag.). Filaments moniliform, dissepiments conspicuous; ordinary cells quadrate; vesicular ones elliptic; sporangia

cylindrical, truncate. *Sphærozyga elastica,* Agardh, Icones Algarum Europæarum. *Cylindrospermum elongatum,* Kützing, Species Algarum, p. 294 (1849); Tabulæ Phycologicæ, t. 99. fig. 111.

Cromlyn Bog near Swansea, *J. R.*
Sweden, *Agardh*; Germany, *Braun.*

Stratum deep bluish green, tender. Filaments elongated, constricted at the dissepiments. Ordinary cells about equal in length and breadth; but when dividing they lengthen, and though quadrate in the recent plant they acquire slightly rounded angles when dry. Vesicular cells at first barrel-shaped, finally elliptic. Sporangia cylindrical, four to eight times longer than broad, their ends at first truncate, but rounded after separation.

The moniliform filaments and shorter joints distinguish this species from *Sphærozyga leptosperma,* and its elliptic vesicular cells from *S. Jacobi* and *S. Carmichaelii.*

Plate I. fig. 9. *a,* immature filament; *b,* mature state.

** *Filaments moniliform; sporangia turgid, much broader than the ordinary cells.*

4. *S. Broomeii* (Thwaites). Filaments moniliform, elongated; ordinary joints suborbicular; vesicular cells barrel-shaped or elliptic; sporangia elliptic, catenate. *Sphærozyga Broomeii,* Thwaites.

Brackish ditch at Shirehampton, near Bristol, *Mr. Broome.*

Stratum bluish or yellowish green. Filaments elongated, obtuse; ordinary cells at first nearly quadrate, but finally orbicular. Vesicular cells smooth, at first barrel-shaped, then elliptic, broader than the ordinary joints, but not so broad as the sporangia, which are elliptic and numerous.

The gelatinous matrix is firmer than in many species of this genus, and under the lens can be detected without difficulty.

The numerous sporangia in each series distinguish *Sphærozyga Broomeii* from every other species I am acquainted with.

Plate I. fig. 10. *a,* immature filament; *b,* mature state.

5. *S. Berkeleyana* (Thwaites). Ordinary joints spherical or slightly compressed; vesicular cells spheroidal, compressed, as broad as the large turgid-elliptic sporangia. *Sphærozyga Berkeleyana,* Thwaites.

Brackish ditch at Shirehampton, near Bristol, *Mr. Thwaites.*

Filaments elongated; ordinary joints nearly globular, sometimes compressed and slightly broader than long, terminal ones longer and somewhat tapering. The vesicular cells are globular in dried specimens (but Mr. Thwaites informs me that in the recent state they are compressed); they are nearly as broad as the sporangia, which are large, broadly elliptic, and sometimes almost globular.

The turgid sporangia and large, compressed vesicular cells characterise the species.

Plate I. fig. 11. *a*, immature state; *b*, mature state.

6. *S. Mooreana* (——). Ordinary joints subspherical; vesicular cells barrel-shaped, much narrower than the large broadly-elliptic sporangia.

Ireland, *Mr. Moore*, to whom I am indebted for specimens.

Ordinary cells minute, somewhat orbicular. Sporangia very turgid, often nearly orbicular, much larger than either the vesicular or the ordinary cells. Vesicular cells minute, smooth and barrel-shaped.

I regret that I have only seen imperfect and dried filaments of this species intermixed with *Nostoc variegatum*, Moore; in a recent state therefore the form of the ordinary cells may not agree with the above description: still the large turgid sporangia must distinguish it from every species but *Sphærozyga Berkeleyana*, and from that it differs in its vesicular cells, which are comparatively much smaller and also longer than broad.

Plate I. fig. 12. Mature filament.

*** *Dissepiments obscure, cells longer than broad.*

7. *S. leptosperma* (Kützing). Filaments elongated, not constricted at the dissepiments; ordinary joints longer than broad, confluent; vesicular cells elliptic; sporangia linear. *Cylindrospermum leptospermum*, Kützing, Bot. Zeit. 1847, p. 198; Species Algarum, p. 294; Tabulæ Phycologicæ, t. 99. fig. 11.

Ditches and pools. Near Carnarvon and near Barmouth, *J. R.* France, *Lenormand.*

Sphærozyga leptosperma occurs in large, shapeless, gelatinous masses in still waters. Its colour varies from deep green to pale yellowish green, but when the filaments are comparatively few it is nearly colourless. The ordinary joints are longer than broad, separated only by transverse dissepiments, which are not contracted, and indeed are often so obscure, that, in the recent state, they can hardly be detected, whilst the filaments, in all respects but their enlarged cells, appear not unlike those of an *Oscillatoria*. Vesicular cells at first barrel-shaped, finally elliptic, and as broad as the sporangia, the early state of which they somewhat resemble, but they may be recognized by the absence of granular contents and by their globules. Sporangia cylindrical, four to six times longer than broad, truncate, slightly broader than the ordinary cells.

The confluent ordinary cells with their obscure dissepiments distinguish *Sphærozyga leptosperma* from every other British species.

Plate I. fig. 13. Mature filament.

Dolichospermum, *Thwaites MS.*

Filaments simple, generally moniliform, aggregated into a gelatinous stratum; sporangia interstitial, elongated, separated from the vesicular cells by the ordinary joints.

Dolichospermum differs from *Sphærozyga* only in the different arrangement of its cells. In the latter genus the vesicular cells connect the sporangia, whereas in the former they are situated amongst the ordinary cells.

The sporangia are much elongated and mostly cylindrical. They are developed from the ordinary cells, which are more or less remote from the vesicular ones. Mr. Thwaites finds that their extremities are invariably truncated, and the endochrome escapes in an undivided mass, a circumstance he has not noticed in the other genera belonging to the *Nostochineæ*.

This genus is distinguished from *Cylindrospermum* by the interstitial position of the sporangia and vesicular cells, and from *Trichormus* and *Spermosira* by its elongated sporangia.

1. *D. inæquale* (——). Filaments moniliform; ordinary cells at first quadrate, finally orbicular; vesicular cells large, spherical; sporangia linear, catenate.

Boggy pools. Dolmelynlyn near Dolgelley, *J. R.*

This plant forms extensive strata, composed of thick gelatinous masses of a deep green colour. Filaments elongated, consisting of from 100 to 200 cells, and, being stouter than in most species belonging to this family, visible to the naked eye. Ordinary cells distinct, quadrate in immature specimens, but at length nearly spherical, appearing punctate on account of the scattered granular matter which they contain. Vesicular cells spherical, broader than the ordinary joints and occurring at short intervals. Sporangia three or four times longer than broad, with truncate ends, in chains of from two to five members.

Dolichospermum inæquale may be known from the following species by its spherical vesicular cells and catenate sporangia.

Plate II. fig. 1.

2. *D. Ralfsii* (Kützing). Filaments moniliform; ordinary joints spherical; vesicular cells elliptic; sporangia elliptic or cylindrical, one or two in each series. *Cylindrospermum Ralfsii*, Kützing, Bot. Zeitg. (1847), p. 197; Species Algarum, p. 293; Tabulæ Phycologicæ, t. 98. fig. 7.

Bog and rivulet at Llyn Gwernan near Dolgelley, *J. R.*

Dolichospermum Ralfsii occurs in extensive strata of a velvety rich dark green colour, sometimes verging towards æruginous green. A portion placed in water threw out, in the course of one night, rays an inch or more in length. Filaments elongated, comparatively stout, visible to the naked eye, under the lens full green when grouped, but bluish green when scattered. Ordinary joints orbicular. Vesicular cells elliptic, broader than the ordinary ones. Sporangia near the middle of each series of ordinary joints, most frequently solitary, rarely more than two together, at first oval, afterwards oblong, finally cylindrical, and about six times longer than broad. In their early state they resemble the vesicular cells in form; but the presence of granular matter and the absence of junction-globules reveal their true character: the longer ones are frequently contracted at the middle, a circumstance I have occasionally noticed in those species which have elongated sporangia.

Dolichospermum Ralfsii is distinguished from *D. inæquale* by its elliptic vesicular cells (which are comparatively less broad), by its more orbicular ordinary joints and by having fewer sporangia.

Plate II. fig. 2.

3. *D. Thompsoni* (——). Filaments spirally curved; ordinary and vesicular cells spherical; sporangia oblong, curved, usually solitary. *Anabaina Flos-aquæ*, Harvey, Manual of Brit. Algæ, p. 186 (1841); Hassall, British Freshwater Algæ, p. 282. t. 75. fig. 2.

"Floating like powdered verdigris on one of the small Lochs Maben, Dumfries-shire," *Mr. W. Thompson.*

A specimen of this plant, given me by Mr. Thompson, forms on paper a thin stain of a bluish green colour. Filaments moniliform and loosely spiral. Ordinary and vesicular cells orbicular, and so much alike in form and size that in the dried state I am unable, with absolute certainty, to distinguish the latter from ordinary cells which have lost their granular matter. Mr. Thwaites however informs me, that by a careful adjustment of the lens, he has detected the puncta in the vesicular cell, in which also he finds the membrane firmer than in the others. Sporangia solitary (rarely two together) in each series. two or three times longer than broad, curved, so as to appear somewhat reniform, and more rounded at their ends than is usual in this genus.

This species is easily distinguished from the others by its curved filament and reniform sporangia. Its moniliform, spiral filament agrees better with *Trichormus* than with *Dolichospermum*, but in its elongated sporangia it differs from every species of the former.

Plate II. fig. 3.

4. *D. Smithii** (Thwaites MS.). Filaments straight, each included in

* For the description of this and the following species I am indebted to Mr. Thwaites.

a definite gelatinous sheath; ordinary cells subspherical, compressed, about as long as wide; vesicular cells subspherical, somewhat barrel-shaped, half as wide again as the ordinary cells, puncta very distinct; sporangia cylindrical, very unequal in length, and with the ends rounded and somewhat truncated.

Occurring amongst other algæ from a freshwater boggy pool at Wareham, Dorsetshire, *Rev. W. Smith.*

D. Smithii is immediately distinguishable from its congeners on account of its possessing a definite gelatinous sheath to each of its filaments, which are of smaller diameter than those of any other species of *Dolichospermum* we are now describing. The ordinary cells are subspherical, somewhat compressed, and of less diameter than the vesicular cells, which are barrel-shaped and with very distinct puncta. The numerous sporangia, which are of about twice the diameter of the ordinary cells, are elongated and cylindrical, very variable in length and in the number which occur together, and their ends are slightly truncate.

Plate II. fig. 4.

5. *D. Thwaitesii* (——). Filaments straight or nearly so; ordinary cells quadrate; vesicular cells oblong, subquadrate, puncta very distinct; sporangia numerous, cylindrical, with truncated ends, very variable in length. *Sphærozyga Ralfsii,* Thwaites in lit. (1849).

In a freshwater pool, Dendham Down near Bristol; also in a brackish ditch near Shirehampton, *G. H. K. Thwaites.*

D. Thwaitesii is nearly allied to the foregoing species, but its filaments are not included in a definite gelatinous sheath. Its filaments are also stouter than those of *D. Smithii,* and there is a difference in the form of its ordinary as well as of its vesicular cells. The vesicular cells of *D. Thwaitesii* are quadrangular, and hardly exceed in diameter the ordinary cells. The cylindrical truncated sporangia are numerous, occurring many in a chain, and very variable in their length; they are of about twice the diameter of the ordinary cells.

Plate II. fig. 5.

Cylindrospermum, *Kützing.*

Filaments simple, jointed, nidulating in a gelatinous stratum; vesicular cells terminal; sporangia oblong or elliptic, interposed between the vesicular and ordinary cells.

(*Anabaina,* Bory and others.)

In *Cylindrospermum* the stratum is similar to that described under the preceding genera; but as the filaments radiate less than is usually the case in *Sphærozyga,* I was, in one instance of admixture, enabled to separate the *Sphærozyga* from the *Cylin-*

drospermum, by availing myself of the greater radiating capacity of the former.

The filaments, as in the other genera, have at first all their joints uniform, but the terminal joint at each end soon enlarges into a vesicular cell, which is either orbicular, elliptic or ovate, and is generally furnished with fine scattered hairs or fibres : the penultimate joints then elongate and become cylindrical, afterwards they increase considerably in breadth, and when mature are always elliptic or elliptic-oblong. Sometimes two or even three sporangia are formed between the vesicular and the ordinary cells. The additional sporangia however are not uniformly present even in filaments from the same stratum, and are sometimes double at one extremity and not at the other; in fact, few mature specimens can be examined without observing examples of these variations. Hence, although the doubling of the sporangia occurs more abundantly in some specimens or species than in others, I cannot rely upon it as a specific distinction.

There can be no difficulty in recognizing this genus under the microscope. The filaments, especially when only one extremity is visible, are remarkable for their animal-like appearance. The chain of ordinary cells resembles a slender-jointed body; the enlarged elliptic sporangium, at least twice as broad as the remainder of the filament, represents the thorax, and the head is mimicked by the vesicular cell, which, in colour, shape and general aspect, differs from the other cells, whilst the presence of fine hairs renders the imitation more perfect.

It will thus be seen that the terminal cells are invariably vesicular, the penultimate ones always become sporangia, and the central ones remain unaltered.

When the filaments break up, the sporangia separate from the ordinary cells, but remain for some time crowned by the vesicular ones. The filament in *Sphærozyga* frequently breaks at the vesicular cells, after which the portion retaining one attached to its sporangium, appears, at first sight, to belong to this genus. In the recent state however the slightest attention will show its true character, for the vesicular cell of the broken *Sphærozyga* retains the punctum or globule at each end, which is not the case in *Cylindrospermum*, as it is only present where another cell has been conjoined.

1. *C. catenatum* (——). Filaments moniliform ; ordinary joints orbicular ; vesicular cells oval ; sporangia oval, catenate.

This species was probably gathered in South Wales, but I omitted to note the habitat when the specimens were preserved.

Stratum bluish green ; filaments very fine, elongated, straight or slightly flexuose, generally parallel. Ordinary cells orbicular, numerous, very minute. Vesicular cells oval. Sporangia (two to eight in each chain) at first similar to the ordinary cells, but usually less orbicular; finally they become more or less oval, the shorter ones approaching to orbicular, and the longer ones to oblong; they are frequently but little broader than the vesicular cell; in fact their size never differs so much as in many species.

Cylindrospermum catenatum differs from every other species in its numerous sporangia.

Cylindrospermum contains many other species, several of them by no means uncommon in this country; but their descriptions must be deferred to some future period, as my friend Mr. Thwaites, who had paid great attention to them, was prevented by his appointment at Ceylon from fulfilling his kind promise to describe them for this paper.

Plate I. fig. 14. *a*, immature filament; *b*, mature state.

APHANIZOMENON, *Morren*.

Filaments simple, flaccid, obsoletely jointed, "cohering laterally into flat lamellæ," aggregated into a mucous stratum; vesicular cells none; sporangia linear, interstitial.

(*Aphanizomenon*, Morren. *Limnochlide*, Kütz.)

Aphanizomenon forms a thin, tender, mucous stratum of a bluish colour. The filaments are extremely slender, flaccid, and very obscurely jointed. No vesicular cells have been detected. The sporangia are much elongated, either scattered or, more usually, solitary near the centre of the filament.

I have examined an authentic specimen of *Limnochlide Flos-aquæ*, and as there seems to be no essential difference between *Aphanizomenon* and *Limnochlide* I have united them, retaining the former appellation on account of its priority. The filaments in both genera are described as cohering in flat lamellæ, but that character is sometimes so little obvious in dried specimens, that I am not inclined to place much dependence upon it as a generic distinction, especially as I could not detect it in recent specimens of a plant, presently to be described, which I think should by no means be placed in a different genus.

Authors differ widely respecting the proper situation of this genus. In Harvey's 'Manual of British Algæ' it is placed at the end of the *Confervеæ*, Montagne appends it to the *Oscillatorieæ*, Endlicher omits it altogether, and Kützing instituted for it a distinct family, which he placed between *Leptotricheæ* and *Nostochineæ*. Mr. Hassall, I believe, first placed it in this family, and I fully concur with his observation that "the true position of the genus is undoubtedly amongst the *Nostochineæ*, connecting them with the *Oscillatorieæ*."

Aphanizomenon agrees in its filament with *Oscillatoria,* but is sufficiently separated by its conspicuous sporangia, which are similar to those of *Dolichospermum.* It differs from all the other genera in the *Nostochineæ* by the absence of vesicular cells and by its obsoletely articulated filament.

1. *A. Flos-aquæ* (Linn.). Filaments cohering laterally in flat lamellæ which separate at their extremities into fasciculi; sporangia cylindrical with an inconspicuous covering. *Byssus farinacea virescens, aquæ inspersa,* Linnæus, Flora Lapponica, no. 532 (1737), ed. 2nd, p. 388 (Smith, 1792); Flora Suecica, ed. 1st, no. 1128. *Byssus Flos-aquæ,* Linn. Species Plantarum, no. 1168 (1753), ed. 2nd, p. 1637. *Conferva Flos-aquæ,* Roth, Catalecta Botanica, fasc. 3. p. 192 (1806). *Oscillatoria Flos-aquæ,* Agardh, Synopsis Algarum Scandinaviæ, p. 107 (1817); Syst. Algarum, p. 59. *Nostoc Flos-aquæ,* Jürgens, Algæ aquaticæ. *Limnanthe Linnæi,* Kützing in Linnæa, vol. xvii. p. 86. *Limnochlide Flos-aquæ,* Kützing, Phycologia Generalis, p. 203 (1843); Phycologia Germanica, p. 168; Species Algarum, p. 286; Tabulæ Phycologicæ, t. 91. fig. 2 *a.* *Aphanizomenon incurvum,* Allman in lit. cum specimine.

Probably not uncommon. Grand Canal Docks, Dublin, *Professor Allman.*

Sweden, *Linnæus*; Germany, *Kützing.*

I am indebted to Professor Allman for a beautiful and characteristic specimen of this species. In its dried state the stratum appears to be composed of minute flocculi, and, with the exception of colour, might not unaptly be compared to scattered snow-flakes. The colour is opake, æruginous green, which however becomes more or less altered after being dried a second time. The microscope shows that the flocculi consist of parallel filaments united together laterally, and forming a flat layer which appears plumose from the filaments converging at the ends into little conical or subulate tufts or pencils. The filaments are straight, obtuse, not attenuated; the joints are rather longer than broad, faintly visible, and especially difficult of detection in consequence of their granular contents. Kützing describes the sporangia as elliptic. In the Dublin specimen they are few in number and immature; but in specimens given me by Professor Kützing they are linear, much elongated, often ten or twelve times longer than broad, and resemble those of the next species except in having a far less conspicuous hyaline covering. The best distinctive mark between these species is the lateral coherence of the filaments in *A. Flos-aquæ.*

In the dried state, the only condition in which I have seen it, the *Aphanizomenon Flos-aquæ* is easily recognized by its flocculent appearance, even to the naked eye. I believe that not only was it one of the earliest-known plants in this group, but that it is the true *Flos-aquæ* of almost every algologist prior to Lyngbye, whose error has misled many succeeding writers and confounded plants of widely different aspect. The descriptions of Linnæus, Roth and Agardh, although more or less deficient, agree far better with this species than with any others which have been confused with it. Lyngbye, indeed, suspected that his *Nostoc Flos-aquæ* was distinct from the plant of the two latter writers*, an opinion confirmed by Agardh so far as regards himself. Mr. Borrer has sent me a specimen of *Byssus Flos-aquæ* distributed by Mohr, who, there is every reason to suppose, was fully acquainted with the plant then known by that name: the specimen, which is a very good one, scarcely differs even in colour from those recently gathered by Professors Kützing and Allman.

I cannot obtain the slightest clue to the *Flos-aquæ* of our earlier British writers. They give no habitats, and although the specific definition of Hudson, Lightfoot and Withering agrees with this species ("filamentis plumosis natantibus"), yet, as it is a mere copy from Linnæus, no dependence can be placed upon it. The two former authors give no original remarks, and Withering's own observations agree but indifferently with his specific quotation; for his description, "jointed filaments straight or curled like a corkscrew," is more applicable to a *Trichormus*.

PLATE II. fig. 6. *a*, portion of foreign specimen magnified; *b*, Dublin sp. ditto; *c*, filaments highly magnified.

2. *A. cyaneum* (——). Filaments free, aggregated into a thin mucous stratum; sporangia linear, eight to twelve times longer than broad, furnished with a conspicuous hyaline covering. *Limnochlide Flos-aquæ, β. hercynica*, Kützing, Species Algarum, p. 286 (1849); Tabulæ Phycologicæ, t. 91. f. 11?

On aquatic plants in boggy pools at Llyn Gwernan and Dolmelynlyn near Dolgelley, *J. R.*

Germany, *Kützing*.

Stratum minute, thin, tender, of an opake light blue colour. Filaments very slender, straight, nearly colourless, having a slightly dotted appearance from the scattered granular endochrome, not constricted at the dissepiments, which are very indistinct, and only to be detected by careful examination in a favourable light; ends obtuse, not attenuated. Joints or ordinary cells nearly equal in length and breadth. Sporangia elongated, cylindrical, generally solitary near the centre of each filament, but sometimes scattered, each inclosed in a broad, hyaline covering.

* "An sit *Conferva Flos-aquæ*, Roth, *Oscillatoria Flos-aquæ*, Ag., justo ambigitur; illæ enim filis rectis et parallelis gaudere describuntur, hæc vero filis curvatis, implexis instructa est."—Lyngbye, Tentamen Hydrophytologiæ Danicæ, p. 202.

Aphanizomenon cyaneum differs from *A. Flos-aquæ* by its stratum not appearing flocculose, by its paler inconspicuous filaments, which do not cohere in laminæ, and would often escape detection under the microscope but for the presence of the sporangium, which has a far broader hyaline covering in this than in the latter species.

Plate II. fig. 7. Filament highly magnified.

3. *A. incurvum* (Morren). "Filaments articulated, cohering together in flat laminæ, laciniated at the apex; articulations two to eight times longer than broad." *Trichodesmium Flos-aquæ*, Ehrenb. in Poggend. Annal. 1830, p. 168 (according to Kützing). *Aphanizomenon incurvum*, Morren in Memoir (1837); Thompson in Annals of Nat. Hist. vol. v. p. 82; Harvey, Manual of Brit. Algæ, p. 145; Hassall, Brit. Freshwater Algæ, p. 280. t. 76. fig. 6. *Limnochlide Flos-aquæ γ. Harveyana*, Kützing, Species Algarum, p. 286 (1849); Tabulæ Phycologicæ, t. 91. fig. 2.

Ballydrain Lake, *Mr. W. Thompson*; Lough Neagh, *Mr. D. Moore*. Belgium, *Morren*; Germany, *Kützing*.

I regret that I am unable to afford any satisfactory information respecting this plant, for although Mr. Thompson has supplied me with specimens, they are unfortunately preserved upon paper, and could not be removed in a condition fit for examination. Respecting the Ballydrain species, one would suppose there could be no reasonable doubt as Dr. Morren has determined it. Still it is very possible that his *Aphanizomenon incurvum* has been rightly supposed by Kützing to be merely the *Flos-aquæ*, for nothing in the descriptions renders the opinion improbable. The Dublin plant at least is decidedly the *A. Flos-aquæ*. Mr. Thompson's *A. incurvum* however differs materially from all my specimens of the *A. Flos-aquæ* both in colour and in the form of the particles, which are circular and dot-like, very unlike the larger and lobed flakes of the other. Mr. Hassall's figure represents the filaments as tapering—a character, indeed, amply sufficient to distinguish the *A. incurvum* from the preceding species; but unfortunately, if the filaments really possess this character, neither Dr. Morren nor Mr. Hassall have noticed it in their descriptions, and so the matter is still in doubt.

Since the above was written, I have received from Mr. Moore some specimens better suited for examination. Although not from the same station as Mr. Thompson's plant, they exactly agree with it in appearance; the specks are unlike any other species that I have seen, and in form as well as in size and scattered habit resemble the small dots made by house-flies. Under the microscope the filaments appear parallel; they do not closely cohere as in *A. Flos-aquæ*, but are rather held together by the mucous matrix, and are neither fasciculated nor laciniated at their ends; they are so very slender that the triplet is not sufficiently powerful to afford a proper examination. I was unable to perceive either dissepiments or sporangia. In no respect, except in their parallel arrangement, did the filaments correspond with Morren's description.

Plate II. fig. 8. *a*, portion of stratum from Lough Neagh; *b*, filament.

II. *Remarks on the Growth of* Bambusa arundinacea *in the large Conservatory, Chatsworth.* By Mr. Robert Scott.

Read 12th July 1849.

In the tropics the Bamboo not only grows with astonishing rapidity, but attains a very great height,—in some instances as much as 100 feet*. This, together with its feathery elegance, places it in bold contrast to surrounding vegetation, and entitles it to rank second to the noble Palm. But under artificial culture it is indeed seldom seen in anything like its native majesty,—the extent of our horticultural structures not admitting of its full development.

In some degree at least this defect is obviated here, the *Bambusa* being planted out in a border of rich loam, with plenty of room for its roots, and the canes likewise, in most cases, having ample accommodation. So situated the Bamboo seems at home.

On the 19th of August, 1846, I observed the crown of a cane just showing itself above the surface of the ground. From its appearance I was led to infer that ultimately it would attain to a large size, and I resolved to watch its progress. The cane was situated at the circumference of a group, and this circumstance rendered the observation of its growth more convenient than it would have been had the cane been situated in the centre.

On referring to notes then made, I find that on September 1st the cane had reached a height of 8 feet from the ground. On the 6th September it had attained the height of 19 feet; and on September 13th it was 25 feet high: during the latter seventeen days of September the growth was uniformly 1 foot per day. Thus in forty-two days the cane had reached 42 feet from the ground, making an average growth of $\frac{1}{2}$ inch per hour. The subjoined table may serve to place this matter in a clearer light.

1846.		Average daily growth.
Aug. 19.	Cane just appearing above ground.	
Sept. 1.	„ 8 feet high.	nearly $7\frac{1}{2}$ inches.
„ 7.	„ 19 „	1 foot 10 inches.
„ 13.	„ 25 „	1 foot.
„ 30.	„ 42 „	1 foot.

* Mr. John Gibson, who collected plants in India for the Duke of Devonshire, has seen the Bamboo 100 feet high.

Having attained the height of 42 feet, the top of the cane was in immediate contact with the roof of the house. This circumstance rendered an arrest of its progress necessary; had it been otherwise, in all probability the cane would have extended 8 or 10 feet more.

In December 1847, the subject of the preceding remarks, along with the other canes forming the group previously alluded to, was cut down. The following observations were then made: Number of internodes, 32; circumference of the base of cane, 8 inches; circumference of top, $1\frac{1}{2}$ inch. The greatest circumference, 9 inches, occurred 8 ft. 3 in. from the base, and extended over four internodes. The two longest internodes measured each 1 foot 6 inches. They occurred at 19 ft. 8 in. from the base, and were each 8 inches in circumference. The shortest internode was 11 inches, and was the lowermost on the cane.

During the growth of the cane the temperature of the house was,—maximum 87°, minimum 60°, Fahrenheit. (Average $73\frac{1}{2}$°.)

In Paxton's 'Magazine of Gardening and Botany' for 1849, p. 62, there are a few remarks on the subject of this notice; but some mistakes have been made in the figures there given.

The cane is now in the British Museum.

I may add, that the *Bambusa arundinacea* very seldom commences to form its canes here until August and sometimes September, while the *Bambusa nigra* invariably makes its growth in May. The latter species has this year produced canes 16 ft. high.

III. *On a supposed new species of* Glyceria. By Frederick Townsend, B.A.

Read 13th December 1849.

In 1846 I drew up a description of a supposed new species of *Glyceria*, which had probably been confounded with other described species, viz. *G. fluitans* and *G. plicata*; and a paper on the three plants was read before the Botanical Society of Edinburgh on November 9 in that year, but for the purpose of adding the results of further observations, it was not then published. Revised characters for, and some remarks upon, the three supposed species are now again submitted to the Society.

In my former paper I applied the name of *G. hybrida* to the new plant; but as the use of that word might lead to erroneous theoretical conclusions, I now substitute the name of *G. pedicellata*. The specific characters may stand as follows:—

1. *Glyceria fluitans* (R. Br.). Panicle simple, elongate, subsecund, spreading whilst in flower, otherwise close; branches simple, lowermost mostly in pairs; rachis smooth; spikelets linear, of 7–12 acute florets; *outer pale oblong-lanceolate, length exceeding twice its breadth*: apex acute, somewhat apiculate; *anthers five times as long as broad*; *sheaths even*; careopsis linear-elliptical.

   Var. β. Inflorescence spiked.

   Rachis perfectly smooth, never swollen as in *G. plicata*. Leaves pungent; sheaths roughish; ligule obtuse, frequently obscurely three-toothed. Panicle subsecund, elongate; branches not bearing more than five spikelets, one branch only of each of the lowermost clusters bearing several spikelets; uppermost spikelets of the branches and rachis mostly sessile or upon short rigid pedicels; pedicels more or less scabrous. Inner pale equaling the outer in length or surpassing it. Anthers purple, sometimes yellow. Careopsis linear-elliptical.

   It flowers from June to September, sometimes bearing a second crop late in the year, and is universally distributed. It grows in stagnant and running water.

2. *G. pedicellata*. Panicle simple, elongate, subsecund; branches simple, always spreading, lowermost mostly in threes; rachis

smooth; spikelets linear, of 7–16 obtuse florets; *outer pale oblong, twice as long as broad*: apex entire or slightly and irregularly denticulate-crenate; *anthers three times as long as broad*; *sheaths sulcate.*

Rachis perfectly smooth, never swollen as in *G. plicata.* Leaves plicate, acute; sheaths roughish; ligule obtuse, somewhat apiculate. Panicle subsecund, elongate; branches not bearing more than six spikelets, one branch only of each of the lowermost clusters bearing several spikelets; spikelets more or less stalked; pedicels slender, flexible. Outer pale strongly ribbed when dry, more membranous than in the other two species; inner pale rather shorter than the outer. Squamulæ with an inflated appearance. Anthers always yellow; lips incurved after bursting. The careopsis has not been observed.

It flowers from June to September, and has been noticed in several places in Cambridgeshire, and at Dovedale near Blockley, Worcestershire. It is found in stagnant and running water.

3. *G. plicata* (Fries!). Panicle compound; branches compound, always spreading, lowermost mostly in fives, uppermost crowded; rachis scabrous above; spikelets linear, of 7–12 rather obtuse florets; *outer pale oval, not twice as long as broad*: apex obtuse-angled, obscurely three-toothed; *anthers twice as long as broad*; *sheaths sulcate*; careopsis roundish-elliptical.

Var. β. Panicle simple.

Rachis more or less rough from just below the panicle and upwards, wavy and twisted above, and frequently with a swollen appearance. Leaves plicate, rather obtuse, more flaccid and of a darker green than in the other two species; sheaths sulcate, rough; ligule obtuse, apiculate, obscurely three-toothed or entire. Panicle often drooping, not so elongate as in either of the above; clusters arranged at shorter distances; branches often spreading in all directions from the twisting of the rachis, uppermost crowded, a single branch often bearing sixteen or more spikelets, two branches of each of the lowermost clusters bearing several spikelets; spikelets shorter than in either of the above, uppermost spikelets of the branches and rachis sessile or upon short rigid pedicels; pedicels always scabrous. Florets smaller than in either of the above. Inner pale rather shorter than the outer. Anthers purple, sometimes yellow. Careopsis roundish-elliptical, and at once distinguishable from that of *G. fluitans*, which is linear-elliptical.

It flowers from June to September, sometimes bearing a second crop late in the year, and is of frequent occurrence. It grows in stagnant and running water. This is the *G. plicata*

(Fries), 'Herb. Normale Suec.' fasc. 5. No. 91, and is thus proved to be the plant described under that name by him.

Glyceria fluitans may at once be distinguished by its *even* sheaths, those of the other species under consideration being sulcate. *G. pedicellata* may be known from *G. plicata* by its spikelets being much longer and florets larger, its panicle simple and elongate, one branch only of each cluster bearing more than one spikelet, and the whole plant of a lighter green and more wire-like. A common observer might at a glance distinguish the plants by these characters.

The character of the inflorescence in *G. pedicellata* appears constant, whilst in the other plants it is variable, and for this reason I have noticed varieties derived from the form of inflorescence. By a compound panicle I understand that the main branches develope other branches upon which the *spikelets* are arranged, and the panicle is thus twice compound; in the simple panicle the pedicels of the spikelets spring directly from the main branches.

The name *pedicellata* has been chosen in consideration of the pedicels of the spikelets being longer and more decided in that plant than in the others, which have frequently quite sessile spikelets.

I have met with no description of *G. pedicellata*. From its having somewhat intermediate characters, it has probably been confounded both with *G. fluitans* and *G. plicata*. With regard to published figures, of which there are many, I will venture a few remarks. The figure given by Reichenbach (Icon. Fl. Germ. vii. t. 79) is an excellent one of *G. plicata*; except the fruit, which is a tolerable representation of that of *G. fluitans*, as will be seen by reference to Nees von Esenbeck (Gen. Pl. Fl. Germ. Monocot. i. 57), whose figure of the fruit is exactly that of *G. plicata*; the rest of the plate by the latter author is not sufficiently accurate. By Parnell (Brit. Grasses, t. 45), as far as I can judge, a fair figure is given of *G. pedicellata*; and in Curtis (Fl. Lond. i. t. 18) also is to be found a good plate of the same plant: the form of the panicle is good; but the outer pale is too long, and the magnified representation still less accurate; the anthers and leaves are accordant. There only remains one other figure to be noticed, viz. that given in 'English Botany' (t. 1520); it is however so faulty that I can determine nothing with sufficient accuracy.

Since the above was forwarded to the Botanical Society at Edinburgh on Nov. 29th, 1849, some "Remarks on *G. fluitans* and *G. plicata*" have appeared in the 'Phytologist' (iii. 734) from the pen of Mr. W. H. Purchas, on whose paper I should wish to say a few words. In *G. fluitans* I have not myself observed any characters by which specimens with appressed branches may be distinguished from those with the branches divaricate; colour is the only distinction which Mr. Purchas has remarked, and of this he appears to speak only from recollection and to consider almost valueless.

G. plicata a. of the same paper is certainly my *G. pedicellata*; but these plants do not agree in the proportion of the outer pale; in the latter the outer pale is twice as long as broad, in the former it is less than twice as long as broad. The character taken from the position of the apex of the outer pale with respect to the floret next above (when first attempting to distinguish the plants) I thought might be of value, but afterwards determined it to be worthless. The plicature of the leaves may be found in all these plants, but not generally in *G. fluitans*, whilst in *G. pedicellata* and *G. plicata* I have found the plicature pretty constant. That a specimen from Mr. Moore agrees with this plant is possible, as the two latter plants possess some characters in common and were not then distinguished; but an original specimen from that botanist preserved in Mr. Babington's herbarium is the *G. plicata* of this paper.

The description of *G. plicata β*, which Mr. Purchas thought to be my plant, is that of *G. plicata* (Fries), with the exception of the proportion of the outer pale and the character given of the leaves. It is curious that Mr. Purchas should never have observed the leaves to be folded, as I have found them very constantly so, having examined plants from numerous localities in several countries. The panicle has truly a "fuller look," "from the greater number of compound branches," as well as from their being arranged at shorter distances. The same botanist also observes, that "two branches of each whorl are almost constantly compound," and this character I have taken the liberty of inserting in other words in my observations on this plant. The remainder of his paper accords with my own observations, with exceptions which have been already noticed. I have however frequently found this plant in stagnant pools, and cannot as yet discover that either of the three affects peculiar situations.

There is only one more remark to be made, and this respecting the suspected hybrid origin of the plant; Mr. Purchas seems to imply that I held that opinion, but in my original but unpublished paper it was expressly stated that my convictions were that it could not be a hybrid, and the plant was therefore considered by me as a species; the unfortunate choice of a name has not unnaturally conveyed a wrong impression of my views.

IV. *On the British species of* Chara. By Charles C. Babington, M.A., F.L.S. &c.

Read 10th January 1850.

Since the genus *Chara* ceased to be considered as Phanerogamic and was placed as a Natural Order of Cryptogamic plants, its species have been excluded from our popular floras, and consequently suffered undeserved neglect from British botanists. The kindness of my friend Professor Henslow having recently placed in my hands a set of foreign specimens of *Chara*, which had been sent to him by Professor Alex. Braun of Freiburg in Breisgau, together with that botanist's notes upon some English *Charæ* submitted to his inspection, I have been induced to attempt the arrangement of our native species in a more complete manner than has as yet been done.

Since the time of Smith, who described all the British species known to him in his 'English Flora' (i. 6) which was published in 1824, only one complete account of our species has appeared, viz. that by Hooker (Eng. Fl. v. pt. 1. 242) in the year 1833, for Hassall's notice of them (Brit. Freshwater Alg. i. 94) cannot be considered as original. In that work Sir W. J. Hooker has characterized eight species, viz. 1. *translucens*; 2. *flexilis*; 3. *nidifica*; 4. *gracilis*; 5. *vulgaris*; 6. *Hedwigii*; 7. *aspera*; 8. *hispida*. More recently two have been added to this list, one by the Rev. M. J. Berkeley (Eng. Bot. Suppl. t. 2824) as the *C. pulchella* (Wallr.), which is considered in this paper as forming one species in combination with *C. Hedwigii* under the name of *C. fragilis*; and another by Mr. D. Moore (Lond. Journ. Bot. i. 43) as the *C. latifolia* (Willd.). The former botanist has also greatly elucidated the obscure subject of specific distinctions in this genus by his elaborate remarks in the same work under *C. Hedwigii* (Eng. Bot. Suppl. 2762). We have still to add an elegant little plant detected many years since in the fens of Cambridgeshire by Professor Henslow, and formerly supposed to be *C. gracilis*, but confidently referred by Professor Agardh, when in the year 1833 we had the pleasure and advantage of his company in an excursion into the fens, to his *C. hyalina*. Owing to the total absence until recently of nucules or globules from the specimens obtained, this plant has not, I believe, been published as a native species, although very many named samples of it have been distributed amongst botanists by Professor Henslow and myself. In this paper I have identified it with the *C. tenuissima* (Desv.), as is indeed done by Agardh, although he has preferred the name of *C. hyalina*; and have added to the list the *C. polysperma* (A. Braun), *C. syncarpa* (Thuil.), *C. mucronata* (A. Braun), *C. prolifera* (A. Braun), *C. Borreri* (Bab.), and *C. crinita* (Wallr.), thereby raising the number of our species to sixteen.

All these species, except two, are preserved in the herbaria of Prof. Henslow and myself, and as neither of us has paid any peculiar attention to this genus, but only collected such specimens as came accidentally under our notice, it is highly probable that several additions to the list will soon be made, and it is chiefly with the view of leading to such discoveries that it is now published.

In France, according to the list given by Lamotte (Cat. des Pl. Vasc. de l'Europe centrale) in 1847, nineteen species are found; in Germany we learn from the same book that there are eighteen species. Reichenbach (Fl. Germ. exc. 148 and 843) in 1833 described sixteen German species; and Fries (Summa Veg. Scand. 60) records fifteen species as natives of Scandinavia, but adds the remark, " spec. nondum pl. explor."

Since a considerable part of this paper was written, a valuable memoir by Prof. A. Braun has appeared in the 'Kew Miscellany' (i. 193), entitled "Charæ australes et antarcticæ," but including remarks upon the differences between the supposed genera *Chara* and *Nitella*, and pointing out new characters for their distinction. Notwithstanding the apparent value of these characters, I have thought it better to retain the name of *Chara* for the whole of the group until they have been carefully studied in the living plants, and their constancy and universality more fully proved. They are prefixed to the usual sectional characters in the ensuing arrangement of the species, in which I have followed that given by Prof. Braun in the above-mentioned memoir. I have also largely availed myself of the same distinguished botanist's valuable paper in the 'Flora, oder Botanische Zeitung' of Regensburg (xviii. 49), and his "Esquisse monographique du genus *Chara*" in the 'Annales des Sciences Naturelles' (ser. 2. i. 350), and have found the account of the species given by Mutel in his 'Flore Française' (iv. 159), and the plates in the 'Atlas de la Flore de Paris' by Cosson and Germain, very useful.

Nat. Order. CHARACEÆ, *Rich.*

Genus CHARA, *Linn.*

Section I. *Nitella.* Crown of the nucule of "ten cells, forming two circles one lying upon the other, never spreading, generally falling off before the maturation of the seeds" (A. Braun). Stems more or less pellucid, composed of a single tube.

A. *Nitellæ veræ.* Globules terminal at the furcation of the branchlets.

a. *Furcatæ.* Branchlets only once divided with one-jointed segments, 6–8 in a whorl, similar.

1. *C. flexilis* (Linn.); monœcious, stem slender equal flexible transparent, *branchlets pointed but not mucronate nearly equally forked* or trifid, nucules and globules together in the forks of the branchlets without bracts.

C. flexilis, *Linn. Sp. Pl.* 1624 (in part); *Eng. Bot.* t. 1070; *A. Braun in Flora,* xviii. 50; *Ann. Sc. Nat.* ser. 2. i. 351.
C. Brongniartiana, *Wedd. in Cat. Fl. Paris.* 152.
Nitella Brongniartiana, *Coss. et Germ. Fl. Paris.* 682; *Atl.* t. 40 C.

Rather slender, green, pellucid. Primary branchlets seldom more than once divided. Sometimes the axillary branchlets are much more divided and clustered, when it has passed for *C. nidifica* with collectors. Nucules with six striæ.

Henley near Ipswich, *Buddle.* Yarmouth, *Mr. D. Turner.* Berrington Pool, Salop, *Rev. E. Williams.* In the river at Bedford, *Dr. Abbot*; *Smith.* Richmond, Yorkshire, *Mr. J. Ward.* Stowting, Kent, *Rev. G. E. Smith.* Whitehorn, Wigtonshire; Clova, Forfarshire, *Prof. Balfour.* Reche Lode, and Lord's Bridge near Barton, Cambridgeshire.

Annual. May. "April to August," *Sm.*

2. *C. syncarpa* (Thuil.); diœcious, stem slender equal flexible transparent, *branchlets bluntish apiculate nearly equally forked* or trifid, nucules or globules at the forks of the branchlets without bracts.

C. syncarpa, "*Thuil. Fl. Par.* 473;" *A. Braun in Flora,* xviii. 51; *Ann. Sc. Nat.* ser. 2. i. 352; *Mutel Fl. Franc.* iv. 160.
Nitella syncarpa, *Coss. et Germ. Fl. Par.* 682; *Atl.* t. 39 (not good).

A slender diaphanous plant closely resembling *C. flexilis,* but diœcious. Nucules with five striæ and scarcely any crown. It is the supposed *C. gracilis* of Mr. W. Wilson in Hook. Bot. Misc. i. 336. No. 2.

Woodmancote, Sussex, *Mr. Borrer.* Cwm Idwel, Caenarvonshire. Ma'am, Galway.

Annual. May.

b. *Mucronatæ.* Branchlets usually repeatedly divided, terminal segments of two joints, last joint usually resembling a mucro. Branchlets 6–8 in a whorl, similar.

3. *C. translucens* (Pers.); monœcious, stem thick equal flexible transparent, *sterile branchlets simple* not jointed, *upper ones ending in two or three short points,* fertile whorls of small trifurcate branchlets very small and closely placed, nucules small oblong usually in threes just below the three bracts surrounding the terminal globule.

C. translucens, *Pers. Syn. Pl.* ii. 531; *Eng. Bot.* t. 1855; *A. Braun in Flora,* xviii. 51; *Ann. Sc. Nat.* ser. 2. i. 352; *Hook. Eng. Fl.* v. pt. 1. 245; *Mutel Fl. Franc.* iv. 160.

Nitella translucens, *Coss. et Germ. Fl. Par.* 682; *Atl.* t. 40 B.

A strong plant. Fertile whorls so disposed amongst the branchlets as to appear to be capitate. Globules solitary. Nucules with seven striæ. The fruit appears to be wrongly drawn in 'Eng. Bot.'

Deep stagnant pools. "Near Shrewsbury, *Rev. E. Williams*; Browston and Belton, Suffolk, *Sir W. J. Hooker*; Scotland;" *Sir J. E. Smith.* Bagnley Moor, Cheshire, *Mr. W. Wilson.* Totteredge, Middlesex, *Mr. E. Forster.* Loch Lubnaig, Perthshire; Lochnaw, Wigtonshire; near Liverpool; *Prof. Balfour.* Near the Fairlop Oak in Hainault Forest, Essex.

Annual. July.

4. *C. mucronata* (A. Br.); monœcious, stem slender equal flexible transparent, *branchlets strongly mucronate* nearly equally forked or trifid, *nucules and globules* together at the forks of the branchlets without bracts.

C. mucronata, *A. Braun in Flora,* xviii.; *Ann. Sc. Nat.* ser. 2. i. 351; *Mutel Fl. Franc.* iv. 161.

Nitella mucronata, *Coss. et Germ. Fl. Par.* 683; *Atl.* t. 40 D.

Rather thick for its length. Secondary branchlets once or twice forked or trifid, the terminal subdivisions rather shorter than the others. "Nucules with four or five striæ."

Marsh ditch at West Grinstead, Sussex, *Mr. Borrer.*

Annual. July.

5. *C. gracilis* (Sm.!); monœcious, stem slender equal flexible transparent, *branchlets in lax whorls* repeatedly divided into three or four segments, terminal segments mucronate shorter than the others, globules and nucules each solitary but together at the subdivisions of the branchlets without bracts.

C. gracilis, *Sm.! Eng. Bot.* t. 2140; *Reich.! Iconog.* t. 793; *A. Braun! in Flora,* xviii. 53; *Ann. Sc. Nat.* ser. 2. i. 351; *Mutel Fl. Franc.* iv. 160; *Hook. Eng. Fl.* v. pt. 1. 245 (in part).

Nitella gracilis, *Agardh Syst. Alg.* 125; *Coss. et Germ. Fl. Par.* 683; *Atl.* t. 41 E.

A very small and slender plant, its branchlets spreading in a lax open manner, and much longer than those of *C. tenuissima.* Nucules subglobose, with four or five striæ, large in proportion to the plant.

My judgement of this species is formed from the plate in 'Eng. Bot.' and a small but good specimen of the original plant, for which I am indebted to Mr. Borrer.

Mr. Wilson's *C. gracilis* from Cwm Idwel is *C. syncarpa.*

St. Leonard's Forest, Sussex, *Mr. Borrer.*

Annual. September?

6. *C. tenuissima* (Desv.); monœcious, stem slender equal flexible transparent, *branchlets short in dense compact subglobose whorls* repeatedly divided into 3–7 segments, terminal segments mucronate longer than the others, globules and nucules each solitary but together at the subdivisions of the branchlets without bracts.

C. tenuissima, *Desv.* "*Journ. Bot.* ii. 313;" *Reich.*! *Iconog.* t. 792; *A. Braun*! *in Flora*, xviii. 53; *Mutel Fl. Franc.* iv. 159.
C. glomerata, *A. Braun*! *in Ann. Sc. Nat.* ser. 2. i. 351, *not* N. glomerata, *Coss. et Germ.*
C. batrachosperma, *Reich. Iconog.* t. 794.
Nitella tenuissima, *Coss. et Germ. Fl. Par.* 681; *Atl.* t. 41 F.
N. hyalina, *Agardh*! *Syst. Alg.* 126, not *DeCand.*

A very small slender plant, its short much-divided branchlets forming little globular compact masses which are often much incrusted. Nucules subglobose, with 6–8 striæ, three times the diameter of the branchlets and placed outside of them. Globules much larger than the nucules.

I have recently (Aug. 6, 1849) found a profusion of ripe nucules and a few globules upon this plant in Bottisham Fen, and with the assistance of Messrs. J. D. C. Sowerby and J. W. Salter have succeeded in satisfactorily ascertaining their positions to be in accordance with the section in which the plant is here placed.

In peaty ditches and pits in the fens of Cambridgeshire.

Annual. July, August.

B. *Tolypella* (A. Braun). Globules placed laterally on the nodes of the chief ray of the branchlets between the lateral rays (bracts) which are always shorter than the chief ray.—Rays of many gradually decreasing joints.

Note.—This little group of singular plants presents more difficulty than either of the other sections, and I am very far from being convinced that a correct view of it is taken below. My original idea was that the plants only formed one species, but further study has convinced me that they are far too different to allow of their being lumped to that extent, and I am reduced to the necessity of considering them all as distinct. They appear to be very short-lived, and in all probability will be found to produce two crops in the year, one in the spring and the other autumnal.

7. *C. Smithii*; diœcious, stem slender equal flexible transparent, *branchlets blunt those forming the primary whorls simple* sterile long jointed (?), the others on axillary branches numerous densely crowded bearing four (three short and one long) bracts at their first node, *globules stalked* subtended by the three shorter bracts, nucules unknown.

C. nidifica, *Sm. Eng. Bot.* 1703 (principal figure).

A small plant remarkable, like the following species, for its bird's-nest-like masses of branchlets which spring from the axils of the simple branchlets forming the primary whorls. It is only known to me from the figure in 'Eng. Bot.' and from some remarks for which I am indebted to Mr. Borrer, and upon which the above specific character is founded.

As the *C. nidifica* (Müll.) is stated by Professor A. Braun (Hook. Kew. Misc. i. 200) to be "peculiar to the north of Europe, and particularly to the Baltic," and can therefore scarcely be the same as this plant, which was found "in a ditch which I believe the tide never reaches" (Borrer in Eng. Bot. Suppl. fol. 2762, note); and as the plate in 'Fl. Danica' is far too imperfect to allow of its identification with either of our *Tolypellæ*; I have thought it better, with the concurrence of Mr. Borrer, to confer a new name upon this plant, which was unfortunately made the representative of his *C. nidifica* by Smith by placing a figure of it in the principal place on the plate in 'English Botany.' I have the authority of the same botanist for saying that the following species was the plant really intended to bear that name. The confusion has originated from the idea prevalent at the time when the figure was published, that the diœcious plant from Lancing was a form of the monœcious one found at Cley. Unfortunately these plants are so evanescent that it is only by chance that they are again found in their original localities, where their seeds probably remain dormant until favourable circumstances cause them to germinate.

Lancing, Sussex (1804–5), in a ditch which the tide probably never reaches; not in Shoreham Harbour, as erroneously stated in 'English Botany.' *Mr. Borrer.*

Annual. Autumnal.

8. *C. prolifera* (A. Braun) ; *monœcious,* stem slender equal flexible transparent, *branchlets blunt those forming the primary whorls simple* sterile long usually of three or four joints, the others on axillary branches numerous densely crowded bearing four (three short and one long) bracts at their first node, *globules* sessile (?) in company with one or more nucules and "subtended by the three shorter bracts."

C. prolifera, *A. Braun in Flora,* xviii. 56 ; *Ann. Sc. Nat.* ser. 2. i. 352.

C. glomerata, *Mutel Fl. Franc.* iv. 161, not *A. Braun* nor N. glomerata, *Coss. et Germ.*

A small plant easily confounded on a superficial view with the preceding, from which it is distinguished by being monœcious. Nucules small with faintly marked striæ. Granules apparently sessile. The presence of decided bracts distinguishes this plant and the preceding and following from *C. polysperma* and *C. flexilis,* the species with which they are in the most danger of being confounded. There can be no doubt that the three smaller appendages are really bracts, although, in all probability, the longer (fourth) one is a subdivision of the branchlet.

In brackish (?) ditches. Cley, Norfolk, *Mr. D. Turner.* Copford, Essex.

Annual. April. "August to October," *Sm.*

9. *C. Borreri* ; monœcious, stem slender equal flexible transparent, *branchlets strongly mucronate those of the primary whorls* simple sterile long jointed, the others on axillary branches numerous densely crowded bearing four (three short and one long) bracts at their first and also sometimes second node, globules stalked or sessile in company with several nucules and subtended by the three shorter bracts.

C. nidifica, *Borr.* ! *in Eng. Bot. Suppl.* fol. 2762, note.

Closely resembling *C. prolifera* and *C. nidifica,* but considerably larger ; agreeing with them in most respects, but essentially different in its branchlets being "suddenly contracted below the acute apiculus." It also differs by sometimes producing a second cluster of bracts and fructification on its branchlets, and also occasionally having one on the larger "bract," which is thus shown to be more correctly a subdivision of the branchlet than a bract. The three true bracts are placed on the under side of the branchlet and at right angles with it, the fourth supposed "bract" is lateral and usually points upwards ; and their arrangement is believed to be exactly like that in *C. prolifera* and *C. Smithii.* This plant is chiefly known to me from the description in 'English Botany,' and from some manuscript notes, for which I am indebted to Mr. Borrer; and as it does not seem to have been noticed elsewhere, I have ventured to record it as a new species, and honour it with the name of my valued friend.

In a marsh ditch at Henfield, Sussex, *Mr. Borrer*.

Annual. July.

10. *C. polysperma* (A. Br.!); monœcious, stem slender equal flexible transparent, *barren and fertile branchlets of the primary whorls* once or twice *unequally branched*: middle subdivision longest, the other branchlets on axillary branches numerous densely crowded much subdivided with short internodes mostly finely pointed, nucules and globules placed at the nodes of the branchlets between the lateral rays.

C. polysperma, *A. Braun* "*Fl. Bad. Crypt.*;" *Flora*, xviii. 56; *Ann. Sc. Nat.* ser. 2. i. 352; *Mutel Fl. Franc.* iv. 162.

C. fasciculata, "*Amici*," *A. Braun*.

A small plant resembling the preceding species, and having like them bird's-nest-like masses of branchlets. My specimens are slightly incrusted, as is stated to be the case in those found in France. Nucules small with faintly marked striæ. Granules small.

I gathered this species in the year 1833 near Haslingfield in Cambridgeshire, but have not been able to find it there again. As numerous specimens were obtained by a party at that time, it is probably preserved in many collections under the name of *C. nidifica*, with which denomination it was sent to Prof. Braun and named by him as above. Mr. Borrer possesses specimens found at Livermere near Bury St. Edmonds by the Rev. G. R. Leathes; and I have obtained it (27 April 1850) from the stream which supplies the town of Cambridge with water.

Annual. April.

Section II. *Chara*. Crown of the nucule of "five cells forming a simple circle and sometimes spreading, persistent" (A. Braun). Stems usually coated with smaller tubes.

Charæ veræ. Granule taking the place of one of the bracts.—*Diplostephanæ* (A. Br.). A double row of spines (stipules) at the base of each whorl.

a. Stem coated with as many tubes as there are branchlets in each whorl.—Branchlets coated.

11. *C. crinita* (Wallr.); diœcious, stem slender *coarsely striated thickly beset with* setaceous patent *clustered spines*, branchlets abbreviated, bracts whorled slender equal, *nucules narrowly oblong* shorter than the bracts.

C. crinita, *Wallr. Ann. Bot.* 190. t. 3; *A. Braun in Flora*, xviii. 70; *Ann. Sc. Nat.* ser. 2. i. 355; *Mutel Fl. Franc.* iv. 165.

C. canescens, *Reich. Fl. exc.* 150.
Hippuris, &c., *Plukn. Phytog.* t. 193. f. 6. *Wallr.*

Stems slender, erect, flexible even when dry, smooth, not opake, densely crowded, slightly branched, pale green. Lower whorls rather distant, upper ones gradually closer, of 8–10 short branchlets each with six nodes and a whorl of five bracts at each node. Bracts usually as long as the internode. Nucules solitary with thirteen striæ and a prominent crown. My British specimens are of the male plant only.

Wallroth refers Pluknet's Irish plant to this with certainty; I have doubts.

In stagnant brackish (?) ponds. Burdock Pool, Falmouth, Cornwall, *Rev. W. L. P. Garnons.*

b. Stem coated with twice as many tubes as there are branchlets in each whorl, those opposite the branchlets bearing spines or tubercles, the others not. Branchlets coated, uppermost joints sometimes naked.

12. *C. vulgaris* (Linn. ?); monœcious, *stems scabrous finely striated* brittle, upper part of the branchlets without external tubes, bracts only on the inner side of the branchlets long: two 2–4 times as long as the nucules, and two equaling them.

C. vulgaris, *Linn. Sp. Pl.* 1624 (in part); *Eng. Bot.* t. 336; *Ag. Syst. Alg.* 128; *Hook. Eng. Fl.* v. pt. 1. 246.
C. fœtida, *A. Braun "Fl. Bad. Crypt.;" Flora,* xviii. 63; *Ann. Sc. Nat.* ser. 2. i. 354; *Mutel Fl. Franc.* iv. 162; *Coss. et Germ. Fl. Par.* 679; *Atl.* t. 37.

Plant diffuse, almost always incrusted. The spinose or tubercular (primary) cortical tubes less prominent than the secondary ones, and collapsing when dry, so as to place spines in the furrows of the stem. Branchlets appearing, at the first view, jointless, minutely pointed. Nucules with thirteen striæ and a short crown, accompanied by the globule. Bracts thick.

Varying greatly in appearance, size and roughness, sometimes hispid, sometimes much denuded of the outer tubes in the upper part. A very much condensed form is the *C. montana* (Schultz), Reich. Fl. exsic. 2143. The Linnæan *C. vulgaris* appears to include this and several other species.

Ditches and streams: common. *C. montana,* Gilsland, Cumberland, *Mr. W. Christy.*

Annual. June to August.

Note. The *C. contraria* (A.Br.), in which the primary cortical tubes project beyond the secondary ones, and therefore the spines are on the ridges not furrows of the stem, ought to be found in Britain.

13. *C. hispida* (Linn.); monœcious, *stem* thickened upwards spirally *sulcate rough brittle* beset with setaceous spines, branchlets elongated, bracts whorled (inner ones much longer), *nucules ovate* shorter than the bracts solitary, accompanied by a globule.

C. hispida, *Linn. Sp. Pl.* 1624; *Eng. Bot.* t. 436; *Wallr. Ann. Bot.* 187. t. 4; *Hook. Eng. Fl.* v. pt. 1. 246; *A. Braun in Flora,* xviii. 66; *Ann. Sc. Nat.* ser. 2. i. 355; *Mutel Fl. Franc.* iv. 163; *Coss. et Germ. Fl. Paris.* 679; *Atl.* t. 38 B.

Stems opake, greenish white, usually incrusted, covered with minute tubercles; spines generally very numerous, sometimes almost wanting upon the depressed primary tubes; whorls of elongate, acuminate (by having the terminal segment denuded of outer tubes) branches, each of which has about six nodes and a whorl of 4–5 short bracts at each node.

Pits and deep ditches, especially on a peaty soil.

Annual. May to August.

14. *C. tomentosa* (Linn.); diœcious (?), stem thickened upwards spirally sulcate rough brittle armed with *scattered obtuse papillæ,* branchlets incurved, bracts unilateral ovate-oblong mucronate-acute, nucule shorter than the bract on each side of it longer than the three in front.

C. tomentosa, *Linn. Sp. Pl.* 1624; *Fries! Herb. Norm.* v. 100; *Mutel Fl. Franc.* iv. 163; *Reich.! Fl. exc.* 150.

C. latifolia, *Willd.!* "*Berol. Schr.* iii. 129;" *Hook. Icon.* t. 532.

C. ceratophylla β. macroptila, *A. Braun in Flora,* xviii. 65; *Ann. Sc. Nat.* ser. 2. i. 355.

The granules and nucules are probably upon different plants. Stem opake, whitish green, covered with very minute tubercles, and bearing distant somewhat whorled short obtuse papillæ upon the prominent primary tubes. Branchlets like the stem; their terminal division thicker, inflated, of one pellucid tube. Bracts pellucid, barren ones unilateral (?). "Nucule with a large ovate bract on each side, and three small linear-oblong ones in front, also having three minute acute tubercles on the opposite side of the stem. Globule from a whorl of two or three large bracts not having smaller ones in front, but with two or three tubercles on the opposite side of the stem." *Hooker.*

In the foreign plant (Reich. Fl. exsic. 92, which is the authentic *C. latifolia,* Willd.), the bracts are apparently whorled. Fries's specimen (Herb. Norm. v. 100) is without any incrustation, smooth and scarcely twisted. Our plant is certainly the *C. tomentosa* (Linn.), *C. latifolia* (Willd.), and the *C. ceratophylla* (Wallr.) is a variety of it.

Belvidere Lake, Westmeath, Ireland, *Mr. D. Moore.*

c. Stem coated with three times as many tubes as there are branchlets in each whorl; *i. e.* two rows of secondary between each pair of primary tubes on which alone spines or tubercles are found.

15. *C. aspera* (Willd.); diœcious, stem finely striate *smooth flexible beset with setaceous patent spines*, branchlets abbreviated, bracts whorled slender (two inner ones longer), *nucules narrowly oblong* shorter than the bracts.

C. aspera, "*Willd. in Berol. Mag. d. N.* iii. 298;" *Wallr. Ann. Bot.* 185. t. 6. f. 3; *A. Braun! in Flora*, xviii. 71; *Ann. Sc. Nat.* ser. 2. i. 356; *Mutel Fl. Franc.* iv. 164; *Coss. et Germ. Fl. Paris.* 680; *Atl.* t. 38 D; *Eng. Bot. Suppl.* t. 2738; *Fries! Herb. Norm.* iii. 100.

Stems erect, not opake, pale green, densely crowded; spines usually scattered, often very short, or irregularly collected in whorls (when it much resembles *C. crinita*, Wallr.); whorls of 6–9 branchlets of six nodes and a whorl of 4–5 bracts at each node; bracts as long as the internode or shorter than it. Nucules solitary, with twelve or thirteen striæ and a prominent crown.

Distinguished from *C. crinita*, as is well remarked by Prof. A. Braun in his letter to Prof. Henslow, "by the more slender outer tubes of the stems." I am doubtful concerning the plant figured by Greville (Scott. Crypt. Fl. t. 339), for he places nucules and granules upon the same plant.

In stagnant water. Orkney, *Mr. Clauston.* Prestwich Car, Northumberland, *Mr. Robertson*; *Greville.* Irthing, Durham, *Mr. Bowman*; *Hooker.* Cleifiog Farm, four miles from Holyhead, Anglesea, *Mr. Wilson.* Burdock Pool near Falmouth, Cornwall, in company with *C. crinita*, *Rev. W. L. P. Garnons.* Loch of Skaill, Orkney, *Miss Watt.* In the river Shannon near Portumna, Galway, *Mr. D. Moore*; *Prof. Balfour.*

16. *C. fragilis* (Desv.); monœcious, stems slender finely striated smooth *not spinous, last* 1–3 *joints of the branchlets without external* tubes, bracts on the inner side of the branchlets about as long or longer than the oblong nucules.

C. fragilis, "*Desv. ap. Lois. Not. Fl. Franc.* 137;" *A. Braun in Flora*, xviii. 68; *Ann. Sc. Nat.* ser. 2. i. 356; *Reich.! Fl. exsic.* 94; *Mutel Fl. Franc.* iv. 164; *Coss. et Germ. Fl. Paris.* 680; *Atl.* t. 38 C.
C. pulchella, *Wallr. Ann. Bot.* 184. t. 2; *Eng. Bot. Suppl.* t. 2824; *Ag. Syst. Alg.* 129.
C. Hedwigii, *Ag. Syst. Alg.* 129; *Eng. Bot. Suppl.* t. 2762.

Slender, green, not incrusted. Main stem and branches usually with equally long branchlets. Nucule with thirteen or fourteen striæ and a long crown, accompanied by the globule. Bracts usually shorter than the nucules, but one equaling them in length; sometimes (*C. fragilis longibracteata,* A. Braun!, *C. delicatula,* Ag.?) longer than them.

The *C. Hedwigii* scarcely differs except in being very brittle when dry, the bracts shorter, and the branchlets of the main stem usually much longer than those of the branches.

Ponds. Sussex, *Rev. M. J. Berkeley.* Derwentwater, *Rev. E. A. Holmes.* Serk, *Rev. T. Salwey.* Paradi, Guernsey.—Var. *longibracteata*; West Chiltington Common, Sussex; Berrington Pool, Shropshire.—*C. Hedwigii*; West Grinstead, Sussex; Sandwich, Kent, *Rev. M. J. Berkeley.*

Annual. June to August.

V. *On the Watery Secretion of the Leaves and Stems of the Ice-plant* (Mesembryanthemum crystallinum, *L.*). By Dr. AUGUSTUS VOELCKER, Prof. of Chemistry Royal Agricult. College, Cirencester.

READ 10TH JANUARY 1850.

A FEW months ago I had the pleasure of communicating to the Botanical Society of Edinburgh the results of an examination of the watery liquid in the ascidia of *Nepenthes destillatoria*. Those present at the meeting will remember that, in opposition to the statements of most botanists who have directed their attention to the subject of the watery secretions of the leaves of plants, I found the liquid in the ascidia of *Nepenthes* to differ materially from puré water, inasmuch as it contained from 0·30 to nearly 1 per cent. of solid substances, partly organic partly inorganic. I stated at that time my doubts as to the watery secretion of plants being nothing but pure water, and gave some reasons for this opinion; Prof. Balfour, with whom I discussed the subject, kindly furnished me with the means of investigating this point still further by favouring me with fresh specimens of the curious Ice-plant (*Mesembryanthemum crystallinum*), a plant which is remarkable on account of the gland-like vesicular eminences with which its leaves and stems are covered. The result of the examination of the fluid secreted by the leaves of this plant has fully confirmed the opinion expressed in regard to the watery secretions of plants; at all events it has shown me that the secretion of the leaves of the Ice-plant is not merely pure water, but water containing several substances in solution. Though I was unable to determine quantitatively the composition of this secretion on account of the small quantity of liquid at my command—a quantity insufficient even for a minute qualitative analysis—yet I had no difficulty in detecting the chief constituent parts of the fluid. The secretion I procured by lacerating the gland-like eminences with which the leaves are covered, with a needle, and collecting the fluid in a glass bottle. The fluid thus obtained was colourless and nearly clear, without smell, and possessing no distinctly pronounced taste. Litmus-paper dipped in it was very slightly turned red, showing the presence of merely traces of a free acid or an acid salt. In order to free it entirely from any particles of epidermis which might accidentally have mingled with the liquid, I filtered it through white filtering-paper. The fluid passing through the filter slowly was now perfectly clear. On heating to 212° F. white flakes were separated, which proved to be identical with vegetable albumen. They were collected in a filter, and the filtrate evaporated to dryness on a water-bath. During the evaporation the liquid turned yellow, particularly when evaporated to a small bulk, and left a brownish-coloured, very hygroscopic residue, which redissolved in a small quantity of distilled water, leaving but a trace of a humus-like, dark-coloured organic substance undissolved.

The chemical nature of the fluid from which the albumen had been separated, was ascertained as far as possible by the following tests:—

Ammonia produced no change.

Carbonate of ammonia gave no precipitate.

Carbonate of soda on boiling gave a white precipitate.

Oxalate of ammonia produced no change.

Phosphate of soda and ammonia, added to the concentrated liquid, gave a crystalline white precipitate of phosphate of magnesia and ammonia.

Chloride of platinum, added to the concentrated liquid after the removal of the magnesia, produced a crystalline yellow precipitate.

The presence of soda was indicated by the yellow colour given to the alcohol flame.

Lime-water produced a white precipitate.

Sulphate of lime likewise produced a white precipitate.

Chloride of barium gave a heavy white precipitate.

Nitrate of silver gave a white flaky precipitate, soluble in ammonia, but insoluble in nitric acid.

Acetate of lead produced a white precipitate.

Basic acetate of lead gave a voluminous white precipitate.

A portion of the water evaporated to dryness and heated to redness left a white ash which effervesced with acids, indicating the presence of carbonates, originated from organic acids present in the fluid.

The nature of the organic acids, which in all likelihood accompanied the oxalic acid, I could not determine from want of material. The presence of oxalic acid however is distinctly indicated by the above reactions. They likewise show the presence of chloride of sodium, potash, sulphuric acid and magnesia.

In comparing this secretion of the leaves of the Ice-plant with the fluid in the ascidia of *Nepenthes*, we find a material difference in their respective compositions, as will be seen by the annexed table, which exhibits the composition of both fluids:—

Composition of the fluid in the ascidia of Nepenthes.	*Composition of the watery secretion of the leaves of* Mesembryanthemum crystallinum.
Organic matter, chiefly malic and a little citric acid.	Organic matter (albumen, oxalic acid, &c.).
Chloride of potassium.	Chloride of sodium.
Soda.	Potash.
Lime.	Magnesia.
Magnesia.	Sulphuric acid.

VI. *Notice of some of the rarer Plants observed in Orkney during the Summer of* 1849. By John T. Syme, Esq.

Read 14th February 1850.

Having passed the greater part of last summer in Orkney, and during that time having examined the natural history of the parts of it which I visited, I now lay before the Society a notice of a few of the rarer plants which I observed. I would have drawn up a list of *all* the species which I met with, but as I had opportunities of botanizing only in the southern part of the mainland and in the islands of Hoy, Burray and Flota, I have thought it advisable to defer this until I shall have made some acquaintance with the botany of the other islands, which I hope to accomplish next summer.

The flora of Orkney is by no means extensive, and excepting some alpine plants which are found at a lower elevation than usual, it embraces very few species of interest;—as is to be expected from its bare and treeless condition and the uniformity of its geological formation; the old red sandstone, with here and there a trap-dyke, being the only rock to be met with; while the incessant winds charged with saline particles and the low summer temperature forbid the growth of the more tender plants, as well as those which rise above the shelter of the surrounding vegetation.

In addition to these adverse circumstances, by far the greater proportion of the ground is flat and moorish, which still more contributes to give a sameness to the vegetation; so that I think we may account for the paucity of species from the physical conditions of the Orkney islands, without having recourse to any theory of centres of vegetation and migration of plants.

I shall now proceed to give the names of the plants I met with, nearly in the order in which I noticed them, with the dates when the various trips were made, as extracted from my journal.

On the 5th of June last, I went on board the screw steamer "Northman," at Leith, and after a tedious passage of forty hours, arrived in Kirkwall Bay. The morning was wet and windy, but being impatient to examine the botany and entomology of a district new to me, and feeling the desire of again walking on *terra firma,* as is natural to a landsman after a sea voyage of longer duration than he is accustomed to, I set out for Swanbister, the place of my destination, about eight miles south-west of Kirkwall. I soon found, however, that novelties or even rarities were not to be expected, for I did not in the whole of my walk find a single plant worth drying.

In the town of Kirkwall I saw *Stachys ambigua* (not yet in flower), growing among the nettles at the sides of the lanes. About two miles from Kirkwall there is a pond and marsh at the side of the road, where *Menyanthes trifoliata* was growing along with *Equisetum limosum* and *Carex ampullacea*; and in the moors along the sides of the roads, I saw *Luzula multiflora, Lycopodium Selago, Salix repens* and *Primula acaulis,* but nothing of any interest until I reached Swanbister, where *Scilla verna* was in great profusion, and *Gymnadenia albida* just coming into flower.

A few days after I found at Smoogro a curious variety of *Plantago lanceolata,* with very woolly leaves, lying flat on the ground and much broader than usual. Near this place *Stenhammaria maritima* used to occur, but there was no appearance of it. I suppose it must have been covered up with shingle by the sea, during the winter.

On the 12th of June I went to Howton Head, about three miles west of Swanbister, to see the station for *Primula scotica,* which was easily found, but appeared to have flowered very sparingly, as I only saw two plants in seed. Here I also found *Lycopodium selaginoides* and *Thalictrum alpinum,* about 200 feet above the sea; a curious fact, as where alpine plants are found at so low a level, it is usually where there is high ground behind, from which they have been brought down by burns, &c.; but here there are no hills of any considerable height near, and, indeed, I never found this nor any alpine plant elsewhere on the mainland.

On the 25th of June I had an excursion, in company with Mr. Robert Heddel, to Kirbister Loch, about two miles north-west of Swanbister. Here we found *Potamogeton filiformis,* 4 or 5 feet long, and with the peduncles 18 inches long (a form which I afterwards observed in the lower Loch of Stennis growing in the brackish water along with dwarfed and discoloured plants of *Fucus vesiculosus*).

In old marl-pits in the loch we found *Zannichellia palustris* and *Potamogeton heterophyllus* and *P. perfoliatus.* After completing the survey of the loch we went to Neversdale, where Dr. Duguid used to find *Ajuga pyramidalis* abundantly, but which had disappeared for the last four years; and after a very careful search, Mr. R. Heddel found a single plant of it, of which of course the root was carefully left. Here we also saw *Eleocharis uniglumis, Melampyrum pratense β. montanum,* and *Botrychium Lunaria.* But by far the most interesting excursion I made was to the Wast hill of Hoy, on the 28th of June, which I owed to the kindness of Mr. Heddel, who took me across in his yacht and pointed out the habitats of most of the very interesting alpine plants which are to be found there. Unfortunately our time was very limited, as we had to beat against wind and tide, and so did not reach the Bow (at the foot of the hill) till the afternoon. The ascent to the hill is at first not quite so steep as the slope of the debris of Salisbury Crags at Edinburgh, and here *Galium pusillum, Saxifraga aizoides* and *Silene acaulis* were abundant, even at the very foot of the hill. After ascending about 500 feet, the red sandstone rock rises nearly perpendicularly for about 150 feet, and here we gathered *Thalictrum alpinum, Saussurea alpina, Oxyria reniformis, Sedum Rhodiola,* and a *Hieracium* not in flower, which appeared to be *H. murorum γ. Lawsoni.* Above the rocks the hill is nearly bare of vegetation, and covered with debris, among which *Dryas octopetala* was growing in great perfection. *Saxifraga oppositifolia* and *Draba incana* also occur on the hill, but we had not time to look for them, as I was most anxious to see the station for *Ajuga pyramidalis,* found by Mr. Robert Heddel, at the Burn of Berridale. We accordingly descended into the valley of Rackwick, gathering *Lycopodium annotinum* on our way, and reached the Burn of Berridale about six o'clock in the evening. This ravine is remarkable as being the only place in Orkney where the birch and mountain-ash are to be seen growing wild. We soon found the *Ajuga pyramidalis,* which is confined to the west side of the burn near its mouth, and is by no means easily noticed. The barren plants resemble very much young plants of *Digitalis purpurea,* and they usually flower under the shelter of bushes of *Calluna vulgaris.* The plants were small, from 1–3 inches high, but were still in flower, while that which I had seen in Neversdale some days before had its seeds nearly ripe. *Melampyrum pratense β. montanum, Scirpus fluitans* and *Drosera anglica* also occurred here, and *Arctostaphylos Uva-ursi* in great profusion. There are also bushes of *Corylus Avellana* and *Hedera Helix* among the rocks. *Rubus suberectus* was found by Dr. Duguid on the north-west of Hoy, but we had not time to visit the station before embarking on our return to the Bow.

My next trip to Hoy was on the 3rd of July, when I examined part of the south-west coast, in company with Mr. Heddel. About two miles from Melsetter, *Stenhammaria maritima* occurred, and on the hills in several places *Arctostaphylos alpina* and *Vaccinium uliginosum.* Mr. Heddel has found *Lobelia Dortmanna* in several of the lakes in Waas, but I did not meet with it myself.

On the 17th of August I again visited Howton Head, but found *Primula scotica* out of flower. I was misled by the plants of it in the garden at Swanbister, which came into flower at this time, being probably delayed in flowering by having been transplanted in the spring. *Anagallis tenella* and *Habenaria viridis* were now in flower at this place, but I saw nothing else of any interest.

On the 28th of August I paid a visit to the north-west coast of Hoy, and found *Drosera anglica* in abundance, and *Vaccinium uliginosum* sparingly, and in the marshes above Rysay *Schœnus nigricans* and *Eleocharis multicaulis,* both of which I also found in several places in the mainland.

On the 31st *Stachys ambigua* was in flower at Kirkwall. Near Piggar, and in several other places round Swanbister, *Anthemis nobilis* occurs in plenty and apparently wild in one marshy field in particular, where it covers a large extent of ground, and is now at all events perfectly naturalized.

At Swanbister there is a tract of low land called the "Fidge," which used to be overflowed by the sea at spring tides, but is now protected from this by a sea-wall built by Mr. Fortescue. Here there are a good many of the plants that are to be found in salt marshes, *Salicornia herbacea, Cakile maritima, Alsine maritima, Sagina maritima, Carex extensa, Eleocharis uniglumis, Ruppia rostellata, Potamogeton filiformis, Blysmus rufus,* and one plant of *Stenhammaria maritima.* On the rocks called "Barnory," to the south of this, *Ligusticum scoticum* and the maritime form of *Pyrethrum inodorum* were seen; both of these plants also occur in profusion in the island of Burray along with *Silene maritima.*

Avena fatua and *strigosa* are found in most of the turnip-fields, &c., and appear to be quite indigenous. *Festuca ovina* var. *vivipara* is also common, and *Radiola millegrana* is to be seen in most of the moors.

There are a few bushes of *Populus tremula* and *Rosa villosa* on the cliffs, on the east side of the Wauk-mill bay between Kirkwall and Swanbister.

These are all the plants which I met with that are worth noticing; but on my next trip to Orkney I hope to be able to visit the north isles, which may perhaps add some others to the list, and make a trip to Orkney of sufficient interest to attract botanists more competent than myself to examine its flora.

84 Great King Street, Edinburgh, Feb. 5th, 1850.

VII. *On the Embryogeny of* Hippuris vulgaris. By John Scott Sanderson, F.B.S.E., Member of the Royal Medical Society of Edinburgh.

Read 14th February 1850.

The subject of the origin and development of the embryo has been lately brought before botanical readers so frequently in the various journals appropriated to vegetable physiology, and so much has been done by so many observers in the elucidation of the subject, that it must appear somewhat uncalled for to occupy your time with facts and observations which are only repetitions of what has been much better detailed by others in regard to other species, and by which therefore these results can only be corroborated.

As however the observations referred to are contained in foreign journals, and may have escaped the notice of many members whose attention has not been directed to this particular branch of botanical science, I trust that the following details will not prove wholly unacceptable, more especially as they will enable me to lay before you some of those highly important generalizations, which are to be obtained from the splendid researches of Hofmeister, Unger, Tulasne, and others, on the subject of embryogeny. We shall see as we proceed, that we are now enabled to construct a morphological type of development complete in all its parts, and applicable to all the hitherto investigated orders of phanerogamous plants.

Hippuris vulgaris belongs to the natural order *Halorageaceæ*, which contains only three British genera, *Myriophyllum, Hippuris* and *Callitriche,* all the species of which are water-plants with floating and submerged leaves. They appear to be distinguished by their submerged leaves possessing distinct bundles of spiral vessels, a fact which may be well seen in the common *Callitriche verna,* and has been lately shown by Barnéoud in those curious plants the *Trapas* which float on the rivers of Southern Europe, and are considered by many botanists as belonging to this order.

The ovary of *Hippuris* is one-celled, containing a single pendulous ovule, attached nearly at its apex by a fleshy funiculus. In its earliest condition I have not had an opportunity of examining it. If however it be examined at a period considerably before that of impregnation and before the development of the solitary anther is completed, it is observed to have become completely anatropous. The nucleus lies loosely in the cavity formed by the envelopes, which completely surround it, attached to the chalaza. The envelope is not distinguishable into primine and secundine, and extends considerably beyond the apex. It consists of small hexagonal cells arranged in series, each containing a nucleus. On one side, the raphe, consisting of a bundle of imperfect spirals, is seen passing from the hilum to the chalaza.

The nucleus, the structure of which cannot be seen on account of the opacity of the envelopes without dissecting it out, consists of a large cell, the embryonic vesicle, extending from its apex to about two-thirds of its length, which is surrounded by a single layer of very transparent, gelatinous-looking nucleated cells, which are however deficient at the apex, at which point the embryo-sac seems to be totally uncovered.

Contained in this embryo-sac is seen the embryo-vesicle. This body consists of a single elongated cell attached to the free extremity of the embryo-sac. This cell (the embryo-vesicle) contains a granular protoplasm in which here and there globules are observed to float. It probably originates at a very early period from the micropyle-end of the embryo-sac, but I have not been able to trace it at any earlier stage than that represented. The form which it presents, of an elongated cell attached to the end of the embryo-sac next the micropyle, and smaller at its attached than at its free extremity, is prevalent throughout the *Scrophulariaceæ*, *Cruciferæ*, and other orders.

From the fact that the embryo-vesicle is developed at so long a period before the bursting of the anther, little doubt can remain as to its existing prior to the act of impregnation, and not being, as supposed by Mirbel and Spach, a consequence of that act. Still less can it be supposed to be the end of the pollen-tube, according to the theory of Schleiden and his followers.

We now proceed to notice the changes which the embryo-vesicle undergoes subsequently to the act of impregnation. After impregnation, the granular protoplasm, which has accumulated at the larger extremity of the embryo-vesicle, becomes transformed into a spheroidal cell. A septum is then observable at the lower part, crossing it horizontally, by which it is divided into two cells. Of these the inferior is developed downwards by successive merismatic division, so as to form a confervoid filament, the suspensor. The upper assumes at the same time a spheroidal form, and is distinguished from the rest by being filled with granules, exactly as occurs in the *Orchidaceæ*. Soon after it divides by a longitudinal septum, and subsequently by a transverse. These are followed by successive divisions, and the embryo with its suspensor is formed. While these changes are taking place, the embryo-vesicle, which in the early stage is adherent by one of its extremities to the micropyle-end of the embryo-sac, becomes correspondingly enlarged and elongated. It however never becomes completely filled with the cells of the suspensor, or at least not until a very late period. It seems to be narrowed at its apex, either by the absorption of its contents by the developing embryo, or by the pressure of the contiguous parts. Subsequently the round mass of cells described above, to which the term *embryo-globule* has been applied, undergoes further development, and the cotyledons and other parts being gradually formed, the embryo assumes its characteristic appearance.

Thus we see in this plant—1st. That the embryo-vesicle exists at a period previous to the act of impregnation; 2nd. That after impregnation a number of cells are formed by an endogenous process in its cavity which assume a confervoid arrangement; 3rd. That of these one is selected to be developed into the embryo; 4th. That the rest undergo no further development, but seem to conduce to the nutrition of the embryo. These facts are in every respect conformable to what is known of the embryogenic process in the *Orchidaceæ*, *Onagraceæ*, *Scrophulariaceæ*, *Cruciferæ*, and other natural orders.

Since the above observations were made, I have had the opportunity of seeing the results of two very important series of researches by Hofmeister of Leipzig and Tulasne. These researches lead to the conclusion, that the mode of development above described in *Hippuris* is that which holds universally throughout phanerogamic plants. The results of Hofmeister, as detailed in his Monograph on the origin of the vegetable embryo, published at Leipzig last year, are as follows:—

A long time previous to the period of fecundation a certain number of free cellular nuclei are formed in the embryo-sac. These generally occur at the end of the sac next the micropyle. After this, free spherical cells are observed to be formed at the same part of the embryo-sac, which are usually three in number, an arrangement which probably depends on merely mechanical causes, and is well seen in the *Orchidaceæ*.

These cells are destined for the formation of the embryo itself, and are to be distinguished from those of a smaller size which are often observed at the same period at the opposite extremity of the embryo-sac, and conduce merely to the formation of the endosperm.

These cells are the embryo-vesicles, and from them the embryo is produced. One of them only remains active, while the rest abort. This being acted on by the fovilla at the period of fecundation, undergoes the development detailed below and becomes the embryo.

At the period of impregnation the pollen-tube arrives at the embryo-sac. Sometimes the sac-membrane is so firm as not to be indented by it. Sometimes it is considerably indented, and adherent for a longer or shorter period. At other times it appears, from its great tenuity, to be pierced by it. In all cases the embryo-vesicle remains perfectly closed, so that any communication between it and the end of the pollen-tube is impossible.

After impregnation the embryo-vesicle becomes divided into two cells by a transverse septum. These two cells are the first of those which form what Hofmeister calls the *pro-embryo*. The distal cell then in most cases divides by horizontal septa into a row of smaller cells. The terminal cell of this row then becomes more developed than the rest, and gives birth by an endogenous process to the embryo-globule. This then becomes developed into the embryo by the successive formation of new cells.

These results will be seen to harmonize perfectly with what has been already said with reference to *Hippuris*. They were obtained from the examination of a very great number of species belonging to various natural orders; among which may be mentioned *Orchidaceæ, Gramineæ, Liliaceæ, Iridaceæ, Amaryllidaceæ, Polygonaceæ, Caryophyllaceæ, Ericaceæ, Geraniaceæ,* &c., and there is every reason to depend on their accuracy.

In the last two numbers of the 'Annales des Sciences Naturelles,' which have only appeared in the course of last week, M. L. R. Tulasne has published the most complete and beautiful series of researches, as far as they go, among the many to which this controversy has given origin. The facts which are brought forward by this author are confirmatory in the most important particulars of what had previously been ascertained by Hofmeister, Unger, and others, but are distinguished by the author's inquiries having been carried to an earlier period in the development than had been arrived at by any previous observer in the families to which they refer, namely the *Scrophulariaceæ* and the *Cruciferæ*.

In the *Scrophulariaceæ* generally, as in *Hippuris,* the embryo-vesicle assumes at an early period an elongated form, and its subsequent development is identical. Tulasne has traced it to its earliest origin in several species. He has shown that it is developed originally on the inner surface of the wall of the embryonal sac near its summit, but at a point quite separate from that at which the pollen-tube is applied. This vesicle, at first exceedingly minute, grows upwards in the cavity of the embryo-sac, until it assumes a form similar to that seen in *Hippuris*. These facts are important, as serving to point out more distinctly the strict correspondence between the morphological modifications of the same development as observed in the *Scrophulariaceæ* and other orders, with those possessed of distinct embryo-sacs, as the *Orchidaceæ*.

The researches before us also derive an additional interest from their showing the total inaccuracy of the observations of Prof. Wydler of Berne, (which were made on the same natural order,) who in the year 1838 set himself to support the theory of Schleiden, and from whose alleged facts that physiologist derived some of the most powerful supports of his views.

In the *Cruciferæ* M. Tulasne has also accomplished all that can be done to perfect our knowledge of the embryogeny of the order. In particular he has described and figured distinctly the embryonal sac, the existence of which was doubted in that order, and has traced the embryonal vesicle from its earliest condition, that of a minute cellule attached to the micropyle extremity of the embryo-sac, up to that of a cylindriform cell filled with a granular protoplasm, at the period at which it should seem that fertilization takes place.

Numerous other points of great importance might be mentioned as illustrated by this admirable series of researches. They will well reward the perusal of all who take any interest in vegetable anatomy and physiology, and they are illustrated by drawings, which exceed in beauty and detail all their predecessors, although many of these have been beyond all praise.

From the accurate knowledge of the facts connected with the origin and development of the vegetable embryo, into the possession of which the researches of Unger, Hofmeister, and Tulasne have put us, we need be at no loss to arrive at certain general conclusions as to the order in which the various steps of the embryogenic process are brought about, and the laws by which it is governed. We shall therefore occupy the remainder of this paper in enumerating as shortly as possible the most important of these generalizations.

In order to facilitate description, we shall divide what seem to be the essential phænomena of the embryogenic process in the higher plants into three classes, in the first of which we shall consider the process of development of the embryo-sac; in the second the changes which take place within the embryo-sac before, and in the third, after the act of impregnation.

We shall first speak of the development of the embryo-sac, or the individualization of a cell of the female organ for reproductive purposes.

At a very early period a constituent cell, of what is called in descriptive language by a singular misnomer the *placenta*, gives rise by successive division to a cylindrical body, which consists of a central series of cells surrounded by others of smaller size. This, by another equally obvious misnomer, is called the *ovule*. From the central series of cells just mentioned one is separated and set apart for reproductive purposes, while the rest are variously developed so as to form coverings to this one. It enlarges at the expense of the rest, and receives the name of embryonal sac, and is strictly analogous to the animal unimpregnated ovum.

We next consider the changes which take place in the cavity of the embryo-sac previous to impregnation.

At a period considerably prior to impregnation a vesicle is developed, always at the micropyle-end of the embryo-sac, and probably always from a cytoblast. This vesicle enlarges more or less, and contains a fluid granular protoplasm. To this the name embryo-vesicle is assigned. It is analogous to the germ-vesicle in animals, both in its production and subsequent development.

Besides the embryo-vesicle other cells are frequently developed at this period, which are destined to conduce to the nutrition of the future embryo.

Lastly, we have to consider the changes which take place in the embryo-sac after impregnation.

At this period a cell belonging to the male organ (the pollen-grain) becomes so developed that its membrane and that of the embryo-sac are brought in contact; in consequence of which an interchange of their contents takes place, and under the peculiar influence of the one upon the other, the embryo-vesicle begins to develope within it two cells divided from each other by a transverse septum, in the same way as the first change observed after animal impregnation is the development of two cells in the germ-vesicle. These cells then multiply to a greater or less extent by transverse division so as to form a confervoid filament. At last, either at the centre or termination of this filament, one cell becomes developed by an endogenous mode of cell-production into a body to which the term embryo-globule is applied, and which is in fact the future embryo, while the rest perform a subordinate function, being probably merely subservient to the nutrition of the embryo. This last process corresponds in animals to the successive divisions of the two cells previously referred to, what is called the "*cleaving of the yelk mass*," on the surface of which the embryo is subsequently developed.

The foregoing sketch of what may be considered as the morphological type of the embryogenic development in the higher plants will, it is believed, include all those modifications which occur in those families which have been hitherto investigated. And considering that of late years, since the means of research have been so much more complete than formerly, there has been such a remarkable consonance in the results obtained by different observers, there is little reason to apprehend that any new facts are likely to arise, which will render it necessary to modify our generalizations to any great degree. We may therefore consider the controversy for the present settled. The doctrine of Schleiden is now only a matter of history, and as such possesses very great interest. When in 1837 he first brought forward his splendid discoveries as to the previously unknown nature and functions of cells, he founded upon them another doctrine, according to which the existence of sexes in plants was denied, and the so-called male organ alone was supposed to originate the germ. The history of this celebrated doctrine exemplifies in a remarkable manner the truth of the observation, that, although false facts may do an infinity of mischief in science, false theories are often productive of the greatest benefit.

The numerous researches which have been set on foot within the last ten years with a view to the refutation of the doctrines of Schleiden, have not only established the utter baselessness of these last, but have furnished us with a series of details more complete and more conclusive than any which we possess in connection with any other subject in the whole range of vegetable anatomy.

VIII. *On* Cannabis indica, *Indian Hemp.* By Alexander Christison, F.B.S.E., Member of the Royal Medical Society.

Read 11th April 1850.

The object of the present communication is to give some account of the Indian Hemp, a substance which has been long used in the Indian and Persian empires as a medicinal and intoxicating agent, but which was unknown to Europeans, except through the reports of travellers, until of late years. It was first brought into prominent notice by Dr. O'Shaughnessy of Calcutta in the year 1839.

It would be beyond the scope of this paper to enter minutely into the early history of the plant, but it may be observed that the narcotic properties of *Cannabis indica* were unknown to the Greek physicians. In the year 600 the Hindoos were in the habit of employing it, since which time it has been in constant use as a means of allaying pain, and more particularly as an intoxicating drug, among the inhabitants of the East. Hemp would seem to have been known at a still earlier period to the Chinese; in a communication to the Académie des Sciences in the early part of this year by M. Stanislas Julien, extracts are given from a Chinese work, showing that so far back as A.D. 220, a Chinese physician named Howshoa produced insensibility in his patients by means of a preparation of hemp, and that operations were then performed without pain to the patients. The veracity of this statement may however safely be questioned.

Until the year 1839 the properties of Hemp were never investigated in this country, but the essay of Dr. O'Shaughnessy published at that time attracted attention to the subject, and many experiments with the drug have now been made. The expectations held out by him have not been so fully realized as one would be led to expect. This can however be so far explained by a want of confidence or neglect on the part of some who have employed the drug, and the use of spurious or ill-prepared substances on the part of others. From the marked success of various experimenters, it is obvious that the plant does possess useful properties as a medicine: these will be pointed out in a future part of the paper.

In Dr. Lindley's 'Flora Medica,' *Cannabis sativa* is placed in the natural order *Urticaceæ*, no allusion being made to the *Cannabis indica,* as he obviously considers the two to be identical. It is thus described:—Flowers diœcious, male flowers racemose; calyx 5-parted, imbricated. Stamens 5. Anthers large and pendulous. Female flowers in spikes. Bract acuminate, rolled round the ovary in room of a calyx. Ovary roundish, with one pendulous ovule and two long filiform glandular stigmas. Achænium ovate, one-seeded, embryo doubled up, with the radicle parallel with the plano-convex cotyledons, and separated from them by a small quantity of albumen.

He also states that it is an annual, 3 feet high, covered all over with an extremely fine rough pubescence hardly visible to the naked eye. The stem erect, branched, bright green, angular. The leaves alternate or opposite on long weak petioles, digitate, scabrous, with linear lanceolate sharply serrated leaves, tapering into a long smooth entire point; stipules subulate. Clusters of flowers axillary, with subulate bracts; the males lax and drooping, branched and leafless at the base, the females erect, simple, and leafy at the base. Male calyx downy; female calyx covered with short brownish glands.

Dr. Lindley now places this plant in the order *Cannabinaceæ*, separating it from the *Urticaceæ*, the latter having small flat stipules, limpid juice, a solid erect ovule, and a straight albuminous embryo; the former having a solitary suspended ovule and a hooked exalbuminous embryo. In the above description Dr. Royle agrees, who has seen the plant in India.

Two species of *Cannabis* have been described by botanists, viz. *C. sativa* and *C. indica*: but repeated careful comparisons have failed to discover any material difference between them; the generally received opinion now being, that the same plant under the modifying influence of climate and cultivation puts on a variety of characters. This opinion has been fully borne out by the result of an experiment in the Botanic Garden, which it may be interesting to detail.

A few seeds picked from fresh Gunjah were sown on the 17th of March 1849, as well as some seeds from decayed Gunjah: the latter never germinated, but the others appeared above ground in a few days; in the course of a week they attained a height of 3 inches under glass. Three shoots were planted in the open air, while the remainder were kept in the hothouse. On August 1st those without had attained a height of 4½ feet, and it was remarked that they had a peculiar strong *minty* odour. On the 1st October one of these was 9½ feet high, with several strong woody stems and abundant foliage: flowering appeared to be commencing, but owing to advance of the season the leaves were withering. The plants in the hothouse at the same period were 4 feet high, slender, with few leaves, but in full flower. Plants of the common hemp growing in the Garden had a very similar aspect, being however in full fruit.

I am indebted to the kindness of Professor Balfour for the following remarks and botanical description of these plants:—"Those in the open air were all female plants; among those in the hothouse were one or two males. I have not been able to make out any specific difference between the so-called *C. indica* and *C. sativa* of Europe. The common hemp in the Garden has not attained the same size as the plants from Indian seeds, and the segments of the leaves are narrower; in other respects they appear alike, more especially as regards their flowers, glands, &c. Both the Indian and European seeds produce plants which have a strong resinous odour. In this respect the European plants in the garden seem to excel the Indian. On the Indian specimens even when cultivated in the hothouse there has not appeared any of the Churrus described by Indian observers. The racemes and spikes of flowers have a resinous feeling when touched. The following is a description of the plants raised from the Indian seeds :—

"*Flowers* diœcious. *Male* plants in the hothouse about 4 feet high; circumference of stem at the base about one inch, lower part of the stem woody. *Stem* somewhat quadrangular, grooved and roughish; surface of the stem at the base of a brownish colour, mixed with greenish streaks. *Leaves* opposite, sap-green above, pistachio-green below, quinate to septenate, at the upper part of the stem the leaves become alternate; segments of the leaves feather-veined, with a prominent midrib below, lanceolate, acute, with large serratures. Stipules 2, subulate.

"*Flowers* in cymose axillary leafy clusters, some of them abortive. *Perianth* of five ovate blunt segments, which are of a pale green colour (the margins being white and the centre greenish) with a marked green midrib, covered externally and internally with glandular pubescence; segments of the perianth concave internally. Stamens covered with glandular pubescence, opposite the segments of the perianth. Anthers large, projecting beyond the perianth, oblong, bilocular, erect, with an apicilar process and longitudinal dehiscence, supported on slender filaments which are shorter than the anthers and have pyramidal bases; pollen spherical, with three facets, each consisting of a small ring in the centre of a larger one. In the centre of the flower there is the rudiment of the pistil.

"*Female Plants.* These are much stronger than the male plants, have attained a greater size, and have a stronger balsamic odour; those in the hothouse attained a height of 5 feet, and those in the open air 9½ feet; stems hollow, 4 inches in circumference, with a tenacious stringy bark. Leaves covered with minute vesicular sessile glands, which give out a viscid resinous-like exudation, and are interspersed with glandular hairs. Flowers in aggregated spikes; usually three or more unibracteate flowers in a cluster in the axil of floral leaves which are often tripartite.

"*Perianth* monophyllous, convoluted, swelling at the base where it includes the ovary. Floral leaves, bracts and perianth covered with glandular pubescence.

"*Pistil* one. Ovary one, rounded, containing a single orthotropal erect ovule. Style short, terminal, ending in two elongate filiform pubescent stigmata. *Fruit* a caryopsis. Seed erect, marked with a coloured hilum. Embryo exalbuminous."

One or two remarks are suggested by this experiment:—1st. That the minute glands under favourable circumstances might act vigorously in producing the active resin. 2nd. That a certain climate which we cannot imitate is necessary to cause this action. 3rd. That the *C. indica* and *C. sativa* are identical; and 4th. That the Hemp plant possesses a peculiar odour of considerable strength, which is not alluded to in the standard works on Botany and Materia Medica.

It may here be observed, that the *Humulus Lupulus* or Hop, which owes its properties like *Cannabis* to a glandular resinous secretion, belongs to the same natural family and is endowed also with narcotic properties.

A short account will now be given of some of the principal forms in which Hemp is met with in the markets of the East; these are:—
1. *Haschich*. 2. *Bhang*. 3. *Gunjah*. 4. *Churrus*. 5. A variety of electuaries, pastes, &c., in all of which butter or some other oleaginous matter is the basis of formation.

I. The first or *Haschich* is the Arabian name given to the dried tops of the plant grown in Upper Egypt, the meaning of the word being "herb," or "*herbe par excellence*:" the tops are gathered some time before the seeds are come to maturity.

II. *Bhang* is an Indian preparation consisting of the larger leaves and capsules, which according to Dr. O'Shaughnessy is the cheapest form used in India, and therefore in common use among the lower orders for smoking, &c.; from it is prepared an intoxicating drink, and it forms a part of the confection called Majoon.

III. *Gunjah* is the chief Indian form of the dried plant, and consists of the drier tops of *Cannabis* after flowering, and from which the resin of the leaves has not been removed; it is chiefly sold in the Calcutta bazaars for smoking, in bundles 2 feet long and 3 inches in diameter; the colour is dusky green, the odour agreeably narcotic, the whole resinous and adhesive to the touch. The specimens I have examined consist of a central stem with branches, round which are aggregated elongated oval masses about 1½ inch long, and closely pressed together by adhesive resinous matter; when steeped in water these masses can be teased out, and are found to consist of the tops of the plant, that is, the flowers, fruit, and smaller leaflets.

IV. *Churrus* is the resinous secretion alone, and is therefore the most powerful shape in which hemp may be used; but it is at the same time expensive, and is not met with in Europe except as a museum specimen. The specimens in Dr. Christison's museum are variously-sized, nodulate, round masses from the size of a pea to that of a walnut, and of greenish black colour. It is collected during the hot season by scraping the leaves and tops. Dr. O'Shaughnessy states, that in Central India and Nepal men in leathern dresses brush forcibly through the plants, and the resin which adheres to them is then scraped off. And Dr. McKinnon states that in Nepal the resin is gathered on the backs of naked coolies. Dr. Royle says, "The glandular secretion is collected from the plants on the hills, by the natives pressing the upper part of the young plants between the palms of their hands and scraping off the secretion which adheres."

V. In the preparation of the electuaries, &c., butter is used as the means of separating the active principle, consequently these compounds are very apt to become rancid. They are thus described by M. Charnac in the 'Annuaire de Thérap.' for 1846:—

1. Preparations mixed with honey or melted sugar. 2. A more active form called *hachich kava-mesk* (musked drug), containing musk, essence of roses and almonds, of pasty consistence, and of the colour

of impure honey; the quantity used being about the size of a walnut. 3. Two kinds are found at Smyrna, called Israël, the one a fine powder, the other a roll of firm mastic consistence. 4. A black round kind has great aphrodisiac repute among the Fellahs, but in this case it is found that cantharides is added to increase the effect.

At Cairo the compound from which the various conserves are prepared is thus made. Equal parts of well-sifted haschich, butter and water are put in a vessel on the fire; after some boiling the water is dissipated; the residue is twisted in a cloth to isolate the fatty matter, and to this the different spices are added.

Haschich is to the Arabians what opium is to the Turks and Chinese. Hachach, signifying in Arabian drunkard, is the epithet applied to those who eat haschich.

The Arabians smoke the powdered plant, free of seeds, which contain fatty, disagreeable-tasted matter, along with tobacco.

VI. Landerer describes a tincture of hemp used at Cairo, called Chatsraky, made by infusing in spirit for three weeks with a gentle heat, the varnish-covered bark sliced from the stems when the plants are in flower.

As the activity of the preparations of hemp depends on the presence of a resinous varnish on the leaves, and consequently as the most active of these is found to contain the largest quantity of resin, it becomes a matter of great importance to decide upon the proper period for collecting the plant.

M. Gastinell, an apothecary at Cairo in 1849, states that he found the active powers of hemp to depend on a resinous matter which forms on the leaves as the seeds ripen. Again, M. de Charnac observes, that in Egypt the tops of the plants are used at the end of flowering, but before complete maturity of the seeds. And Mr. Jameson, Director of the Botanic Gardens at Saharunpore, makes a like statement in a letter dated 17th August, 1849. As this letter contains an interesting account of Hemp in that part of India, it has appeared to me to be well worthy of a place in this essay. He says—"In Kimaon and Gurhwal *Cannabis* is grown in large quantities, partly in order to obtain its resinous secretion, and partly for its bark, from which a strong coarse cloth called *Bungila* is manufactured; it forms the dress of the poorer inhabitants, particularly through Gurhwal. It is sown in July and gathered in October. From the female plants only the Churrus is procured. Towards the beginning or middle of October the seeds begin to form, and when in this unripe state the upper part of the plant is pressed between the palms of the hands, it deposits upon them a yellowish green secretion, which is scraped off with a blunt knife: this is the well-known Churrus. From the male plant Bhang and Cath are prepared. Bhang is prepared by drying the leaves and other parts of the plants, both male and female, and is thus used:—A small quantity is put into a mortar with a little water and pounded; the refuse water being thrown away, an additional quantity of water is then added, from half a pint to a pint, depending on the strength required, and well mixed; it is then strained through a fine cloth, the residue thrown away, and the liquid is ready for drinking, a wineglassful or more being taken at a time. Gangah is the thin preparation, and is the produce of the upper portion of the stem, that is about $1\frac{1}{2}$ foot; it is only used in the hookah to smoke; this also applies to the Churrus. The Gangah is carefully dried and mixed with an equal quantity of tobacco, and well rubbed together in the palm of the hand; it is then ready for the hookah. We have thus the three preparations:—1. Churrus. 2. Bhang or Lubzi. 3. Gangah or Ghangah. The first is only prepared on the hills, and the two latter are common to both hill and plain, but Bhang is principally prepared in the latter. At Bhaeit, about sixteen miles from Saharunpore, it is prepared in large quantity, and is subject to a heavy duty; yearly from 40,000 to 50,000 maunds are produced (a maund is equal to 80 lbs.). The reason why the Churrus is not prepared in the plains is, because the plant does not secrete the resinoid principle, showing that its secretion is connected with climate. But still the plants are identical in external characters, and you will I think find that the European and Indian plants are also identical. In order to ascertain the fact, I send you a small packet of hemp-seeds procured at one of the Gurhwal villages where it is grown in vast quantity. In your letter you say that the active principle forms on the stems and leaves; this is not the case, as it is only procured when the seeds are in an unripe state;—attempt to procure it before this period, and none will be forthcoming. It will appear strange how ignorant natives can distinguish female from male plants—were you to see the plant growing your surprise would soon be removed. The female plant when ready for making churrus has at its upper part a "bunchy" appearance, whereas the male plants have become by this time mere stems and leaves, the flowers also having fallen off.

"In October, in crossing the Himalayas from Almorah to Missouri, I have passed through dozens of villages 6000 to 8000 feet above the level of the sea, and seen hundreds of men, women and children, all employed in making churrus. The plant grows to a height of from 10 to 14 feet."

The plants cultivated in the Edinburgh Botanic Garden present exactly the characteristic difference between male and female described by Mr. Jameson.

From these observations then it appears to be undoubted, that the only period for collecting the plant in its active state is that time when the seeds are beginning to ripen, when therefore the tops of the plants are covered with the resinous varnish on which its properties depend.

The resin secreted by *Cannabis* is insoluble in water, but soluble in rectified spirit; and it may also be separated by oily matters. By the action of spirit upon Gunjah the extract of hemp is formed. In this country two extracts are used, the one sent from Calcutta, and the other prepared in England from the dried plant. The best extract presents a dark green colour and is thick and tenacious; when pressed between the fingers it softens and adheres obstinately to them, a solvent being necessary for its removal;—any extract which is found to rub down in the fingers should be looked upon with suspicion, and will be found to be nearly if not almost totally inert. The finest extract I have seen is that prepared by Mr. Robertson, Professor of Chemistry at Calcutta, which however is not in the market. Of this Mr. Robertson prepared about 30 lbs.; from a hundredweight of the plant he obtained about 8 lbs. of extract. His process consisted in passing the vapour of boiling alcohol through the plant packed in a cask, an ordinary worm leading from the cask to a receiver; the preparing of it cost him much time and trouble on account of the heavy duties upon hemp and also upon spirit, and the expense he reckoned at 15*s*. a pound. On these accounts he abandoned the attempt to manufacture it in this way, and though he received large orders for it from various quarters, he felt compelled to refuse the undertaking. Specimens were sent for experiment to various parts of Europe, and among others to Edinburgh for Dr. Christison; this is now four years old and retains all its energy, and is much more active than the extracts of the shops which are formed by cold percolation. I repeated his process on a small scale and found it to be a very complete means of exhausting the plant, while at the same time the consumption of spirit is less.

Good extract should give a grass-green tincture with spirit, and when the tincture is of a brown colour it is weak or inert.

Various investigations have been made as to the nature of the resin secreted by the leaves of *Cannabis*, and it has been ascertained that a pure resin can be separated retaining the properties of the plant in full energy. Gastinell, apothecary at Cairo, has prepared this substance, of which he says 2 grs. are as effective as 6 of alc. extract. M. de Courtive of Paris says that the resin prepared by him is in the dose of $\frac{3}{4}$ gr. as effective as 30 grs. alcoholic extract. He also prepared the resin from Paris-grown hemp and from French hemp, 6 grs. of the first, and 8 to 16 of the second being necessary to produce the effect. Surely he cannot have obtained a pure resin, when such various doses are required; for the pure principle, from whatever source obtained, should possess exactly the same activity in every case.

The Messrs. Smith of Edinburgh have made careful experiments on this subject: they observe that the narcotic action of hemp resides in a soft neutral resin called Cannabine, which when heated gives out a strong aromatic smell, and has a warm pungent balsamic taste; that it is insoluble in water or weak spirit, which is clearly proved in the following way—the addition of a fifth of water to a solution of the resin in strong spirit causes separation to begin, and all the resin is thrown down when a half of water is added. For a detail of their process I must refer however to the 'Pharmaceutical Journal' for 1846, merely observing at present, that in repeating the process with old Gunjah of 1840, ten per cent. of resin was obtained, answering to the characters given above; that the whole occupied a period of three weeks, and was very tedious. The following is a rough estimate of the composition of 8 oz. of Gunjah, used in my process:—

Resin	390 grs.
Nearly dry watery extract	500
Extractive by carb. soda	640
Vegetable fibre, &c.	2310—3840.

The physiological actions of *Cannabis indica* must now be considered, and the first question which presents itself is, whether this plant is a poison in large doses, and has it proved fatal to man? The prolonged use of it has certainly destroyed many in India, but no mention is made by authors of its proving fatal in one or two large doses. The only allusion to such an effect that I have seen, is that made by Mr. Reddie, a member of the Calcutta Bar, who in a letter to Dr. Christison, dated July 1849, says:—"The plant is a poison with many of the qualities of opium and some singular ones peculiar to itself," and that "it is frequently used at Calcutta as a poison." As this information was unsolicited, no details have been given, but Mr. Reddie has offered to give any additional information that may be required. Dr. O'Shaughnessy made a series of experiments on animals with the view of determining the quantity that it would be safe to administer as a medicine, but in none of these did death occur. In one experiment he gave 10 grs. churrus to a middling-sized dog. "In half an hour he became stupid and sleepy, dozing at intervals, starting up and wagging his tail as if extremely contented; he ate some food greedily; on being called to, he staggered to and fro, and his face assumed a look of utter and hopeless drunkenness. These symptoms lasted about two hours; in six hours he was perfectly well and lively. And again 20 grs. of ext. Gunjah, dissolved in spirit, were given to a dog of very small size. In a quarter of an hour he was intoxicated; in half an hour he had great difficulty of movement; in an hour he had lost all power over the hinder extremities, which were rather stiff, but flexible; sensibility did not seem to be impaired, and the circulation was natural. He readily acknowledged calls by an attempt to rise up. In four hours he was quite well. In none of these experiments was any pain evinced, or any convulsive motion." The dose mentioned above was the largest he gave; and the question remains, would yet larger doses have had a fatal effect? One point is however determined,—and Dr. O'Shaughnessy administered large and repeated doses with benefit in treating disease,—that so large a dose as 10 grains of churrus did not prove fatal to a dog.

A very curious result of Dr. O'Shaughnessy's experiments is, that carnivorous animals and fish very speedily underwent the effects of hemp, while graminivorous animals were only very slightly affected even by large doses of the drug.

The physiological action of hemp is in the first place stimulant in small doses, exciting the cerebral and digestive systems; and secondly, when given in larger quantity its effects are powerfully sedative and antispasmodic; and at last it induces insensibility. A consequence of these properties is the extensive use of the compounds of hemp in the East for the purpose of causing intoxication, and the effects correspond to the natural disposition of the individual. In some mere laziness and stupidity are induced, in others a pleasing state of reverie without other remarkable condition; and many are attacked with loud laughter, fits of dancing and singing, venereal appetite, inclination to quarrel, according to the various dispositions. The aphrodisiac action is by most authors regarded as peculiar to the hemp, but on the other hand there are some who regard this effect as merely depending on the disposition of the individual.

But what really appears to be inherent in the plant is, that in all there is a remarkable desire for food; it is quite astonishing and at the same time very ridiculous to observe an individual under the influence of *Cannabis* eagerly devouring his food without stopping, and apparently without any intention of so doing.

It has been noticed by Dr. O'Shaughnessy and others in India, that in most cases the effect of hemp is powerfully aphrodisiac. After the stage of excitement, sleep supervenes; and on waking the experimenter returns to his natural state, except that the ideas are often confused for a little, and in some cases vertigo is present to a slight extent. An example of the great extent to which the use of hemp is pushed in India is given by M. Liautaud, in his communication to the Académie des Sciences, as follows:—

"The grand feast of Dourga Pondja is terminated by the ceremony of immersing the idol in the river; after which the people return to intoxicate themselves with a drink from the leaves of hemp, and the whole ends in a scene of disgraceful drunkenness;" and in allusion to the physiological action, M. Liautaud remarks, that "there is peculiar ecstasy without convulsion;" that "the drinks excite the nervous system more than the powder or smoke." "This intoxication has appeared to him much less intense than that of opium and that produced in the Chinese smoker; the consequences are not so deadly, but the moral degradation the same."

Dr. O'Shaughnessy thus described the delirium induced by the incautious use of hemp:—"The state is at once recognized by the strange balancing gait of the patient, a constant rubbing of the hands, perpetual giggling, and a propensity to caress and chafe the feet of all bystanders of whatever rank. The eye wears an expression of cunning and merriment which can scarcely be mistaken, there is no increased heat or frequency of circulation, and the skin and general functions are in a natural state."

An interminable variety of ideas enters the mind when under the influence of hemp. In the work of Moreau, 'Du Haschich,' some interesting details of these effects are given. Among others, M. Théophile Gautier, in describing his sensations, says:—"After a feeling of numbness, it appeared to him that his body became transparent, and that he saw within his breast the haschich which he had eaten, in the form of an emerald, from which issued millions of little sparks. At the same time his eyelashes became indefinitely elongated, and began to roll as gold threads upon small ivory wheels which revolved with great velocity." A very curious effect was an increase of his power of hearing, whereby slight noises became as loud as thunder, and he heard the noise of colours, green, red, blue and yellow sounds coming to him in perfectly distinct waves; he did not dare to use his voice in case he should knock down the walls or burst himself like a bomb. His calculation of the time he enjoyed these dreams was about 300 years; the fact being that only a quarter of an hour had elapsed.

Dr. Christison describes the effects upon himself as follows:—On trying Mr. Robertson's extract once for toothache, I found that about 4 grs. taken about 3 A.M. caused in an hour cessation of pain, a pleasant numbness in the limbs, giddiness, a rapid succession of unassociated ideas and impossibility to follow a train of thought, frequent intervals of sleep, and slight increase in the force of the pulse. He felt no pain, but was quite conscious the toothache was present. Next morning there was an ordinary appetite, much torpidity, great defect and shortness of memory, extreme apparent protraction of time, but no peculiarity of articulation or other effect, and these symptoms lasted till 2 P.M., when they ceased entirely in a few minutes after taking lemonade.

One or two cases have come under my own observation; the first of these illustrates the less powerful and more gradual effect, when the hemp extract is taken in the form of pill. On the 3rd of April at 4 P.M., a friend took 2 grs. of the extract prepared by Mr. Robertson. At a quarter past six he felt as if weak, chiefly about the knees, with slight inclination to laugh; stupidity and forgetfulness, but without reverie; he continued in this state till he retired to bed, where he slept soundly. Next day he was perhaps more stupid than before, but was enlivened by drinking lemonade; he was not exactly himself till the following day; his appetite was strong, but he was not affected in any other way.

In the second experiment I took on the same day 1 gr. of the same extract dissolved in spirit, and though only half the quantity used in the first case, the effects were much more apparent. At a quarter past five, when sitting down to dinner, I felt a peculiar numbness creeping through my body and limbs; I did not think this was the action of the *Cannabis*, and began to fancy I was very ill, so that I could not eat my dinner; I lay down, and the numbness continued for a quarter of an hour, when my sensations became agreeable. I laughed heartily several times, answered questions incoherently, and immediately forgot what they were about; delightful reveries came over me, and whatever I looked at became lost as it were in a maze; the lamp appeared to be slowly turning round, and when I lost sight of this, the red lines on the paper of the room appeared to intertwine in a most beautiful manner. The most remarkable effect was the constant succession of new ideas, each of which was almost instantly forgotten; when roused to tea I ate ravenously without feeling satisfied; I slept soundly, and next day was stupid and forgetful, but was much improved by drinking lemon-juice. On the following day I was quite recovered.

My friend Mr. Maclagan has kindly described for me his sensations under *Cannabis* on the same day as above; he says:—"I took 2 grs. dissolved in spirit and 1 gr. as pill shortly afterwards; this was at 4 o'clock. At a quarter to six when seated at dinner, and after taking a copious draught of water, I felt a curious buzzing in my ears, with slight tinnitus aurium and giddiness; two minutes after, burst into an immoderate fit of laughter without any cause; I was asked what I meant, but disdained to answer, and despite of rebuke I laughed on for about five minutes. I then retired, but after walking from room to room for some time, I found myself quite unable to appear with my family, and therefore went to Dr. Christison's house, experiencing however great impediment by my legs bending under me at various angles. At one time, thinking a man was in pursuit, I took to my heels, and did not stop till I reached Dr. Christison's door; when it was opened I laughed in the servant's face and walked upstairs, where I continued to laugh till Dr. Christison entered the room, when my laughter became aggravated, and his questions were only answered by monosyllables and grins; I lay down on a sofa, where delightful sensations continually occurred to me.

"At 8 o'clock I got tea and ate three slices of bread; voracity seemed to be my object; I again lay down and laughed and sang till 10 o'clock; many of my exclamations, I was told, were decidedly verging on the affectionate. I also raised my right leg at regular intervals, and then let it fall upon the other, for a long time."

Such are the observations which have been made on the physiological action of Indian Hemp. I might have entered upon its therapeutical effects in hydrophobia, tetanus and other diseases, but this subject being connected more immediately with medical practice, is not fitted for the Botanical Society.

IX. *Remarks on some British species of* Carex. By W. O. Priestley, F.B.S.E.

Read 13th June 1850.

Having been engaged studying the British Carices for some time past, and having made some observations which may be interesting, I have been induced to lay them in as brief a manner as possible before this Society. I have had my attention particularly directed to a mode of arranging them, by which they might be more correctly studied, and with greater ease. It is however by no means an easy matter to form divisions which will answer this purpose. The number of male and female spikelets, the arrangement of them on the stem, their being erect or pendulous, stalked or sessile, bracteated or ebracteated, are very variable characters, and a slight difference in situation may cause many and altered forms of the same plant. The most stable characters I believe will be found in the fruit,—in its form, nerves, and position on the spike, and I think so well marked are the differences, that a person familiar with these might recognise three-fourths of our Carices by the fruit alone. Still, this is not universal; there would be great difficulty for instance in distinguishing the fruit of *C. remota* from that of *C. axillaris,* and some of the intermediate forms between *cæspitosa* and *stricta.* Nature indeed appears as though she would be bound by no laws, and the same obstacles to accurate and stable arrangement which exist in every other branch of natural history are met with in many of the genera of plants. We must however have classification to assist us in the acquisition of every science, and if we cannot have a perfect one, we must be content to make exceptions.

Yet so important do I think the fruit as a means of diagnosis in Carices, that I think every one wishing to name them correctly should have authentic specimens, or at least correct drawings, for differences are not so easily described as they may be seen.

I have first to read a short description of a *Carex,* a living specimen of which is now before the Society, *C. montana,* and shall then notice two or three of our more obscure species.

C. montana.

Male spikelet terminal, clavate, fertile, 2–3 sessile, ovate, approximate, closely surrounding the barren spikelet. Bracts glume-like, membranous, terminating in a foliaceous scabrous apiculus, the lowest longer than its spikelet. Glumes purplish brown, the male obtuse, the fertile mucronate. Stigmas 3; style long, exserted. Fruit hairy, bluntly triquetrous, oblong obovate, acute below, emarginate at the apex, with the long beak of the nut protruded. A prominent line running down each anterior face. Colour pale, longer than the glumes when mature. Nut elliptical, attenuated below, with a rather long tapering beak. Stem 5–6 inches high, slender, triquetrous, with rough angles.

Leaves chiefly radical, confined to the base of the stem, narrow, linear, rough at the edges and keel. Root fibrous. Began to flower last month.

This *Carex* is described by Mr. Babington in the last edition of his 'Manual,' and said to have been found by Mr. W. Mitten near Tonbridge Wells. It is certainly a very rare *Carex* in Britain, and has been cultivated with success in the gardens here. As it has not previously been brought under the notice of this Society, I have taken the liberty of reading the description I made of the plant.

This appears to be the true *C. montana* of Linnæus. Dr. Goodenough, although perhaps our most correct writer on this genus of plants, thought it but a starved specimen of *C. pilulifera*, described as a second species by Linnæus, but it is essentially different either from *C. pilulifera* or *C. præcox*. In *C. pilulifera* the spikes when mature are rounded, the fruit spreading in all directions; whilst in *C. montana* they retain the ovate or elliptical form; again, the fruit and nut are both subglobose in *C. pilulifera*, while in *C. montana* they are both triquetrous. The habit and general appearance of the plant at once separate it from *C. præcox*.

I have next to notice the fructification of *C. intermedia*. In dissecting the fruit of this plant I at first found it invariably abortive, and became afraid I should not be able to procure the nut to add to my dissections, but fortunately having a considerable number of specimens, I noticed one in which the summits of the upper and lower spikelets were occupied by what I then thought immature florets; on examining these I found them to contain the nut perfectly developed, while the larger or inflated fruit, which is usually described by authors, was always abortive. I at once looked on the latter as a monstrosity, and the former as the true fruit, because it inclosed the nut. The abortive fruit is oblong lanceolate, inflated, with a swollen beak, slightly incurved, and is twice the length of its glume. The fertile fruit is ovate lanceolate, straight, very narrowly winged, and is scarcely longer than its glume. This abortive form is of very general occurrence in *C. intermedia*; a perfectly fertile spike appears comparatively rare; I cannot tell to what cause we must attribute this anomaly. It seems not to be a form of ergot, as I have some specimens of a *Carex* so diseased, and it is very different, being firm and solid, while that in *C. intermedia* is hollow. It appears to undergo some such change as the fruit of the common juniper found on the Pentland Hills. I saw a specimen of this *Carex* so changed, in the Museum of this Society, marked "infested with insects," but I am unable to say whether this be the cause of the monstrosity; or if so, why the insects should prefer this species to other individuals of the genus.

I have been somewhat particular in detailing this fact, as neither Hooker nor Babington distinctly notices it: the latter describes the abortive fruit without noticing the true one, and hence, if a perfect specimen were under examination, it might be believed to be another species.

Many opinions have been expressed, and much has been written, as to the identity of our British *C. Œderi* with *C. flava*. Sir W. J. Hooker scarcely knows how to distinguish one from the other, and Mr. Babington, at once decided, places it as a variety, but at the same time adds some new species equally hypothetical. If the arrangement of the spikes and habit of plant be regarded as characteristic, I really cannot tell where to mark the distinction. I met with both lately growing in the same tuft, and many intermediate varieties. The fruit in both is very much alike; it is the same shape, has a similar number of ribs, and the beak is often curved in the lower part of a spike of *C. Œderi*, while in specimens of *C. flava*, where the spikes are distant, and everything else is characteristic of *flava*, the beak is straight, or in short, the fruit has not been properly or quickly enough matured. The nut in each is identical. I have procured foreign specimens of *C. Œderi*, which agree with Schkuhr's description, and think it very probably may be a distinct species. The spikelets are very different from those of the same age in *flava*; the arrangement of them does not vary so much in the two, and it seems by no means a constant character that they should be approximated in *Œderi*; but the fruit is different in form. It can scarcely be said to be beaked, but is rather acuminate and cleft, while in *flava* the fruit in the youngest state is remarkable for the length of its beak.

Seeing then that our species does not correspond with the foreign *C. Œderi*, I have been led to believe that *C. Œderi* may be a distinct species, but that ours is nothing more than *flava* stunted in its growth, and so better adapted for the elevated and bleak situations where it is usually found.

It is very difficult to say whether the *Carex Bœnninghausiana* described by Mr. Babington, is a distinct species from *axillaris* or only a variety, and for the reason that mature specimens cannot be procured. It has been cultivated in the Botanic Garden of Edinburgh for some time, and Mr. M'Nab assures me that the fruit has never become matured, while both *remota* and *axillaris* have ripened fruit. All the specimens I have seen in the University herbarium and in Dr. Balfour's collection have unripe fruit, and Mr. Babington's description is evidently taken from one of these, as he is uncertain about the nut.

I think it highly necessary to see a plant in all its stages of growth, before we create it a new species, especially if it has a close affinity with others. Having the lowest spikelets composed of alternate spicula instead of crowded, is scarcely a sufficient distinction between this and *axillaris,* and I have a specimen in which there is an attempt to cluster in *Bœnninghausiana,* while it preserves its other characters. The fruit can scarcely be admitted as evidence when immature; it undergoes many changes in form before it ripens, and the young fruit in *axillaris* and *remota* is identical with it.

The roughness reaches below the middle, it is said, in the perigonium of *Bœnninghausiana*; so it does in *axillaris* when very young, and the thickening of the fruit and consequent forming of the beak appear to be from below upwards, where the embryo is first placed.

It may be a hybrid produced from the impregnation of *axillaris* by the pollen of another *Carex,* as *remota.* Be this as it may, it is very singular that it does not come to perfection, and this fact strengthens the idea that it may be a hybrid.

I think we are perfectly justified in regarding it as a variety of *axillaris,* unless, were it ever to mature, it should prove different.

The last *Carex* I shall notice is an alpine one placed by Mr. Babington as a distinct species under the name of *Carex Persoonii.* This too has evidently been examined in an immature state, as Mr. Babington is usually particular in mentioning the form of the nut, which he has omitted here. It turns out in fact to be identical with *Carex curta*; its spikelets as they ripen are becoming from oblong, roundish-elliptical, on account of the spreading of the fruit. The perigonium has become longer than the membranous glumes, and has taken the exact form of that in *curta,* the split beak having become an emarginate one, and the nut elliptical. This is an illustration of what I referred to before, and shows how necessary it is to have a mature plant before we write a description.

X. *On the effects produced by some Insects, &c. upon Plants.* By James Hardy.

Read 11th July 1850.

I do not intend in the present notices to offer any remarks on the general subject of the effects of the Annulosa upon vegetation; this is a theme too important to be disposed of cursorily, and to follow it out in detail would require a treatise. I design merely to make a few statements relative to some observations recently made on some points, where botany and entomology may be said to be conterminous and capable of affording mutual illustration.

1. *Vibrio Graminis.*

On the 28th of May I noticed that the leaves of the sheep's fescue grass (*Festuca ovina*), and if I recollect aright, of some other grasses, growing close upon the sea-coast, were affected with several purplish swellings, of which I brought away examples for examination. They only appear a little thicker than the leaf in whose substance they originate, and according to their length are squarish or oblong, slightly roughish, stiff and rounded like a piece of wire, and occupy either the entire breadth or are confined to the edges. At first, from finding in the interior only bluish or purplish granules, I felt disposed to attribute them to a fungus; till opening others more carefully, I observed several minute Annelides, coiled up in channels winding amongst the granules. These I subsequently found were *Vibriones,* of which one species, *Vibrio Tritici,* as is now well understood, produces the disease called "Ear Cockles," or "Burnt Corn" in wheat. Others of somewhat similar character swarm in decaying potatoes and turnips, and the "eel" of vinegar is an example familiar to microscopic amateurs. Some of the knots contained only a single occupant, but one of the more elongated ones had about half a dozen of various sizes. The worms are white, almost transparent, very minute and slender, just visible to the eye, pointed at each end, the posterior tapered for a very considerable space, contracting as it were by three separate gradations till it terminates in a point; the head end is something like that of an eel, bluntish, and gradually widening out for a considerable way backwards, where there is a greenish annulus, formed perhaps by the commencement of the intestines, as behind this there is a cloudiness all along the middle. I could not perceive the oral opening, but behind the point there is a dusky spot connected by a line with the interior. The young ones are immaculate white, but the old contain a profusion of greenish granules, which may be either the eggs or the undigested food. Although not indicated externally, the body is evidently composed of a series of rings which separate the internal contents; as one in which the skin happened to be ruptured was emptied in a manner corresponding to this structure. The movement of the particles at the wound was a rapid rush, which extended itself by degrees upwards; but there were intervals where the current seemed to be impeded as if by constrictions, upon passing which it again flowed freely. The worms placed in moisture agitate themselves to and fro, but are usually rather inactive. The length is about 1 line. The species is probably new, and may be called *Vibrio Graminis*.

According to the observations of Mr. Bauer, *Vibrio Tritici* is originally introduced, in the young or egg state, into the germinating seed-corn, and after a succession of generations during the passage, is conducted by the propulsion of the circulating fluid up higher and higher, till it reaches the ear. Whether this be the means by which the present species gains access to the position which it occupies, I cannot determine. It is by no means uncommon, and as the parts affected by its presence dwarf the blade, interfere with the healthy flow of the sap, and will probably soon decay, it may be regarded as somewhat prejudicial to the coast pastures, which are principally composed of the grasses that it attacks. The granules with which the knots are filled give out a brown tincture when moistened.

2. *Cecidomyiæ of the Willow, Rose, and Rock-rose.*

It has recently been discovered by the German naturalists, that several of the galls which the Cynipides originate upon the leaves of trees produce two different forms of gall-fly; it has not however, so far as I am aware, been remarked, that the galls formed by the Dipterous *Cecidomyiæ* may in like manner be colonized at one and the same time by distinct species. The rose-gall upon the summits of willow shoots has attracted the attention of most observers, and DeGeer has briefly indicated the fly (*Cecidomyia salicina*), which he reared from the red larva which occasions it, as black with brown wings. During the present spring I met with one of these productions upon the *Salix cinerea,* tenanted by about eight or nine pupæ, which became flies on the 22nd of May, and these were at once seen to be not all of one species. The smallest and most numerous had the wings dusky and very pubescent, with the antennæ 17-jointed in the male and 16-jointed in the female, and were from $\frac{3}{4}$–1 line long, and the expanse of the wings 2 lines. The second, of which I only obtained a single male, was considerably larger, had the antennæ 22-jointed, the wings ample, clear, with only a few scattered hairs. Length $1\frac{1}{2}$ line, expanse of the wings 4 lines. I have not been able to identify these with any described species, and have named the first *C. saligna,* and the second *C. Cinerearum**. The *Cecidomyia salicina* of DeGeer, according to Macquart's account, has about twenty joints in the antennæ, and has the wings hairy and slightly obscure. Length 2 lines. The woody oblong gall of the willow likewise produces a *Cecidomyia,* which I venture to term *C. Gallarum-Salicis.* If I mistake not, from an examination of dried specimens, the antennæ are 20-jointed in the male and 19-jointed in the female, and the wings are slightly dusky and grayish pubescent. The length is $1\frac{1}{2}$ line, and the wings are 3 lines in expanse. Bouché, on the other hand, describes from this gall an insect which he likewise designates *Cecidomyia Salicina,* as 1 line long, with brown wings. There is thus a great confusion of synonyms on this topic, and it is possible from the observations which I have just recorded, that this may have arisen from insects really distinct having passed under the review of different observers. Mr. Westwood has recently brought forward another species found in the young twigs of *Salix viminalis* and *S. rubra.* This he names *C. viminalis,* and in it the antennæ are 17-jointed in both sexes, and the wings are colourless with the hinder margin strongly fringed.

I have also recently remarked an instance of two species of gall-midges acting in concert on roses. The leaflets of various wild species of these are tenanted in the centre by companies of larvæ which cause this part to thicken and blister on each side of the midrib, and the leaflet being thereby prevented from expanding, protects, as if in a pod, the little community. These larvæ have the characters of those of the *Cecidomyiæ,* viz. are spindle-shaped or subelliptical, only slightly convex, with distinct subcompressed lateral margins, the head end attenuated to a point, with a pair of horn-like bristles behind it, a dusky spot visible above and beneath, and a dagger-shaped polished mark

* *Cinereæ,* a sectional term applied by Mr. Borrer to the sallows.

on the fore-part of the breast; and the hinder end is subtruncate, slightly tuberculate. The most numerous is orange mottled with yellow; and the other is white, smoother, more minute, with the hinder apex trituberculate: both are sparingly bristled across the segments. The first is scarcely distinct from another yellowish grub often found on the underside of the leaves of garden roses affected with mildew, which appears to be engaged in devouring the minute fungi in which the disease consists. They descend into the soil to undergo their changes, and I doubt if I shall succeed in rearing them. About the time of their first appearance, however, I met with two species of *Cecidomyiæ* frequenting the infested rose-bushes, of which one, *C. Rosarum*, was occupied in depositing its eggs in the unopened leaflets. They are both undescribed species, and till the contrary is proved, I shall assume that they are the parents of the grubs in question.

To render these remarks more satisfactory, I shall append descriptions of the species to which they refer; which, except in the instance previously specified, are taken from fresh specimens.

1. *C. saligna*; nigro-cinerea; facie, verticeque sericeo-albis; occipite, oculisque nigris; scutello, lateribus, margineque posteriori thoracis subcarneis; pleuris et macula ante bases alarum argenteis; abdomine carneo, segmentis superne transversim nigricante fasciatis (♀); vel nigricante, marginibus posticis segmentorum vix carneis (♂); pedibus subelongatis, argenteo-cinereo-testaceis, tarsis fuscis; alis modice amplis, denigratis, dense griseo pubescentibus et fimbriatis, nervo costali nigro, angulo nervi furcati subrecto; antennis brevibus, cinereis, basi subtestaceis, 16-articulatis, articulis duobus primis cyathiformibus, ultimoque ovato exceptis, suboblongis, confertis, pilis verticillatis obsitis (♀); vel nigris, 17-articulatis, articulis, 1mo cyathiformi, 2ndo subrotundato, ultimoque subgloboso exceptis, pedicellato-oblongis, pilis longis fere biverticillatis obsitis (♂); halteribus albis, modice elongatis et clavatis. Long. corp. lin $\frac{3}{4}$–1; alar. exp. lin. 2.

2. *C. Cinerearum*; nigro-cinerea; facie grisea; oculis nigris; thoracis lateribus, nonnisi pleuris, maculaque ante bases alarum argenteis, concoloribus; dorso subelevato; abdominis dorso nitido piceo, lateribus obscurioribus; pedibus prælongis, pallide testaceis vel carneis, argenteo-micantibus; alis amplis, subhyalinis, sparse cinereo-pubescentibus et fimbriatis, nervis brunneis, subtenuibus, angulo nervi furcati subrecto; antennis nigris, 22-articulatis, articulis duobus primis crassioribus, subtransversis, reliquis, ultimo elongato-ovato excepto, pedicellato-subglobatis, introrsum longe, extrorsum breviter discreteque pilis verticillatis obsitis; halteribus elongatis albis, capitulo subdilatato vix fuscescente. Long. corp. lin. $1\frac{1}{2}$; alar. exp. lin. 4. ♂.

3. *C. Gallarum-Salicis*; nigro-cinerea; scutello piceo, concoloreve;

pleuris, ventre, lateribusque abdominis argenteis; pedibus elongatis cinereis, argenteo-micantibus; alis subamplis, subdenigratis, dense cinereo-fimbriatis, nervo costali crasso, obscuro, angulo nervi furcati rectiore; antennis nigris, 19?-articulatis, articulis confertis, dense setigeris, duobus primis, ultimoque exceptis, subcylindricis (♀); vel 20?-articulatis, duobus primis, ultimoque elongato oblongo-ovato exceptis, pedicellato-oblongo-subquadratis, confertim pilis verticillatis obsitis (♂); halteribus albis, capitulo dilatato. Corp. long. lin. $1\frac{1}{2}$; alar. exp. lin. 3.

4. *C. Rosarum*; nigricans, minuta, nitida, vix subcinereo-micans; thoracis margine posteriori, alarum radicibus, scutelli apice, metathoraceque interdum carneis; abdomine carneo, segmentis ad bases nigricantibus; ventre notis nigris asperso; pedibus elongatis gracilibus, albo-argenteis, subcinereisque variantibus; alis mediocribus abdomine brevioribus, denigratis, crebriter atro-cinereo pubescentibus et fimbriatis, nervo costali, primoque longitudinali, subnigris, angulo nervi furcati subrecto; antennis brevibus, gracilibus, nigris, 14-articulatis, articulis subcrebre pilis longis verticillatis obsitis, 1mo cyathiformi, 2do rotundato, 3io ovato breviter pedicellato, succedentibus oblongo-ovatis, confertis, ultimo tamen breviter ovato; halteribus albis, modice elongatis et clavatis. Long. corp. lin. 1; alar. exp. lin. 2. ♀.

5. *C. rhodophila*; pallida, minuta, gracilis; capite atro; thoracis dorso fusco-cinereo, lineis tribus pilorum griseorum notato, margine posteriori, scutello, metathoraceque flavidis, subcarneisve; abdomine curtato pallide flavo; pedibus elongatis, gracilibus, subflavis, extrorsum cinerascentibus; alis sublatis, hyalinis, purpureo-iridiscentibus, subtiliter minus confertim pubescentibus et fimbriatis, nervo costali, primoque longitudinali distinctis, subdenigratis, angulo nervi furcati subacuto; antennis nigris, basi flavidis, gracilibus, 18-articulatis, articulis, 1mo et 2do brevioribus, crassioribusque, subcyathiformibus, succedentibus cylindricis, gradatim longitudine et latitudine decrescentibus, ultimo ovato, breviter discreteque pilis verticillatis obsitis; halteribus albis. Long. corp. lin. $\frac{1}{2}$; alar. exp. lin. $1\frac{1}{2}$. ♀.

Obs. Mas adhuc exilior evasit.

About the 2nd of July the leaves at the summits of the twigs of *Helianthemum vulgare*, in this vicinity, were collected into bunches, but not so firmly compacted as those of the sallow. At the bases of the leaves numbers of the larvæ of a *Cecidomyia* were congregated, to whose operation the deficient extension of the shoots was owing. The grubs were narrow, slightly orange, with the centre more dusky, somewhat truncate, and quadrituberculate behind; the attenuated anterior end with a pair of bristle-like horns and a dusky spot; a testaceous dagger-like line on the breast, and a few hairs on the segments, with five or six apical ones. Length 1 line. From these I reared a single specimen of the midge, which may be named

6. *C. Helianthemi*; ochracea, minuta; oculis brunneis; thorace subflavo, atomis strigisque fuscis variegato; scutello carneo; facie, pedibus, antennisque flavis, his 14-articulatis, articulis, 1mo et 2ndo brevibus, ultimo subelongato, ceteris angustiore, reliquis pedicellato-subcylindricis, capitulis subcylindricis versus bases subcoarctatis, pilis longis biverticillatis obsitis; alis mediocribus, subalbido-flavidis, pallide nervosis, subcinereo-maculato-fasciatis, exitibus fasciarum maculas 7 cinereas marginales efficientibus, angulo nervi furcati subacuto; halteribus albis, capitulo modico. Long. corp. lin. $\frac{3}{4}$; alar. exp. lin. $1\frac{1}{2}$. ♂.

Obs. Habitu *C. bicoloris*, sed abunde differt; a *C. punctipenni*, Meig., numero articulorum antennarum minore, facile dignoscitur.

3. *Spotting of the leaves of Grasses, &c.*

I have often been unable to account for the suddenness with which the leaves of *Ranunculus repens*, and of many grasses (*Triticum repens* and *Alopecurus pratensis* being of the number) growing by the sides of walls, become whitened in minute specks and irregular lines all over the upper surface, as if the colour had been extracted from them, or had left some cells by a kind of elective preference for others. I have recently found this to be occasioned by a small dusky red-legged mite, which harbours under stones, but comes out in the sunshine in immense swarms to feast upon the foliage. Owing to the numerous mouths at work, large patches, especially in the grasses, are speedily drained of their sap and become quite dead or blighted. The mite is not described in any accessible work on the Arachnides. Dr. Johnston considers it to be a *Rhyncholophus*, but that the structure of the fore-legs indicates an affinity with *Bryobia*. From *Trombidium* it differs, he observes, in the eyes being sessile and on the shoulders. I have named it *R. haustor*, and the following specific character may serve to distinguish it:—

R. haustor; subovatus, atro-sanguineus, fronte, vitta dorsali, marginibus elevatis corporis plerumque, pedibusque coccineis; oculis, serieque marginali granulorum rufis; pedibus anticis gracilibus extensis posterioribus duplo longioribus. Long. corp. vix lin. $\frac{1}{4}$.

It occurs likewise upon the leaves of fruit-trees, but the dusky parts are then greener. In autumn it is much darker and more convex. It runs rapidly, agitates its fore-legs like antennæ, sloughs off its skin where it feeds, and leaves behind it an excrementitious deposit that glitters like honey-dew.

4. *Adelges Abietis.*

This insect forms the cone-like excrescences on the spruce-fir. The original matriarch lives outside the gall, remaining all winter in a dormant state at the root of the bud. As soon as the bud swells she revives likewise, and speedily becoming enlarged with the juice imbibed, she lays some hundreds of eggs about her. The bud meanwhile instead of growing in length becomes fleshy, and this fleshiness is communicated to the leaves. The result is an arrested bud, into the recesses of which, the young issuing from the cluster of ova on the outside of it beneath betake themselves, and become soon closed in during the growth consequent on the increased irritation occasioned by their presence in its interior.

From the statement of Linnæus one might infer that he was acquainted with the process of their formation: "Corpus Abietis in ipsis ramorum extremitatibus fragiforme, habet extus supra se et inter squamas foliaceas imbricatas, in sinu squamarum, plurima animalcula parva, e quorum ano quasi lana prominet. Juxta basin hujus corpusculi seu fragi observatur lana major in copia, in qua mater minorum, quæ caussat fragum."—*Faun. Suec.* p. 215. no. 700. edit. 1.

As to the alleged diversity of the species produced by the small rounded cones at the summit of twigs (*Chermes coccineus*, Ratz.), and those from the larger, more fleshy, and more oblong galls arising at the bases, or enveloped in the substance of shoots (*C. viridis*, Ratz.), the greater exposure to the sun is sufficient to give a deeper tint of colour as well as a more rapid evolution to the inclosed inmates. The difference assigned in the structure of the wing-veins quite eludes my detection.

Those arrested individuals that pass the winter on the branches are perhaps the progeny of winged females, which are oviparous. I observe, also, that winged females of two other species are in like manner oviparous, viz. those of *A. Laricis* and *A. corticalis*. M. Macquart had long since remarked this fact in regard to *A. Laricis*, and felt persuaded that it was only the second generation whose winged females are in this condition. He considered it to be a *Psylla*, and being anomalous proposed to form of it a new genus, which, not finding he had prefixed a name to, MM. Amyot and Serville, in attempting to supply the oversight, have called *Cnaphalodes* (Hemipt. 594, 595). The structure however of the larvæ of *Adelges*, as well as that of the mature insect, indicates that it follows the type of the *Coccidæ* rather than either that of the *Psyllidæ* or *Aphidæ*.

XI. *On the Hedge Plants of India, and the conditions which adapt them for special purposes and particular localities.* By Hugh F. C. Cleghorn, M.D., Hon. E.I.C.S.

Read 1st August 1850.

It is my purpose to notice the hedge-plants observed in the Peninsula, as well as a few indigenous species of frequent occurrence, from the employment of which advantages may be derived. My intention is to glance at them under their botanical and agricultural characters, and to allude to some which deserve to be generally diffused with a view to their œconomical properties and practical utility.

Since my admission on the Madras establishment in 1842, I have traversed a considerable portion of that Presidency in the execution of duty, including the Southern Division, the territories of Mysore, with parts of Canara, and the Southern Mahratta country. Along the line of march, and in the course of botanical rambles, I made rough camp notes as to the vegetation and general appearance of the country. From want of leisure, these were unavoidably very imperfect, yet they may serve to attract attention to a subject which seems to me of no small importance; and I trust some little advantage may be derived from my observations.

The system of Indian husbandry continues much in the rude state our fathers found it a century ago. In the day of rapid progress at home, agriculture in Hindostan evinces few signs of improvement. The farming utensils are simple and wretched; the most abject utilitarianism characterizes field operations. With the Ryot no motive seems to exist beyond providing the means of immediate subsistence: he scratches the soil with his black-wood plough, tipped with iron, and made light with the pole of bamboo, so as to be carried on the shoulder; he drops the seed upon the furrow, drags a log of wood,—hollowed like a trough but open at the ends,—to break the clods and smoothen the surface, or draws a few thorny branches of Acacia over the field, which may be termed the brush-harrow of the Hindoo: nature has been bountiful—man is indolent, and gives himself no concern about his crop, trusting for the anticipated harvest to the immense productiveness of the soil, which yields, in many parts thrice a year, such abundant crops under the favouring rays of a tropical sun, that the cultivator is not stimulated to farther exertion. The Ryot, however, understands irrigation and the succession of seasons, but knows little regarding the biennial or triennial rotation of crops. The sites of tanks are invariably well chosen, being selected where one or more *nullahs* or water-courses naturally meet in a convenient locality for embankment. Manure is never employed on the cotton plains, although usually in sugar-cane fields, and to a great extent in Sooparee gardens, as well as to the root of grape vines and pine-apples. The manure used generally consists of rotted leaves, cow-dung, wood ashes, blood, dead fish, &c.; and indeed the dunghills of Betel plantations are so valued as occasionally to become the subjects of litigation. I would simply mention the fact that œconomy is not practised in the employment of animal manures. In 1846–47 large quantities of bones of animals that had died of disease and drought, were scattered over the plains, in the Mysore territories. I had a portion collected in heaps, ground to fragments in a Chunam mill, and then sparingly applied to a potato field: the result showed the fertilizing effect.

There is no spring of activity among the aborigines of these unhappy lands; hence it becomes the especial duty of the Agri-horticultural Societies at the different Presidencies, of the Chambers of Commerce, and of every enlightened and liberal member of the community, to aid and encourage the regeneration of the agricultural system.

Whilst deploring that past exertions have been retarded by the indisposition of the natives to adopt the improvements of science and the suggestions of practical men*, "which they foolishly conceive to be unprofitable innovations," there is ground for consolation in observing that the results of "*persuasion, patience* and *perseverance*" are visible in the improved face of the country over large tracts, as Mysore, the Ceded districts and Southern provinces, which have been longest under our rule, and in which a cessation from war has enabled our resources to be devoted more assiduously to *the triumphs of peace.*

This altered aspect has been brought about by the bridging of rivers and nullahs; the formation of Ghauts, by which the inland traffic reaches the coast; the abolition of transit duties;

* Madras Athenæum, May 9th, 1843.

the extension of made roads; the increased number and better construction of labour-carts, arising from increased facilities of intercourse; and the completion of other public works, as Moosaffir-Khanahs, Choultries, Travellers' Bungalows, &c. Let us hope that as the various impediments are successively removed, in process of time our modes and systems will be better understood and appreciated; the lands will be more generally manured, the fields enclosed, and the roadsides fenced; additional tracts cultivated, and English improvements gradually introduced into Hindostan,—giving an impetus to commerce throughout the country.

As the *climate* widely varies in different parts of the Peninsula, so the *aspect* of the country, the soils and productions of the districts, the modes of cultivation, and the facilities of traffic differ in an extraordinary degree, and those cultivators accustomed to one method of agriculture can seldom manage any other.

The arid sands of Madras, the undulating plateau of Mysore, the extensive plains of the Deccan, the primæval forests of Coorg and Malabar, the jungles of Hydrabad and Nuggur, present botanical and geological features strikingly dissimilar*. There is as much variety in the surface of the ground as there is in different parts of Europe: indeed so complete is the contrast between the extreme sterility of some tracts of the Carnatic plains, which exhibit a painfully barren picture of desolation from the total absence of wood, and the luxuriant arboreous vegetation of the Neilgherry slopes, which the researches of Wight prove to possess one of the richest floras in the world, that no two countries in Europe display more opposite characteristics. The climate of the former is remarkable for excessive drought, so that European furniture invariably cracks and warps; whereas in the vicinity of the Malabar Ghauts the south-west monsoon is felt in full force, and the fall of rain exceeds 120 inches in the season, producing an atmosphere so charged with humidity that the lancet in my pocket has been covered with rust in a few days. It must be clear, therefore, that in suggesting as worthy of trial any vegetable products calculated to enrich and improve the country, great attention must be paid to the question of local applicability. The effects of moisture greatly favour the growth of most species, while a very dry state of the air is incompatible with the life of others.

The *Cacti*, *Agaveæ* and *Euphorbiæ* are adapted to the arid

* Hence the importance of specific habitats being given to every specimen in our Indian herbaria; not such a vague one as "*India Orientalis*" or "*Montes Hindostaniæ*."

districts, their structure enabling them to exist, when refreshed with only occasional showers; the *Mimoseæ* and *Cæsalpineæ* seem to enjoy the somewhat more cold and moist climate of the Balaghaut districts; while the *Bambuseæ* and *Pandaneæ* luxuriate in the rich loamy soil of the Mulnad (*i. e.* Rain country). Hence, were a railway* to cross the Peninsula, the fences ought to differ as the line is continued through various districts, in accordance with the conditions under which particular plants thrive best between certain limits of temperature and moisture. The great prevalence of spiny shrubs and prickly bushes all over India is remarkable to every one; they are a continual source of annoyance to the traveller, and a fruitful cause of admission into hospital, as every regimental surgeon can testify.

Scutia indica (Brong.), *Zizyphus* (four species), *Solanum indicum* (L.) and *trilobatum* (L.), *Toddalea aculeata* (Pers.), *Pterolobium lacerans* (R. Br.), *Carissa carandas* (L.), *C. diffusa* (Rox.), *Azima tetracantha* (Lam.), *Smilax ovalifolia* (Rox.), *Acacia*†, *Mimosa*, many species, and other armed climbing plants, are widely diffused. These often grow interlaced in thickets, or surround the clumps of jungle like a fringe—presenting a rampart which is almost impenetrable, especially when forest conflagrations have occurred and a dense tangled underwood has succeeded. The long flexuous stems of several species of *Calamus* are particularly troublesome, obstructing all passage through the unfrequented forests of the Malabar Ghauts, and even when the path has been cleared with a bill-hook, the graceful tendrils unobserved frequently trip the most cautious traveller, and the recurved prickles are with difficulty unhooked from his clothes.

Again on the open ground the traveller's progress is impeded by *Echinops echinatus* (Rox.) with its globular spinous heads, *Tribulus lanuginosus* (L.) with its hairy pointed fruit, *Solanum Jacquini* (Willd.), completely armed with prickles, *Barleria prionitis* (L.) and *buxifolia* (Rox.), spreading everywhere in Mysore, *Asteracantha longifolia* (Nees) on the margins of ditches and tanks, which has six to eight spines at each verticil, *Lepidagathis* (two species), with spinous pointed leaves.

The prickles and spines of these plants wound the barefooted pilgrim, especially during the hot months, when the leaves having

* Whilst writing these pages, Dr. Royle, the E.I. Company's botanist, informed me that an official reference had been made to him concerning the plants best adapted for hedging the Indian railways, now in progress.

† One of the most remarkable is *Acacia latronum*, W., common in the barren tracts, armed with large white stipulary thorns united at the base. Linnæus designated it "Frutex horridissimus, ramosissimus:" it is entitled to this distinction.

dropped off, the thorns are left bare and exposed, which renders travelling extremely difficult in some parts, as the spines are so strong as to pierce a shoe or sandal of dressed leather; and if the weary traveller seek to rest himself, he must beware as much of thorns, as of red ants, tarantulæ, and other biting insects which infest the soil. Innumerable climbers festoon the Euphorbiaceous hedges, enveloping them with their umbrageous leaves, and showing off their elegant and many-tinted blossoms to the best advantage on these nearly leafless shrubs.

The rich inflorescence bursts forth towards the close of the rains. All do not unfold their flowers at once—a continuous succession of blossom is presented throughout the year in the subalpine districts, which are under the influence of the S.W. monsoon. These strong climbing plants, consisting chiefly of *Convolvulaceæ, Cucurbitaceæ, Apocynaceæ* and *Asclepiaceæ*, delight the eye and often diffuse an agreeable fragrance, but by their rank luxuriance prove very destructive to enclosures. Some of those most frequently met with are as follows:—

CUCURBITACEÆ.

Mukia scabrella, Bryonia laciniosa, epigæa and *mysorensis, Coccinia indica, Trichosanthes Cucumerina* and *palmata.*

CONVOLVULACEÆ.

Ipomæa sepiaria and *vitifolia, Pharbitis nil, Quamoclit pinnatum* and *phœniceum, Argyreia aggregata* and *bracteata, Calonyction speciosum* (Ch.).

ASCLEPIACEÆ.

Oxystelma esculentum, Dæmia extensa, Holostemma Rheedii, Pergularia odoratissima.

APOCYNACEÆ.

Ichnocarpus frutescens (R. Br.), *Carissa carandas* (L.), *C. diffusa* (Rox.), *Vallaris pergularia* (Burm.).

The herbaceous plants generally met with, enjoying the shelter of the hedges by the roadsides, are suffruticose *Malvaceæ, Mirabilis Jalapa, Plumbago zeylanica, Deeringia celosoides, Asystasia coromandeliana* (N. E.), *Peristrophe bicalyculata, Boerhaavia* (two species), *Basella alba, Cardiospermum Heliocacabum* with balloon-like capsules, *Abrus precatorius, Mucuna prurita, Canavallia virosa, Clitorea ternatea,* a blue and white creeper of great beauty. The cyan hue of the *Clitorea,* with the yellow petals of *Abutilon,* and the pure white of *Coccinia indica*—found in every hedge—offers a truly splendid appearance.

After these preliminary notes, as to the abundant provision in nature for the extensive diffusion of hedges, let us see to what extent the plants adapted for live fences have been made subservient to that use in the œconomy of agriculture. Supplied with such materials for hedge-making as few countries possess, we have wretched enclosures,—in many parts none at all, and cultivators go on in the old way of their ancestors, whose footsteps they follow with the utmost devotion and reverence. Some carefully tie the necks of the sheep and donkeys to their fore-legs to prevent their straying over the plains: other villagers by general agreement drive away the cattle at the beginning of the monsoon, and again permit them to roam unherded as soon as the rains are over.

If the traveller stations himself on one of the detached conical hills or droogs, which form a peculiar feature of Southern India, for the purpose of obtaining a bird's-eye view of the surrounding country, he probably finds during the rainy and cold season, a fine sheet of cultivation, comprising a great variety of cereal, leguminous and oleaginous plants, sown with regularity and spreading round the scattered mud-built villages to a great extent: the fields in full flower look beautiful and give an appearance of prosperity. During the hot season the scene is very different; few are the traces of vegetation,—an arid plain then stretches around you; the sun acts so powerfully as to produce fissures and cracks all over the ground. "The surface of the plain presents a monotonous and almost treeless extent of arenaceous waste, bounded by the horizon, and unbroken save by a few rocky elevations that stand forth abruptly from the sheet of black soil like rocks from the ocean."

"Sir Thomas Munro might well observe that these (the Ceded) districts are more destitute of trees than any part of Scotland he ever saw, and that the traveller scarcely meets with one in twenty miles, and nowhere with a clump of fifty*."

Since the time of that enlightened governor, much has been done to improve the physical aspect of the country, by the plantation of numerous topes of *Bassia latifolia* (Mahwa) and avenues of *Ficus indica* and *religiosa* (banyan and peepul), which being planted on both sides of the trunk-roads afford a pleasant shade.

The custom generally is to separate the patches of arable land when dependent on irrigation by low mounds of earth; when dry by slight fences of dead thorns (*Vachellia Farnesiana*), or by leaving between them uncultivated strips or spaces from 3 to 15 feet wide, sometimes broader (according to the value of the

* Capt. Newbold in 'Madras Journal of Science,' vol. x. p. 113. Since writing the above we have heard of the lamented death of this able and distinguished geologist, at a time too when diligently employed in publishing his researches.

land). These are overrun with spinous plants, studded with dwarf Mimosas, or at certain seasons thickly covered with long grass: these interspaces add to the beauty of the country, and contribute in some measure to the fertility of the soil by preserving a little moisture; but their irregularity presents a very slovenly appearance, and the brush is often inhabited by wild hogs and antelopes which greatly damage the crops. Fences as in England are few and rarely to be seen. Some of the fields are surrounded by hedges; but these are not kept in such repair as to resist the pressure of cattle: they are frequently meant only to distinguish the lands appertaining to particular castes or classes of the villagers.

The hedges observed in our wanderings generally consisted of *Opuntia Dillenii* (Haw.), *Euphorbia Tirucalli* and *antiquorum,* with *Agave americana* (L.). When the ground is sown, the gaps are filled up with branches of *Vachellia Farnesiana,* a small tree which grows in many fields.

It is only in the neighbourhood of large towns, encircling the smaller villages, military cantonments, missionary settlements, or the dwelling-houses of intelligent foreigners, that we find ornamental or even regular enclosures. A few very fine hedges demonstrate how well they would thrive, and show the practicability of agricultural improvement, if the will and energy existed among the natives. The hedges of the country in general, even when kept up as fences round temples, are in a very slovenly condition, and are ruined by being overgrown with rank climbing plants, such as those previously enumerated.

Opuntia Dillenii, Haw.

Cactus indicus, Rox.

Hedge Prickly Pear.

Nag phena, *Hindustani.* Naga-kulli, *Canarese.*

Probably introduced from South America, though so long domesticated all over India, that many consider it a native.

Commonly used as a hedge-plant about cantonments, forming an impenetrable fence, 4 to 6 feet high; but excludes the air, and harbours destructive vermin and venomous reptiles. Cultivators object to it, because it spreads, cannot be kept within bounds, and impoverishes the land.

The hotter the district the more luxuriant this plant: it flowers at all seasons, and grows in the most sterile ground—in sand—in the rocky beds of rivers—in the fissures of mud walls. It is easily propagated by planting leaves in the earth half-buried; they seldom fail to strike root and prosper; it is difficult to eradicate; the figs are eaten sparingly in times of scarcity. Spines one to three together in a tuft.

Sir Hans Sloane mentions in his 'History of Jamaica' that, "In the Island of St. Cristopher, when it was to be divided between English and French, it was ordered by the consent of the two nations that there should be planted three rows of the *Opuntia tuna* as a boundary, thinking these the strongest fortification to hinder the attempts of one another in cases of war." The Grecian traveller, Clarke, has suggested that in some latitudes it might serve as an outwork for fortifications; since, as he says, "artillery has no effect upon it; pioneers cannot approach it; fire will not act upon it; and neither infantry nor cavalry can traverse it."

In fact in the Spanish colonies in America this plant is considered as a very important means of military defence, and is propagated constantly around fortifications with that intent. Desfontaines in his 'Flora Atlantica' remarks of *O. tuna*: "Munimentum hortorum et domorum impenetrabile."

We object to the prickly pear from its unsightly appearance, "the enormous area it covers, and the harbourage of every variety of filth and vermin." It should only be employed when none of the plants aftermentioned will grow. The cantonments of Hurryhur and French Rocks have been greatly improved by the substitution of neatly kept milk-hedges for the prickly pear, which formerly deformed them. The bandicoot rat (*Mus malabaricus,* Shaw, *M. giganteus,* Hardwicke), a most destructive animal, is partial to hedges of the *Opuntia* and *Agave,* burrows under them to a great depth, and roots up the seeds of garden plants sown near its haunts.

Pereskia aculeata (Haw.), the West Indian gooseberry, grows readily, and seems likewise well adapted for hedges.

Agave americana, L.

A. Cantula, Rox.

Fourcroya Cantula, Haw.

[Figured in Lindley's Vegetable Kingdom, 2nd ed.]

The American Agave. Native name: *Wilaeete Ananas,* i. e. English Pine Apple. Sans. *Kantula.*

Introduced from America.

In some parts the hedges are formed almost exclusively of this stately aloe-looking plant, which is both ornamental and useful. The flower-stalks rise to the height of 15 to 30 feet, when ten or twelve years old, and are employed in roofing. It flowers in the rains.

The long sheathing leaves are sometimes macerated for the fibres, which are separated by beating on stones, and form excellent cordage. The lower decayed leaves are used as fuel in the absence of wood, and the terminal spines sometimes serve instead of pins and nails. The Agave juice is not collected in India, vinous beverages being formed from the date and cocoa-nut palms, which flourish in the same localities. These latter trees, with the *Agave, Opuntia,* and Bamboo, give a character to the landscapes in Southern India. This species is propagated by suckers, and young plants are in great request. There are hedges of this plant in Spain, Portugal, Sicily, Calabria, West Indies, South America, Mauritius, Cape Town. Native gardens are often surrounded by mud walls, armed with Agave leaves, the spines being made to project at both sides.

Euphorbia Tirucalli, L.

Ossifraga lactea, Rumph. Herb. Amb. vii. t. 29.

Milk Bush.

Lunka-sij, *Beng.* Tiru-kalli, *Tam.* Doodu-kalli, *Can.*

Probably introduced from Africa.

This, with *E. antiquorum,* is common all over the Madras Presidency, growing abundantly anywhere on the rough and rocky parts of the Deccan, though doubtfully indigenous. It is much used as a hedge-plant, and though unarmed makes an excellent fence. It grows to 20 feet high; but should be annually clipped, as it becomes open at the roots. It is customary to plant *E. antiquorum,* L. (Nar-sij) in these openings, which grows well under the shade of its congener. Both united constitute a most serviceable enclosure, which has the advantage of occupying *little space* and being *touched by no animal*: the tenacious acrid juice quickly causes sneezing or produces ophthalmia.

At the beginning of the rainy season a trench is dug to the depth of two feet where the fence is intended to grow. The cuttings take root in any soil; and in one year it becomes a tolerable fence (Buchanan's Journey, i. 36). The villagers are prejudiced against this as a fence, and cut it down in seasons of pestilence, supposing that it exerts a baneful influence. The juice is often employed instead of a wafer for closing despatches, and is a very effectual blister in rheumatic affections. Cattle will not break through, nor vermin live under it. The trunk of old trees affords a yellow close-grained wood, 8 or 10 inches in diameter, which is valued for gun-stocks, &c.

These four plants thrive in the most arid soil: when the ground seems much parched they retain their greenness, and improve the scenery, giving an appearance of verdure when all else is withered and lifeless.

Euphorbia nivulia, Buch.

E. neriifolia, Hort. Beng.

Ela Calli, Hort. Malab. ii. t. 43.

Sij, *Hind.* Ela Calli, *Can.*

A poor-looking tree, grows abundantly in the rocky parts of the Deccan, and forms a common hedge, delighting in the arid districts. "Habitat ubique in Indiæ sepibus."—*Buch.* It has a whitish dead appearance, resembling a bundle of dry sticks, and unless for a short period during the rains, when it puts forth a few leaves, rather takes from than adds to the appearance of the landscape (*Graham*). The branches being as thick as the stem, their accumulated weight often breaks it, and the plant falls to the ground.

Cæsalpinia sepiaria, Rox.

Mysore Thorn. Hyder ka Jar, *Hind.*, i. e. Hyder's Plant.

A showy scandent shrub, armed with short strong recurved prickles. This plant is invested with historical interest, Hyder Ally having employed it much as a protecting hedge around his strongholds. The fences are handsome, and almost impenetrable. The village fortifications in the Mysore territories have in a great measure fallen to pieces; but the remaining mud walls are still encircled by stout hedges of this and *Pterolobium lacerans,* as are also the dwellings of the Pariahs who are not permitted to build within the village walls. It is generally used as a fence in the Baghyat lands of the Deccan. Indigenous in the subalpine districts, and has been domesticated at Madras and in Bengal, where it is now nearly as common as in Mysore. Hyder's plant possesses the advantages of beauty and durability, is easily raised from seed in rows wherever the fence is to be established, and seems to grow vigorously both above and below the Ghauts in almost every climate. The hedge requires little care beyond shortening the side branches by occasional pruning. The base is generally substantial, so as effectually to resist the pressure of cattle and to prevent the ingress of destructive vermin.

Cæsalpinia Sappan, L.

Sappan Wood.

Patanga-mara, *Can.*

An armed climbing shrub planted in garden or other fences; it is easily reared from seeds in almost any soil, if the plants are watered during the dry weather. After ten or twelve years the wood of the plant becomes valuable for its red dye, and is exported extensively from the western coast*.

* Mad. Top. Report, i. p. 495.

Pterolobium lacerans, R. Br.

Cæsalpinia lacerans, Buch (Journey, i. 37).

A common jungle shrub in wooded districts, aptly designated *lacerans* by Roxburgh, for it is *completely armed*, and as dreadful as the Kantuffa of Bruce*, which belongs to the same genus. The legume is curious, ending in a membranous knife-shaped wing. When associated with *C. sepiaria* it makes an excellent fence; singly it is rather diffuse.

Guilandina Bonduc or *Bonducella*, L.

Nicker Tree.

Nata, *Bengal.* Kad Gajaga, *Can.*

A handsome well-armed shrub common in hedges of Mysore and Canara: forms an impenetrable fence. Seeds solitary, like marbles, and are a favourite remedy in catarrh and ephemeral fever.

Parkinsonia aculeata, L.

Prickly Parkinsonia or Jerusalem Thorn.

A handsome low-sized tree, not unlike the laburnum, planted for fences, which are very beautiful, from the bright green and feathery foliage, and pretty yellow flowers in loose pendulous racemes. It seems well adapted for hedges, and is naturalized in many districts. Observed at Cairo by Hooker, and in Jamaica by Macfadyen, at Bellary by Newbold, and about Bombay by Graham.

Poinciana pulcherrima, L.

Gool Mohur. "Peacock's Pride."

A common armed shrub in every garden, reared more for the beauty of its flowers than as a serviceable fence. *P. elata*, L., is a more showy plant, not so frequently met with, and unarmed. "In Barbadoes *P. pulcherrima* is planted for a fence, and to distinguish fields from one another, both for its use and ornament. I thought I never saw anything finer than a hedge of this †."

Mimosa rubicaulis, Lam.

A large climbing shrub, well armed; common in Mysore; rather straggling, but capable of forming an elegant fence; conspicuous from the purple flowers changing to white. I am not aware that this species has been tried.

Inga dulcis, Willd.

Koorka poolly, *Teling.*

A handsome tree, introduced from the Philippine Islands according to Roxburgh, and there probably from America, of which

* Travels in Abyssinia, vol. v.

† Sloane's Jamaica, p. 50.

it is a native. It is now frequently met with, being much employed as a fence, particularly below the Ghauts. I have observed a thriving hedge at Shemogah, which was an excellent substitute for prickly pear in enclosing a compound. I have seen Inga hedges at Bangalore and in Capetown. The pulp of the curiously twisted seeds is sweet and nutritious; hence the specific name.

Acacia arabica, Willd.

Babool, *Hind.* Karijalee, *Can.*

The most common indigenous tree, known to all travellers—often the only visible tree, thriving in every soil. Seeds and pods of great value to the shepherd in the hot season as food for his flock. Dr. Gibson suggested some years ago that the waste parts of the Deccan should be planted with this tree, as it grows rapidly, and requires no water. The timber is used for tools and tent-pegs, the bark for tanning, and the gum as a substitute for wafers in the public offices. When covered with its globose heads of yellow flowers it gives a smiling aspect to the arenaceous waste; and Moore aptly introduces it in an Arabian scene :—

"Our rocks are rough, but smiling there
The Acacia waves her yellow hair
Lonely and sweet, nor loved the less
For flowering in a wilderness."

Acacia concinna, DC.

Mimosa saponaria, Rox.

Shigai or Shikakai, *Can.*

A large climbing plant with numerous aculei. Some villages and coffee gardens are surrounded with strong hedges of this plant, which are rented annually in Nuggur, the thick saponaceous legumes being articles of trade, and sold at the rate of three for a pice; used as soap for washing the hair, &c. (Buchanan, i. 38.)

Vachellia Farnesiana, W. & A.

Kalee Kikur, *Hind.*

A small tree common everywhere in hedges and fields. The branches are lopped off for fuel, and for repairing the fences. This is a most useful tree, affording timber for ploughs, bandies, and other agricultural implements.

All these *Mimoseæ* and *Cæsalpineæ* are of easy culture. Cuttings of them root freely.

Bambusa arundinacea, Willd.

Arundo Bambos, Linn.

The Common Bamboo.

Bans, *Beng.*

This arborescent grass is capable of forming an excellent fence, nd is used extensively for gardens and fields in Coorg, the Southern Mahratta country, and Guzerat, where it grows in the greatest abundance, delighting in the rich soil along the edge of mountain streams. It requires a much more humid climate than the prickly pear or milk bush. These abound in the Carnatic plains, while the bamboo flourishes everywhere beside the water-courses of the Western Ghauts: "omnium vulgatissima." (*Buch.*) It forms a dense and graceful underwood: when luxuriant it occupies too much space and harbours vermin. To obviate this, the young thick shoots should be removed frequently and carefully, and the lateral branches only allowed to remain. From its singularly rapid growth it exhausts the soil where it grows, and deprives the ground of its nourishment, instead of preserving its moisture. "Bamboo fences are peculiarly adapted to pasture land, the cattle browsing on the young shoots keeping down their growth, so that very little additional care is required*."

Buchanan (Journey, i. 5) mentions with commendation that Mr. Place, a collector, of Arcot, "caused each village to be surrounded by a hedge of bamboo: by this measure a large quantity of that most valuable plant will in time be raised," which is applied to a great variety of œconomical purposes. In times of scarcity the seeds are eaten by the poorer classes of Mysoreans, mixed with honey. The inflorescence I have only observed in rich moist situations, and in these its favourite haunts the thorns are sometimes absent.

There are several species of bamboo. *B. spinosa,* by the number and strength of the spines and branches, is said by Roxburgh to form the most impenetrable jungle of India. *B. nana* (Rox.), introduced from China to the Botanic Garden, Calcutta, makes beautiful close hedges; and the *Behoor Bans* of the Bengallees, a variety of *B. Tulda* (Rox.), (*Dendrocalamus Tulda,* Nees), being small, solid, bent to one side, and armed with numerous strong thorns, is very fit for hedges.

Pandanus odoratissimus, L.

Fragrant Screw Pine.

Mundige; also Kaythege-mara, *Can.*

A large spreading ramous shrub, 6 to 10 feet high, having the habit of a gigantic *Bromelia.* Very common in Coorg and Nuggur, and known on the coast of Coromandel as the Kaldera Bush. The patches of hill rice are often fringed with belts of this shrub, forming a natural enclosure. It is sometimes planted for the purpose of hedging. The leaves are 3 to 5 feet long, drooping,

* Macfadyen (Hook. Bot. Misc. iii. p. 83), who gives an excellent account of the hedge plants of Jamaica.

armed on the back and sides with strong spines. Avenues of *Pandanus* are seen in China and Cochin-China, and in the Mauritius (*Loureiro* and *Hardwicke*). It answers well for hedgerows, but requires too much room: it grows well from branches. Often forms impenetrable thickets, which I have been told by hog-hunters are a favourite resort of these animals. The sweet-scented flowers are much prized, and often sell in the bazaars at two annas a piece.

Capparis sepiaria, L.

A much-branched shrub of low size, with very strong and sharp recurved prickles, very common in the uncultivated tracts of Mysore. This and *C. incanescens*, W. & A., form whole jungles at the foot of the Bababooden Hills, and in the South Mahratta country. It is an excellent plant for hedges: we have admired some fine village hedges in the Shikarpoor talook. "Habitat ubique in Indiæ dumetis, solo aridiore."—*Buch.*

C. horrida, L., *C. aphylla*, Rox., *C. Roxburghii*, Wight, and *C. incanescens*, W. & A., are worthy of trial, though more straggling than *C. sepiaria*. The first is very common in Mysore, likewise the second, much sought for its berries, which are pickled. The latter grows everywhere in Scinde and Guzerat.

Balsamodendron Berryi, Arn. Ann. Nat. Hist. iii. 85.

Protium Gileadense, W. & A. (Exc. Syn.)

Amyris Gileadensis, Rox. (Exc. Syn.)

A most common spinescent plant in some parts of the country, and constantly used for making fences. (*Wight.*)

Toddalea aculeata, Pers.

Scopolia aculeata, Sm.

Paullinia asiatica, L.

Toddali, *Can.*

A prickly shrub, with trifoliate leaves, common in the hotter parts. It is usually of a very ramous character, and might be employed in the formation of hedges. We observed it in many parts of Mysore and the South Mahratta country, and have experienced infinite difficulty in attempting to make our way between the bushes. The flavour of the black seeds is pungent, resembling pepper. The berries make an excellent pickle.

Pisonea aculeata, Rox.

A very common large straggling shrub, armed with strong axillary recurved thorns. It makes excellent impenetrable fences, and when fairly caught in it, it is no easy matter to be extricated, the prickles being so numerous, crooked and sharp.

Both Kœnig and Roxburgh were so situated amongst the Vendalore Hills, near Madras; hence the former named it *Tragularia horrida,* not at that time suspecting it to be *P. aculeata.* (Rox. ii. 217.)

Hemecyclia sepiaria, W. & A. in Edin. New Phil. Journ. xiv. 297; Wight, Cat. 940.

This Euphorbiaceous plant forms a rigid densely interwoven shrub rising to 8 or 10 feet, of rather frequent occurrence. The leaves are extremely hard, and resemble those of *Celastrus emarginatus.*

Epicarpurus orientalis, Blume.

Trophis aspera, Retz.

Streblus asper, Lour.

Suna Gargathee-mara, *Can.*

A rigid milky tree of small size, with numerously interwoven branchlets, common everywhere in India. Leaves scabrous, employed for polishing ivory and furniture. Wood used for fuel; berries eaten by birds. Much used as a fence, for which it is well fitted by its very ramous rigid character: though unarmed, it affords good protection by the closeness of its branches. Detached plants form low trees with bushy heads.

The scarp of Fort William is strengthened by an impenetrable hedge of *Trophis aspera.* (Hook. Misc. iii. 29.)

Jatropha Curcas, L.

Angular-leaved Physic Nut

Mara harulu, *Can.*

Domesticated all over India. A most common bush, seen growing round the little native gardens throughout Mysore. It is of speedy growth, attaining the height of 6 or 8 feet; but forms a bare, scraggy, useless enclosure. The leaves are deciduous; the seeds are purgative; the stems are soft and spongy, and will not even burn. "Colitur ubique in Indiæ sepibus."—*Buch.*

Rhamnus circumscissus, L.

Scutia indica, Brong., Wight Ill. t. 73.

A straggling shrub armed with recurved prickles overrunning the country, particularly towards the Ghauts. It would, from its sharp aculei and numerous diverging branches, form an excellent hedge-plant.

Azima tetracantha, Lam.

Monetia barlerioides, Rox.

Trikanta-jatee, *Hind.*

A common thorny bush, frequently associated with *Scutia indica*. It somewhat resembles in habit the English furze. It grows freely in every soil, giving off many opposite branches, spreading in every direction. The spines are quatern, axillary, sometimes 2 inches long. The white berries are eaten by men and birds.

Gmelina asiatica, L.

A pretty shrub, of a very ramous character, common in the Peninsula, bearing large yellow flowers, and opposite thorns in the axils of the branches. It forms an elegant and excellent fence in the gardens of Bombay. (*Graham.*)

Rumphius wrote of this plant, "Frutex stipitosus qui sese sursum explicat in longos et flagellosos ramos."

There are many ornamental plants which we often observe arranged in straight lines, forming inner fences or shady avenues in Eastern gardens. These are the *Lawsonia inermis*, the Hennah plant of Egypt (*Mendi*), resembling the English privet. The *Lonicera ligustrina*, Wall. (privet-like honeysuckle), is much used at Ootacamund, and answers well, forming a very compact fence about gardens. (*Wight.*)

The lime, mulberry and pomegranate are suitable, and have been long in use; likewise the *Hibiscus rosa sinensis*, L. (shoe-flower), *Adhatoda vasica* and *Betonica*, Nees, *Gardenia florida* (*Gundha raj*), *Allamanda cathartica*, &c.

Phyllanthus reticulata, Poir. (*P. Vitis-Idæa*, Rox.), "found wild in every part of India, and seems to thrive well in all soils and situations. It is frequently employed for ornamental hedges in gardens, for which end it is well chosen, as its thick evergreen foliage and constant succession of beautiful red berries give it a pretty appearance*." I am not familiar with this in southern India, except as a small jungle tree.

Pedilanthus tithymaloides, Poit. (the slipper plant) is much planted as a border for gardens, taking the place of box. Neither goats nor cows will touch it. The following are also used for garden borders :—

Graptophyllum hortense (*Justicia picta*) with its variegated leaves; *Vinca rosea*, Willd., common all over India; *Heliotropium curassavicum*, L., domesticated at Bangalore; *Rosa indica*, L.; *R. semperflorens*, Curtis.

The above are the hedge-plants most frequently noticed in the

* Roxburgh's Fl. Ind. ii. p. 665.

Peninsula. The number is a large one, to which I could have added many more, indigenous in the jungles, which have not been tried. We have confined our remarks to quick hedges "vivæ sepes," because they are obviously preferable to every other mode of protecting agricultural produce in a climate like that of India. Ditches are particularly unsuitable, rapidly filling up with rank vegetation, and their sides often giving way under the violence of the monsoon. Stone walls are rarely seen, being expensive and always badly constructed. Wire fences, coated with dammer, were introduced at Bombay by the energetic Dr. Buist in 1843; these unquestionably form a light and elegant enclosure for oriental compounds, but are too expensive to come into use among native cultivators.

The subject is truly important. Large tracts consisting of many acres together, wholly or partially uncultivated, and the frequent occurrence of seasons of scarcity, attest the still neglected state of Indian agriculture, while the remains of quickset hedges, decayed terraces and ruined wells in many parts convey the impression that irrigation and husbandry *in remote ages* had been practised more assiduously than by the present generation.

One of the obstacles to improvement we believe to be, that from the time the grain appears above ground till the harvest is gathered in, the ryot has to watch his field; but as many wild hogs and other animals infest the neighbouring jungle, this watching is difficult and often ineffectual, and hinders the farmer from extending his operations *. We know too from the official return on cotton culture in India (pp. 444, 489, 490), and from the testimony of many collectors and other observers †, that great devastation takes place annually from herds of antelopes and thousands of heads of cattle which migrate or are driven from place to place in particular seasons. The wild animals are being destroyed in large numbers, and as cultivation extends will find no shelter, while the damage occasioned by stray bullocks could be prevented by encouraging a more general system of field enclosures.

"The frequent fearful occurrences of famine in India remind us of the almost forgotten period when they were of as frequent occurrence in Europe, and the inference follows, that when the light of European science has extended to India the same bene-

* Asiatic Researches (Carey), x. 34.

† Dr. Gibson, Superintendent of the Botanical Gardens at Dapooree, states with reference to an experiment (sowing of upland cotton), that it was one on which a general conclusion could not be based, inasmuch as the field enjoyed the shelter of a hedge on one side and tree plantations on other two sides—few of those appliances are to be found in nine-tenths of the villages of the Deccan.—Bom. Hort. Trans. no. 2. p. 49.

ficial consequences may follow, and that foresight may eventually prepare for, and knowledge obviate many of the evils which now fall without alleviation on the naked head of the native sufferers. The loftiest ambition of the most enlarged mind, when dwelling upon hopes of the most extended usefulness, could hardly imagine a wider range of benevolence." Thus wrote Dr. Kennedy, Physician General, Bombay, whose extensive information and long acquaintance with Western India give his opinion a peculiar value. A season of peace and tranquillity has in providence succeeded to times of anarchy and confusion, and it behoves us to use every effort for developing the resources of those vast countries, and securing the best interests of the many millions committed to our care for higher and nobler ends than our own aggrandizement.

1. *Hedge Plants.*

Opuntia Dillenii, *Haw.*
Agave americana, *L.*
Euphorbia Tirucalli, *L.*
—— antiquorum, *L.*
—— nivulia, *Buch.*
Cæsalpinia sepiaria, *Rox.*
—— Sappan, *L.*
Pterolobium lacerans, *R. Br.*
Guilandina Bonduc, *L.*
Parkinsonia aculeata, *L.*
Poinciana pulcherrima, *L.*
Mimosa rubicaulis, *Lam.*
Inga dulcis, *Willd.*
Acacia arabica, *Willd.*
—— concinna, *D.C.*
Vachellia Farnesiana. *W. & A.*
Hemicyclia sepiaria, *W. & A.*
Epicarpurus orientalis, *Blume.*
Jatropha Curcas, *L.*
Pisonea aculeata, *Rox.*
Capparis sepiaria, *L.*
—— aphylla, *Rox.*
Scutia indica, *Brong.*
Azima tetracantha, *Lam.*
Gmelina asiatica, *L.*
Balsamodendron Berryi, *Arn.*
Toddalea aculeata, *Pers.*
Bambusa arundinacea, *Willd.*
—— spinosa, *Rox.*
—— nana, *Rox.*
Dendrocalamus tulda, *Nees.*
Pandanus odoratissimus, *L.*

II. *Ornamental Plants forming inner fences.*

Lawsonia inermis, *L.*
Lonicera ligustrina, *Wall.*
Citrus Limetta, *Riss.*
Morus indica, *L.*
Punica granatum, *L.*
Phyllanthus reticulata, *Poir.*
Hibiscus rosa sinensis, *L.*
Adhatoda vasica, *Nees.*
—— Betonica, *Nees.*
Graptophyllum hortense, *Nees.*
Gendarussa vulgaris, *Nees.*
Gardenia florida, *L.*
Allamanda cathartica, *L.*

III. *Plants used for edging garden walks.*

Pedilanthus tithymaloides, *Poit.*
Vinca rosea, *Willd.*
Heliotropium curassavicum, *L.*
Rosa indica, *L.*
—— semperflorens, *Curtis.*

XII. *On the Composition of the Ash of* Armeria maritima, *growing in different localities, with remarks on the geographical distribution of that Plant; and on the presence of Fluorine in Plants.* By Dr. A. Voelcker, Professor of Chemistry in the Royal Agricultural College, Cirencester.

Read 13th February 1851.

The relation of the inorganic constituents of the soil to the plants is exhibited in a very distinct manner by those plants which are confined to perfectly distinct geognostic formations; for it is evident that their growth is influenced in a great measure by those inorganic matters found in their ashes, which form constituent parts of the soil upon which they grow. If we find, for instance, that a plant which requires a considerable quantity of common salt for its perfect development will not thrive in a soil destitute of common salt, or that plants the ashes of which have been found to contain invariably a certain amount of phosphoric acid, do not grow vigorously on land which contains few traces of this acid; further, if we find the condition of such plants greatly improved by the addition of common salt or phosphoric acid to their respective soils, we cannot remain doubtful for a moment as to the cause of the failure in the first instance.

There are however very few plants characterized by particular inorganic constituents; in fact the only plants which are so are the maritime plants; in the ashes of which we invariably find iodine and bromine, two substances which are not generally met with in the ashes of other plants *. All other plants on burning

* M. Chatin and several other French chemists, as well as Prof. Marchand of Halle, have satisfactorily proved the existence of iodine in a great many inland plants. The ashes of inland plants, however, by no means universally contain iodine; those plants in which its existence has been proved, further contain but mere traces of iodine, whereas this element *invariably* occurs in sea-weeds and other exclusively maritime plants, and always in *notable* quantities.

leave ashes which contain almost always the same number of inorganic substances, but in different relative proportions. The complexity of the composition of the plant-ashes with which we have to deal in the investigation of the exact relations of the inorganic matters to the growing plant, is the chief cause of the great difficulty we experience in assigning to each of them its proper function in the vegetable organism. It appears to me that we cannot arrive at anything like a rational method of cultivation until we shall have become acquainted with the functions of every one of the inorganic substances found in the ashes of plants, and until we shall have learned how far one substance is capable of replacing another in the vegetable organism; and lastly, how far a change in the chemical composition of a soil affects the natural habits of plants. I do not mean to say that these are the only points which require to be settled, but I consider them as questions, a satisfactory answer to which would prove useful to practical agriculturists.

With regard to the second question we possess several analyses, which prove clearly that soda can be replaced by potash, and lime by magnesia to some extent, and *vice versâ*; and as it appeared to me useful to contribute a few facts towards our knowledge on this subject, I took advantage of Dr. G. Wilson's kindness, to whom my best thanks are due for the use of his laboratory, and made a few ash-analyses of *Armeria maritima*, which I trust will be found not without interest in several points of view. My attention was first directed to this subject by a "notice of the presence of iodine in some plants growing near the sea," by Dr. Dickie of Aberdeen, now Professor of Natural History in Belfast. The author found by chemical examination of specimens of *Armeria maritima* from the sea-shore, and of others from inland and higher districts in the neighbourhood of Aberdeen, that the former only contained iodine; and having taken the precaution to wash the specimens previous to analysis, and having thus removed any objections which might have been made, namely that the iodine was derived from saline incrustations, Dr. Dickie has been led to conclude that marine Algæ are not the only plants which possess the power of separating from sea-water the compounds of iodine and condensing them in their tissue, without any detriment to their healthy function. In the same notice the author states that soda was more abundant in the specimens of *Armeria maritima* grown on the sea-shore, and potash prevailed in those grown in the inland higher places of Aberdeenshire.

The plants which I used for ash-analyses were grown in the neighbourhood of Edinburgh, and collected when in flower in the month of June; roots, leaves, and flowers were burned together.

No. 1. Ash of specimens grown close to the sea-shore and during high water exposed to the sea-spray.

No. 2. Ash of specimens grown on an elevated, partially decomposed trap-rock opposite the former locality.

No. 3. Ash of specimens grown in Mr. Lawson's nursery near Edinburgh, upon light sandy soil.

No. 4. Ash of specimens grown in the Scottish Highlands.

Dr. Dickie's experiments I found perfectly confirmed by my own. With the exception of those specimens which were exposed to the sea-spray, the examination for iodine of *Armeria maritima* grown in other localities, gave me negative results; and a comparison of the composition of the ash of No. 1 and 2 likewise proves the correctness of Dr. Dickie's statement respecting the prevalence of soda or potash.

I endeavoured to determine the quantity of iodine in the ash of specimens of *Armeria* grown near the sea-shore; but though I used large quantities of ash, I had to give up the attempt on account of the minute quantity of iodine present in the ash.

The iodine reaction made with large quantities of ash, compared with the much more intense blue colour which a much smaller quantity of the ash of sea-weed produces with starch, renders it evident, that the proportion of iodine in the ash of *Armeria maritima* amounts to mere traces; and I am inclined therefore to differ from Dr. Dickie's conclusion in ascribing to this plant a power of separating from the sea-water iodine compounds and condensing them in its tissue—a power similar to that possessed by marine Algæ. The power which marine Algæ possess of extracting iodine from sea-water appears to me altogether different: iodine is an essential element for the healthy condition of sea-weeds; without it these plants cannot exist, and hence we can well imagine that their peculiar organism possesses a power of extracting iodine from sea-water, of assimilating the same, and perhaps of storing it up. *Armeria maritima* on the contrary does not require iodine as a necessary element, and grows equally well in a soil destitute of iodine as on the sea-shore. I am therefore inclined to ascribe the occasional presence of iodine in *Armeria maritima,* not to a power similar to that possessed by marine Algæ, but to an endosmotic action of the roots of *Armeria,* by means of which small quantities of iodine-compounds present in the sea-water are taken up by the plant in the same manner in which any other soluble salt would be absorbed, when presented to the roots of this plant in a watery solution.

Notwithstanding the repeated washings of the plants, a considerable quantity of fine sand remained concealed between the fibres and scales of the roots, as will be observed in the following analyses:—

Ash Analyses.

No. I. Ash of specimens of *Armeria maritima* grown close to the sea-shore in the neighbourhood of Edinburgh:—

	Actual result.	After deduction of sand, carbonic acid, and calculating for 100.
Potash	6·73	8·86
Soda	3·39	4·47
Chloride of sodium	18·22	24·03
Iodine	traces.	
Lime	10·24	13·50
Magnesia . . .	8·33	10·98
Oxide of iron . .	6·01	7·92
Alumina	1·50	1·97
Phosphoric acid .	4·27	5·77
Sulphuric acid . .	6·01	7·92
Carbonic acid . .	1·73	
Silicic acid . . .	11·06	14·58
Sand	23·20	
	100·69	100·00

No. II. Ash of specimens grown on an elevated rock opposite the former locality:—

	Actual result.	Deducting sand, carbonic acid, and calculating for 100.
Potash	6·32	8·85
Chloride of potassium	5·88	8·21
Chloride of sodium .	13·19	18·44
Lime	10·33	14·44
Magnesia	8·55	11·95
Oxide of iron . . .	4·89	6·83
Phosphoric acid . .	8·40	11·75
Sulphuric acid . .	6·21	8·68
Silicic acid	7·76	10·84
Carbonic acid . . .	2·87	
Sand	25·12	
	99·52	100·00

No. III. Ash of specimens grown in Mr. Lawson's nursery, near Edinburgh, upon sandy soil:—

	Actual result.	Without sand, carbonic acid, calculated for 100.
Potash	9·29	13·81
Chloride of potassium	17·94	26·65
Lime	6·14	9·12
Magnesia	2·88	4·28
Oxide of iron . . .	4·46	6·62
Phosphoric acid . .	14·18	21·07
Sulphuric acid . .	4·93	7·33
Silicic acid	7·48	11·12
Carbonic acid . . .	2·37	
Sand	30·90	
	100·57	100·00

Several observations are suggested by the inspection of the above analytical results:—

1. The proportion of alkaline chlorides, as well as that of silica in all three ashes, is considerable.

2. The quantity of soda is more abundant in the ash of specimens grown near the sea-shore, whilst potash prevails in the ash of plants grown on the solid rock near the sea-shore.

3. Soda is entirely replaced by potash in the ash of *Armeria* grown in the nursery.

4. The quantity of phosphoric acid in No. III. is considerable when compared with that in No. I. and No. II.

5. The proportion of magnesia in the ashes of *Armeria maritima* in its natural state is larger than in the ash of specimens grown in the nursery.

I must observe, that the character of the specimens grown in the nursery was somewhat altered. The plants appeared a great deal more vigorous, their leaves were brighter green and broader than those of the wild-growing plants, and the specimens on the whole had lost much of the rigidity of the plants in their natural state.

The above analytical results are well calculated to throw light on the causes which contribute to chain this plant to a particular well-defined geological formation.

We are informed by Prof. Schleiden, in his beautiful work 'Biography of a Plant,' that the *Armeria maritima* grows everywhere upon the arid sand-dunes on the northern coasts of Germany, and is universally distributed over the sandy plains of northern Germany, but that it is not met with on the granite, clay-slate, and gypsum of the Hartz Mountains, nor on the porphyry and Muschelkalk of Thuringia, and is only found again when we arrive at the Keuper-sand plains on the further side of the Maine in the neighbourhood of Nuremberg. It extends further south through the Palatinate, till the Muschelkalk of the Swabian Alps again sets a limit to it.

Neither on the Swabian Alps nor in the whole Alpine region is the sea-pink seen, but it appears at last again on the sandy soils of Northern Italy. Schleiden in the above-mentioned work, after having directed attention to some other plants, which are confined to well-defined geognostic formations, asks the questions: "How is it that these plants everywhere disdain the richest soils in their range of geographical distribution, and are confined to perfectly determinate geognostic formations? Must not the lime, the salt, the silica, have a most distinct influence in the matter?"

The above analytical results point out clearly that *Armeria maritima* requires not only a considerable amount of silicic acid, but also of alkaline chlorides for its healthy condition, and we can now conceive easily why this plant will refuse to grow on a soil which does not contain these substances in sufficient quantities. The fact that the sea-pink is not found on every sandy soil in Germany, would suggest the idea that those localities where it occurs are rich in salt, and that some of the observed places in all probability have been the beds of some ancient dried-up sea.

In England and Scotland *Armeria maritima* is found universally on the sea-shore, but, with a few exceptions, we do not find it to extend to any distance in the inner regions of the island *. As a most remarkable exception to this general rule of its geographical distribution in England, we find the appearance of *Armeria maritima* on the summits of several inland mountains of the Scottish Highlands. Now, how does it happen that we do not meet with it in the Lowlands in localities much nearer to the sea-shore? I was anxious to ascertain whether the composition of the ash of plants grown on Highland mountains showed any marked difference, and am much indebted to Professor Balfour for furnishing me with the material for analyses. The plants were collected by Professor Balfour himself on the top of Little Craigindal and other lofty mountains in the Braemar district. The analyses of the ash furnished the following results:—

* Dr. W. Francis informs me that *Armeria maritima* occurs in profusion with *Cochlearia officinalis* at Nappa in Wensleydale, Yorkshire.

No. IV. Ash of *Armeria maritima* grown on Little Craigindal in Braemar:—

		Deducting carbonic acid and sand.
Chloride of sodium .	2·64	4·89
Potash	7·25	13·44
Lime	22·29	41·34
Magnesia	1·08	2·01
Oxide of iron and a little alumina . .	2·46	4·56
Phosphoric acid . .	5·28	9·79
Sulphuric acid . .	4·05	7·51
Silicic acid . . .	8·87	16·46
Sand	37·74	
Carb. acid and loss .	8·34	
	100·00	100·00

The composition of this ash differs from that of plants grown in other localities, particularly with respect to the lime, which appears to replace in part the alkaline salts. However, silica and chloride of sodium, two substances which are essential to the healthy growth of *Armeria*, are present in considerable quantity.

The circumstances connected with the occurrence of *Armeria maritima, Plantago maritima, Cochlearia officinalis,* and some other marine plants in the Scottish Highlands, deserve to be well investigated. Not having had an opportunity of examining myself the localities in which *Armeria, Plantago,* and other marine plants are found in the Highlands, it does not become me to offer an explanation of this curious fact. I may however be allowed to urge those interested in this subject to pay attention to the meteorological condition of those places in the Highlands where maritime plants are said to occur. It is a well-ascertained fact, that the spray of the sea is carried into the air to a considerable height, from which the salt in it is sent down again to the earth with the rain. The quantity of rain in mountainous districts being generally much greater than in the lowlands, it appears to me not unreasonable to suppose, that particularly those sides of elevated points in the Highlands which are exposed to frequent sea-winds will be provided with a quantity of salt, sufficiently large to supply the wants of the sea-pink, which plant, as indicated above, always contains a notable quantity of common salt.

In conclusion, I beg to offer a few observations respecting the occurrence of fluorine in plants. Dr. Will of Giessen has the merit of having first discovered fluorine in plants. Comparatively few examinations of plants have been made in reference to the occurrence of fluorine in them. Most examiners have confirmed

Will's observations, and have found distinct traces of fluorine. Some however have denied its presence in plants. Amongst the former is Dr. Wilson, who, in an able paper read before the Royal Society of Edinburgh in 1846, "On the solubility of fluoride of calcium in water," states that he had detected distinct traces of fluorine in crude American potashes. Until lately, I must confess that I looked with suspicion on the statements referring to the occurrence of fluorine in plants; but I have now had ample opportunity of convincing myself of the truth, that there are plants which contain fluorine. In my former investigations I failed in detecting fluorine, owing to the presence of silica; for I find that this substance interferes with the usual method of testing for fluorine.

The plan which I found to answer the purpose is one suggested by Dr. G. Wilson. He recommends to precipitate the hydrochloric acid solution of the ash of a plant with ammonia, to collect the precipitate on a filter, and to add chloride of barium to the clear solution filtered from the ammonia precipitate. The two precipitates thus obtained are well-dried, and separately examined for fluorine in a platinum or leaden vessel in the usual manner.

Following Dr. Wilson's plan of procedure, I was enabled to detect distinct traces of fluorine in the ash of specimens of *Armeria maritima* grown near the sea-shore, and also in the ash of the same plant grown in the nursery near Edinburgh. I likewise found fluorine in *Cochlearia officinalis* and *Plantago maritima*, but was unable to detect it in Canaster tobacco. If we recollect that tobacco leaves are soaked in a considerable quantity of water in the manufactories, and if we bear in mind that fluoride of calcium is soluble in water, as shown by Dr. Wilson, we cannot be surprised that no fluorine should be present in the ashes of Canaster.

XIII. *On* Lastrea uliginosa, *Newm.* By Thomas Moore, F.L.S., Chelsea Botanic Garden.

Read 13th March 1851.

Some discussion has recently taken place respecting a fern belonging to the "spinulose" group of *Lastreæ,* said to be new to England, which was found not long since by Mr. Lloyd, and which Mr. Newman has described under the name of *L. uliginosa* (Phytol. iii. 679). Having had ample opportunities of observing the plant both in a living and dried state, I venture to state to the Botanical Society the conclusions at which I have arrived respecting it.

It is curious enough that six botanists "who had paid attention to ferns," and who were consulted as to the name of this plant (which for the sake of distinction I will here call Lloyd's fern), should have recorded their opinions as follows: "1. a form of *Filix-mas*; 2. *L. rigida*; 3. *L. cristata*; 4. *L. spinosa,* strong var.; 5. *L. dilatata,* rigid var.; 6. no way different from *L. spinosa.*" It does not at all closely resemble *Lastrea Filix-mas* and *L. rigida*; nor can it well be confounded with *L. dilatata.* The other opinions approach nearer the truth.

Those botanists whose organs of concentrativeness hardly allow them to suffer the plants known as *L. spinulosa, dilatata,* and *Fœnisecii,* to take rank as varieties, will of course at once bury *L. uliginosa* in some part of this accumulation of vegetable matter; but I would submit that at least with cultivators and fern-fanciers, a form recognisably distinct possesses sufficient interest to claim and ensure attention; and Lloyd's fern is at least sufficiently distinct in the growing state to be selected by the eye without hesitation from among the allied species.

Two questions however suggest themselves with respect to it: (1.) Is it really new to England, and (2.) specifically distinct? My own observations lead me to answer both questions negatively. We have however in this plant an apparent justification of those older botanists (Linnæus and others) who are charged with having confounded *L. cristata* and *L. spinulosa,* and even of including both in their idea of one species. The existence of a fern exactly intermediate between them, as Lloyd's is, and differing from both in no character whatever, seems to explain all the doubts and difficulties, the "great confusion" as Newman has it, respecting the crested fern. There are evident traces of the record of such a fern—intermediate between *L. cristata* and *L. spinulosa*—having been found formerly in this country; and probably like other doubtful questions, the determination of the plant has been postponed, until turning up again in a more convenient season, it has been fortunate enough to obtain consideration. For these evidences I shall merely quote Newman, who writing some years since of *L. spinulosa,* remarks: "it occurs frequently in marshes, and there mingling with *cristata,* so closely approaches it in appearance, that I have found the greatest difficulty in separating them;" the puzzling form alluded to being now identified by him as Lloyd's fern (Phytol. iii. 679). As this intermediate form is found widely distributed in England, occurring in Cheshire, in Nottinghamshire and in Norfolk, I assume that it probably exists also in Sweden, and if so, may have formed the stumbling-block of Linnæus in his idea of the species "*cristata,*" and in some measure justified him in uniting, or "confounding" as it is said, if he really did intend to unite, the ferns which we moderns call *Lastrea cristata* and *spinulosa*.

As to whether Lloyd's fern is specifically distinct, different opinions will be held, no doubt. From the first it has appeared to me as being intermediate between the two species just named; but before having seen the barren fronds, which the plant I believe constantly produces, I was led to think it more closely allied to *spinulosa* than to *cristata*. Mr. Lloyd himself thinks it intermediate between these two kinds; and Mr. Newman calls it "almost precisely intermediate," which, in fact, it is. Its relationship thus seems clear enough; but I do not agree in the conclusion which has been drawn, namely, that being thus intermediate, it cannot be referred to either species as a variety, and must either combine them into one, or itself be regarded as a species.

Lastrea uliginosa is correctly said to differ from each one of its allies, in certain points in which it resembles the other. Thus the "more acuminate, more divided, more serrated, more aristate pinnules," which separate it from *cristata,* unite it to *spinulosa*; and the "adnate decurrent pinnules," together with the outline of the barren fronds which separate it from *spinulosa,* unite it to *cristata*. The "erect rigid habit," the "obovate diaphanous concolorous scales," and the "entire eglandulous" indusium, are characters common to both; and it differs from both, as we are told, *only* in the "more equal distribution of the clusters of capsules over all parts of the frond." This latter is however an unsound character, for I have gathered specimens, undoubtedly *L. spinulosa*, in which every pinna is as thoroughly furnished with perfect sori, as is the case in Lloyd's fern.

It thus appears that no tangible specific character has been pointed out by which to distinguish *L. uliginosa* (Newm.) as a species. I do not however fall back upon the alternative already mentioned—that of uniting *cristata* and *spinulosa*—though it is *possible* that this may after all be the true solution of the question; but looking upon it as a variety of one of these species, there appear to be points in its structural details which connect it more closely to one than to the other.

The characters of venation and vernation may be considered as of higher value than the mere form or incision, or mode of connection of the pinnules. Now it is in their form and mode of incision that Lloyd's fern most closely approaches *spinulosa* and diverges from *cristata*; whilst in their vernation it exactly coincides with *cristata*, and absolutely differs from *spinulosa*. In the venation, too, it very nearly coincides with *cristata*, certainly resembling that species much more than it does *spinulosa*. I therefore regard Lloyd's fern as more nearly related to *cristata* than to *spinulosa*—a conclusion different, it will be seen, from that drawn from the inspection of a single fertile frond, and arrived at by an examination of the entire growing plant, selecting those characters which appear of the highest structural importance. I propose to rank it as a variety of *L. cristata*, and to define it thus:—

Lastrea cristata. Fronds narrow linear-oblong sub-bipinnate: pinnæ elongate triangular, with oblong serrated decurrent pinnules, the lower crenately, often deeply lobed; lateral veins of the pinnules with several branches.

β. uliginosa: (fertile fronds) pinnules oblong, pointed, deeply lobed, somewhat aristato-serrate, the lowest sometimes scarcely decurrent.—*L. uliginosa*, Newm. (Phytol. iii. 679).

It should be mentioned that the plant usually, if not constantly, produces dissimilar barren and fertile fronds. The former are not to be distinguished from barren fronds of true *cristata*; and the latter alone are scarcely to be distinguished from specimens correspondent in size of the true *spinulosa*; occasionally, the barren form of frond is more or less fertile.

These conclusions, which have been some time formed, are somewhat at variance with the views embodied in the most recent authoritative book on British botany, namely Hooker and Arnott's 'British Flora,' in which *Lastrea uliginosa* is not allowed to take rank even as a variety; they are however the result of careful observation, influenced no doubt by an impression that plants which are permanently different from others are deserving of record.

XIV. *On a supposed new species of* Rubus.

By Fenton J. A. Hort, B.A.

Read 10th April 1851.

At a time when descriptions of Brambles, published by botanists whose qualifications have been fully tested and acknowledged in other fields, are received with incredulity and even derision, those who possess no such advantages have little right to expect a gentler and more charitable treatment. If therefore it were allowable to be guided wholly by personal considerations, I should not venture to add another species to our already crowded list: but cowardice and mock-modesty are as unjustifiable in science as in anything else. It is at all times unfair to assail the worth of a supposed new species and escape the labour of honest investigation by recklessly imputing vanity to the describer: but in the case of Brambles such imputations are not less absurd; for the possible attention of the isolated few who now study this genus can surely have but poor attractions for a vain mind, when accompanied by the certain suspicion of the great mass of botanists, good as well as bad: and on the other hand, there is an obvious restraint in that fear of future opprobrium from the chance of erroneous conclusions and consequent ultimate rejection, which must always haunt the study of difficult groups of plants. Until then a time arrive, when the worshipers of observation and sober induction shall cease to assume *à priori* the worthlessness of the careful observations of others, conducted with a view to trace the manifold laws of variation through the living forms of Nature under the influence of the most different circumstances, we must be content to go our own way quietly, asking no more than bare toleration from those who affect to try our conclusions by a few dry fragments of an isolated form or two out of each species. To students of Brambles therefore, and to them alone, the following description is offered:—

Rubus imbricatus; *caule* decurvato *ramosissimo* angulato *sulcato* glabro, *aculeis* parvis *validis* declinatis, *foliis* quinatis subtus pallidioribus *convexis*, *foliolis imbricatis subconvexis* subundulatis *cuspidatis*, infimis breviter pedicellatis terminali subrotundo cordato longius pedicellato, paniculæ angustæ inferne foliosæ *ramis longis racemosis ascendentibus*, sepalis abrupte cuspidatis a fructu globoso prorsus reflexis, stylis sulphureo-virescentibus, toro subgloboso subsessili.

Stem soon decurved horizontally or more rarely arching, almost invariably throwing out numerous slender flagelliform shoots, rooting, angular, slightly furrowed, purplish red, glabrous or nearly so, the axillary shoots with a few hairs. Prickles purplish red, glabrous, enlarged and compressed at the base, slender but very strong, declining and rather small, on the axillary shoots slightly deflexed and longer, mostly confined to the angles of the stem. Leaves quinate, convex, slightly wavy over the whole surface, rather opake and nearly glabrous above, paler and sparingly pilose beneath: leaflets convex; their margins doubly but not deeply dentate-serrate-apiculate; lower pair oblong, cuspidate, shortly stalked, overlapping the obovate cuspidate intermediate pair, which themselves overlap the roundish or roundish-obovate cordate leaflet, which has rather a long stalk: midribs and petioles with strong decurved prickles; general petioles flat above, partial channelled; all hairy. Stipules linear, slightly hairy.

Flowering shoot very variable in length, surrounded at its base by brown scales clothed with white hairs, purplish red, with a few patent hairs. Prickles small, strong, slightly deflexed, glabrous or slightly hairy. Upper leaves simple; intermediate usually quinate, subglabrous above, paler and slightly pilose beneath; leaflets cordate-ovate or -obovate: petioles and midribs with very slender slightly deflexed prickles. Stipules linear. Panicle rather narrow, compound, slightly hairy below, very hairy, but not tomentose above; hairs white: prickles few, short, slender, deflexed: branches long, racemose, the four or five lowest axillary, distant; all ascending or nearly erect. Bracts trifid with narrow segments or simple and broad. Flowers small. Sepals ovate, abruptly cuspidate with an usually rather short linear or almost filiform point, clothed with ashy tomentum within and without, completely reflexed from the fruit. Petals elliptical, concave, clawed, converging, white. Styles greenish yellow below. Primordial fruit rather small, subglobose, glossy black: torus subsessile, ellipsoidal or nearly globose.

In many places, mostly on sloping banks, for three or four miles on both sides of the Wye below Monmouth, in both Monmouthshire and Gloucestershire. June and July.

The position of this plant is easily determined. It belongs to the group possessing subglabrous eglandular rooting barren stems and stout leathery leaves. It is closely allied to *R. affinis*, *R. cordifolius*, and *R. incurvatus*. On a hasty inspection it might probably be referred to *R. corylifolius*, but there is in reality a wide gap between them, the latter species being rightly, I think, referred by Mr. Bloxam to his group of "Rubi Cæsii," possessing subterete barren stems, with often a glaucous bloom and sometimes a few small true setæ, somewhat subulate prickles, and many of the drupes in each fruit abortive. Again, it is often difficult to distinguish dried specimens of *R. imbricatus* and the three species above mentioned, although no one accustomed to look at Brambles could confound them when growing. The present plant may be known from the larger and more typical forms of the protean *R. affinis* by the structure of the branches of the panicle, which are racemose and not cymose, and their much slighter degree of divarication from the rachis, and by the sepals being abruptly cuspidate and not gradually acuminate; (to the less developed forms, which apparently constitute Mr. Lees's *R. lentiginosus*, having suberect stems and nearly simple panicles, and growing chiefly in heathy places, it bears no resemblance :) from *R. cordifolius** by the laxer and less pyramidal panicle, the absence of tomentum on the under side of the leaves, and the agreeable flavour, globular shape and glossy lustre of the fruit, which in the latter species are very peculiar, when able to ripen freely, being remarkably large, oblong, with somewhat flattened drupes, dull and burnished rather than glossy, and very insipid (it should be observed that all these three species grow in the same neighbourhood): from *R. incurvatus* by the leaves being hairy, but not clothed with a firm velvet beneath, and by the yellowish green not flesh-coloured styles. The numerous secondary shoots of the barren stem, the imbricated and convex leaves and leaflets, and the absence of tomentum on the upper part of the panicle, sufficiently separate it from all three species.

The extraordinary tendency of *R. carpinifolius* and *R. macrophyllus* to assume the most unlike forms renders it possible that they may be confused with *R. imbricatus* as with several other species. In this case single dried specimens are almost useless, but an intelligent examination of numerous bushes in the same district will commonly detect the aberrancy of type: both are sure to throw out occasionally superfluous small prickles (or even true aciculi) and a few setæ or subsessile purple glands from their barren stems, and a tendency to puffiness and flac-

* Perhaps I may be allowed to take this opportunity of expressing my surprise at Dr. Bell Salter's union of *R. nitidus* of English authors with this species. I carefully watched the two plants last summer growing freely intermixed in the same hedge, and in their sportive variations deceiving the eye for a moment, but for a moment only. When autumn came, the fruits of *R. cordifolius* were invariably perfected, those of *R. nitidus* for the most part abortive, throughout my neighbourhood. Facts like these appear to me valuable collateral proofs of the distinctness of species. Thus I found last year *Luzula Forsteri* always fruitful, *L. pilosa* usually the reverse.

cidity is perceptible in even the thicker leaves: *R. carpinifolius* is moreover apt to have its terminal leaflets wholly or partially subdivided, so as to produce septenate leaves. These characteristics are absent from the group "Nitidi," to which *R. imbricatus* belongs.

I may add that it flowers early, almost contemporaneously with *R. nemorosus,* and nearly a month before its true allies.

Trinity College, Cambridge, March 25, 1851.

XV. *Biographical Notice of the late* Mr. George Don *of Forfar.* By Pat. Neill, LL.D.

Read 15th May 1851.

George Don's early education was limited to the reading, writing, and arithmetic taught at the parish school; he had a natural turn for mechanics, and acquired a taste for reading and observation. Even from his boyish days he delighted in noticing the minute characters of such birds, insects, and plants as came within his reach.

He was apprenticed to a clockmaker in the town of Dunblane, and here formed his first hortus siccus, consisting of all the phænogamous and cryptogamous plants which he could cull in the neighbourhood, and they were numerous.

When he became journeyman he removed to Glasgow; and here he generally worked five days a week at his business, and in this space of time finished the making of a clock. The remainder of the week was spent in botanizing, if the weather permitted. Occasionally he stole an additional day or two, and penetrated into the Highlands as far as Ben Lomond and even Ben Lawers, in search of alpine plants—adding several unexpected rarities to the lists known to Mr. Lightfoot, or to his guide, the excellent Dr. Stuart of Luss.

Having himself saved a very small sum of money, and married a young woman who had saved a little money, he went to Forfar and procured a long lease (99 years) of a small bit of ground from Charles Gray, Esq., of Carse, at a trifling rent, but on condition of his building a cottage of certain dimensions within a given period. Here he spent four years, necessarily in a very frugal and penurious style. The chief part of the ground was occupied as a *mail* garden, the vegetables being sold to such inhabitants of Forfar as chose to send for them. A portion which bordered on the loch of Forfar was laid out as a botanic garden of hardy herbaceous plants, arranged according to the Linnæan classes and orders; and to these it is believed Mr. Don gave more of his time and attention than to the more vulgar but more profitable culinary sorts.

When on a pedestrian excursion along the east coast of Scotland, I happened to spend a night at Montrose, and it occurred to me that both Brechin and Forfar deserved to be visited—the former for its well-known Den Noran, and its round tower of remote antiquity; and the latter for its remarkable botanic garden, and its owner, whose fame was familiar to me, owing to my intimacy with his regular correspondent, Mr. John Mackay of the Leith Walk Nurseries. In passing along the margin of the sea basin above Montrose, the tide being at ebb, I picked up some fine plants of *Salicornia herbacea*, then in flower, and also a somewhat shrubby variety. On reaching Forfar towards evening, I soon found Don's garden, and entering, inquired of a very rough-looking person with a spade in his hand, whom I took for a workman, whether Mr. Don was at home. The answer was, "Why, Sir, I am all that you will get for him." Having apologized in the best way I could, I stated that when I left home I did not anticipate a visit to Forfar, else I could have brought a note of introduction from Mr. John Mackay. Mr. Don, pointing to my botanical box, immediately said, "That is introduction enough to me;" and having inspected the contents, remarked that he was in want of an example of *Monandria Monogynia*, an *Equisetum* not having succeeded, and forthwith conducted me to the Linnæan arrangement. I was then introduced to Caroline his wife, who had brought him two sons and a daughter. I persuaded him to accompany me to the inn at Forfar, where he spent the evening with me. Next morning by six he met me there by appointment, and conducted me to Restennet Moss, where I had the great satisfaction of procuring a living patch of *Eriophorum alpinum*, and a number of fine specimens for drying. The Moss was at this time partially drained, for the sake of a rich deposit of marl; but at one end there was still sufficient marsh for the growth of *Cladium Mariscus* and *Eriophorum angustifolium*, and, of course, for the rare *E. alpinum*, which grew on the drier or firmer parts of the Moss. Mr. Don remarked that in a few years the plant would disappear, which I understand has accordingly happened.

The situation of Curator of the Edinburgh Botanic Garden having become vacant, Mr. Don was strongly recommended to Professor Rutherford by the late Mr. Brodie of Brodie, and his recommendation was backed by Sir James Edward Smith, who was well aware of the merits of Mr. Don as a practical botanist, from having published in his 'English Botany' several of his Scottish discoveries. He was accordingly appointed, and removed to Edinburgh with his family, leaving his garden in care of his father who resided on the spot, and who was himself a great cultivator of flowers for amusement, and followed the trade of a currier first in Dundee (where George Don must have been born) and afterwards in Forfar.

Mr. Don had not had experience in the cultivation of stove plants, and, it must be confessed, did not shine in that department. At the same time there can be no doubt that as a botanist he greatly excelled the Professor, who was an accomplished chemist, but had little turn for botany. It thus happened that there soon arose a want of cordiality between the parties; and Mr. Don contemplated a return to his favourite spot of ground at Forfar.

During his residence in Edinburgh he attended nearly all the medical classes, with the view of ultimately following that profession. On his return to Forfar he added the nursery business to that of the Botanic Garden, which, however, turned out very unprofitable, partly in consequence of the ground being bad and labour expensive. He formed an extensive collection of plants, principally hardy, as well as a considerable herbarium, chiefly of British plants, making numerous excursions to the mountains—at the same time following his profession of a country surgeon, which he had qualified himself for in Edinburgh. Had he thrown up botany he would have done well in his new profession, for he was very successful at first, but his business ultimately dwindled in consequence of his being continually out of the way when wanted, in search of new botanical discoveries—a pursuit ill adapted for a poor man with a large family. He died in January 1814. His remains were interred in Forfar churchyard, about 100 yards from the church, on the south side, towards the east end of the church.

It seems to be remarkable that there is no monument to mark Don's grave, and we understand that steps are now being taken to do so, and that Mr. M'Nab at the Botanic Garden is willing to receive subscriptions for the purpose.

XVI. *Remarks on* Dickieia. By John Ralfs, Esq.

Read 16th May 1850.

Dickieia, *Berk. & Ralfs.*

Frond subgelatinous, tender, plane, containing oblong scattered frustules.

In this genus the frond is so extremely tender that dried specimens are destroyed in the act of removing them from the paper, their gelatinous matrix being apparently dissolved by the application of moisture. The frond tapers at the base and expands upwards into a lanceolate or obovate form. I could detect neither striæ nor puncta in the frustules, which in the front view are nearly quadrate, and are rarely twice as long as broad; in the lateral view they are narrow-linear with rounded ends; as they do not appear to be siliceous, it is probable that dried specimens (the only ones I have examined) become, in that view, somewhat narrower than they are when recent,—a fact which I have noticed in some genera of this order, whose frustules cannot without injury be submitted to the action of nitric acid.

Dickieia differs from *Schizonema* by its flat fronds and scattered frustules.

Dickieia Dansii (Thwaites) does not belong to this genus, since its gelatinous matrix forms an irregular mass and not a plane frond. Its frustules also differ, being decidedly siliceous, striated, and having a longitudinal pellucid line and central punctum (aperture, Kützing) in the lateral view.

1. *D. ulvoides* (Berk. and Ralfs). Frond undivided, obtuse at the apex. *Dickieia ulvoides,* Berk and Ralfs, Annals of Nat. Hist. vol. xiv. p. 328. t. 9; Kützing, Die Kieselschaligen Bacillarien, p. 119; Species Algarum, p. 109.

   Rocky shore, Aberdeen, April, *Professor Dickie.*

2. *D. pinnata* (Ralfs). Frond sparingly pinnate, all the divisions lanceolate. *Dickieia pinnata,* Ralfs, Ann. Nat. Hist. S. 2. vol. viii. p. 204. t. 5. f. 6.

   Small shallow marine pools, especially on detached masses of rock; Torquay, September, *J. R.*

   Fronds olive-brown, becoming greener when dried, 1 to 2 inches high, lanceolate, irregularly pinnated; the pinnæ lanceolate and alternate. The margins, both of the primary portion and of the divisions, are uneven and minutely laciniated. The frustules are like those of the preceding species.

In 1836 I observed this plant growing plentifully near Torquay, since which time I have had no opportunity of searching for it. In the recent state it has, to the naked eye, much the appearance of a minute species of *Dictyota*; but it is so exceedingly tender, that it is difficult to carry it home in a condition fit for preservation. It differs from *Dickieia ulvoides* in its darker colour, divided frond, and more tapering extremities; besides, it is an autumnal and the other a vernal species.

Note on Spirulina.

Professor Kützing has described and figured eleven species of this genus, but the specific differences which he relies on do not seem to me satisfactory. They are chiefly the colour of the stratum and comparative closeness and diameters of the spires or coils. But the colours I have found to vary much, according to the age of the stratum, its greater or less exposure to light, and the state of the weather. In all the specimens whose growth I have watched, the spires were at first very dense, but became laxer after a short time; and in a specimen of *Spirulina tenuissima* sent me from Bristol by Mr. Thwaites, the spires were relaxed at the extremities of many of the filaments, though at the middle they remained compact. In *Spirulina* the diameters of the filaments increase considerably as they advance towards maturity, but this increase has its limits, and an acquaintance with all the species is necessary to enable the observer to determine what value he should assign to this character as a specific distinction.

XVII. *On* Chantransia, *Desv.* By John Ralfs, Esq.

Read 19th June 1851.

Chantransia, *Desv.* Trentepohlia, *Agardh and British authors.*

Plant affixed, tufted; filaments branched, jointed, monosiphonous; fructification—capsules with granular contents and usually terminal and subcorymbose on proper branches.

Freshwater, minute, tufted Algæ of a red, purplish or inky colour. Filaments much branched, jointed; main branches elongated, mostly level-topped. Fructification capsular, usually on short, much divided proper branches; capsules generally crowded, subcorymbose, and terminal on short stalks, their contents simple.

The proper position of this genus is doubtful: in habit and appearance some of its species agree so closely with the minute, parasitic, irregularly branched species of *Callithamnion*, that Dr. Harvey in the 'Flora Hibernica' united it to that genus; and although, at Mrs. Griffiths' suggestion, he has, in his 'Manual of British Algæ,' again separated them, yet he justly remarks, that deep-coloured specimens of *Trentepohlia pulchella* (*Chantransia Hermanni*) so much resemble *Callithamnion Daviesii* as scarcely to be distinguishable from it.

Whilst, however, the red colour of some species of *Chantransia* seems thus to indicate an affinity with the *Rhodospermeæ*, the inky-green of others appears to forbid us to rank the genus in that order. Dr. Montagne, a high authority, places it in *Ectocarpeæ*, a tribe belonging to the *Melanospermeæ*, and Kützing refers it to the *Conferveæ*. *Chantransia* has thus been associated by authors of distinguished merit with the three great primary divisions of the Algæ,—a proof how difficult it is to ascertain its proper position. As the contents of its capsules are simple and not divided into tetraspores, I believe its correct situation is with the *Chlorospermeæ*.

1. *C. Hermanni* (Roth). Tufts dense, reddish; joints of filaments three to five times longer than broad; fructiferous ramuli patent,

capsules crowded. *Conferva Hermanni,* Roth, Cat. i. p. 164 (1797); Cat. iii. p. 180. *Conferva nana,* Dillwyn, Conf. t. 30 (1803); Smith, Eng. Bot. t. 2585. *Chantransia Hermanni,* Desv. (?); Kützing, Phycologia Germanica, p. 230. *Trentepohlia pulchella,* Agardh, Systema Alg. p. 37 (1824); Harvey in Hooker's Brit. Flora, p. 382; Manual of Brit. Algæ, p. 75; Hassall, Brit. Algæ, p. 75. t. 8. f. 2. *Auduinella Hermanni,* Duby, Botanicon Gallicum, p. 972 (1830).

On aquatic plants in streams.

The tufts of *Chantransia Hermanni* are dense, soft and woolly, not gelatinous, and adhere but imperfectly to paper; they are often confluent; their colour is reddish, becoming tawny by age and in drying. Filaments much branched, main branches elongated, somewhat level-topped; fructiferous branches lateral, numerous, short, patent, much divided. Capsules at first oval or clavate, finally orbicular, crowded in a corymbose manner, mostly stalked. Joints of stem three to five times as long as broad, those of fertile branches shorter.

Chantransia Hermanni differs from *C. chalybea* in colour and in its shorter joints and more patent ramuli.

2. *C. investiens* (Lenormand). Parasitic, rose-red, much branched; joints many times longer than broad; capsules solitary or in pairs, lateral and terminal, clavate or obovate. *Batrachospermum rubrum,* Hassall, Brit. Algæ, p. 113. t. 15. f. 2, 3 (1845). *Chantransia investiens,* Lenormand in Kützing's Species Algarum, p. 431 (1849); Ralfs, British Alg. no. 12.

Parasitic on *Batrachospermum moniliforme* and *B. atrum* in a stream, Penzance, *J. R.*

France, *Lenormand*!

Plant bright red, at first appearing as minute reddish stains, finally clothing the invested plant with a continuous downy covering. Filaments creeping and interlacing at base, and surrounding the plant on which it grows, much branched. Branches not attenuated, alternate, erect, elongated; joints very long, often twelve times as long as broad, and filled with a pink, slightly granular endochrome. Capsules clavate or obovate, alternate or opposite, sometimes, though rarely, opposite a branch; the terminal ones are more orbicular.

3. *C. chalybea* (Roth). Tufts rather lax, inky-green; joints of filaments five to six times longer than broad, those of fructiferous ramuli turgid; branches appressed. *Conferva chalybea,* Roth, Cat. iii. p. 286. t. 8. f. 2 (1806); Dillwyn, Brit. Conf. t. 91. *Conferva corymbifera,* Smith, E. Bot. t. 1996 (1809). *Ectocarpus chalybeus,* Lyngbye, Tent. Hydrophytologiæ Danicæ, p. 133. t. 44 (1819); Fl. Dan. t. 1666. fig. 1. *Trentepohlia pulchella, β. cha-*

lybea, Agardh, System. p. 37 (1824); Harvey, Manual of Brit. Algæ, p. 118. *Auduinella chalybea,* Bory, Dict. cl. iii. p. 340. *Chantransia chalybea,* Fries; Kützing, Phyc. Germ. p. 229; Species Algarum, p. 429; Ralfs, British Algæ, no. 11.

β. major. Filaments longer with rather shorter joints, ramuli more distant.

a. Common. Rivulets, waterfalls, and on water-wheels.

β. Wells, Penzance, *J. R.*

Plant laxly tufted, of an inky colour, more or less tinged with green. Branches rather distant, level-topped, erect, their joints four to six times longer than broad. Fertile branches short, appressed, their joints shorter and usually turgid. Capsules orbicular, corymbose, less crowded than in *Chantransia Hermanni.*

Chantransia chalybea differs from *C. Hermanni* in its colour, penicillate tufts and its appressed fructiferous branches, the joints of which are more turgid. The dried plant is usually more or less glossy.

4. *C. compacta* (Ralfs). Plant minute, hemispherical, inky-green, firm; filaments much branched, joints twice as long as broad; branches erecto-patent.

On aquatic plants in a rivulet at Trengwainton near Penzance, *J. R.*

Chantransia compacta forms very minute hemispherical tufts or fronds of a dark colour, and very much resembles a *Rivularia* in appearance; the fronds are so firm as to require considerable pressure in order to separate the filaments for microscopic examination. Filaments comparatively stout, rigid, much branched, at the base horizontal and interlacing. Branches crowded, erecto-patent. Joints about twice as long as broad, but the lower ones frequently shorter. Capsules orbicular, numerous, lateral, arising from all parts of the plant and usually on short stalks.

Chantransia compacta differs from *C. chalybea* in its compact, firm habit, more crowded branches, shorter joints and more scattered capsules.

I am unacquainted with *C. violacea,* Kütz., and am consequently unable to decide with certainty that this plant is not a variety of that species; but its difference in colour has induced me to propose it as a distinct species.

Kützing in his 'Species Algarum' mentions two other British species: as I am unacquainted with them, I subjoin his descriptions:—

5. *C. scotica* (Kütz.). Cæspite cæruleo-chalybeo, majori, trichomatibus $\frac{1}{240}'''$ crassis, ramis ramulisque remotis patentibus elongatis;

articulis diametro plerumque duplo longioribus. Kützing, *Phyc. Gener.* p. 285 ; *Species Alg.* p. 430.

In Scotia legit cl. *Klotzsch.*

6. *C. violacea* (Kütz.). Cæspite minuto, violaceo, subgloboso ; trichomatibus radiatim dispositis, rigidis, ramulis crebris approximatis, abbreviatis, patentibus, subsecundis ; articulis inferioribus diametro fere æqualibus superioribus 2–3plo longioribus. Kützing, *Phyc. Germ.* p. 231 ; *Species Alg.* p. 431.

In fluviis et rivulis montanis Germaniæ et Scotiæ ad Lemaniam fluviatilem.

XVIII. *Some Remarks on the Plant Morphologically considered.* By the Rev. Dr. M'Cosh.

Read 10th July 1851.

According to the common idea, the Plant is composed of two essentially distinct parts, the stem and the leaf. The axis of the embryo proceeds downward and upward simultaneously, the descending axis being the root, and the ascending one the stem or trunk. Upon these axes others are formed as subterranean or aërial branches. The leaf is formed upon the ascending axis, and besides its common form, it assumes, while obeying the same fundamental laws, certain other forms, as in the sepals, the petals, the stamens and pistils. Schleiden, in 'The Plant a Biography,' gives us a picture of a typical plant constructed on this principle. This makes a plant a dual, or composed of two essentially different parts.

But to us it appears possible to reduce a plant by a more enlarged conception of its nature to a unity. According to our idea, it consists essentially of a stem sending out other stems similar to itself at certain angles, and in such a regular manner, that the whole is made to take a predetermined form. The ascending axis for instance sends out at particular normal angles in each tree, branches similar in structure to itself. These lateral branches again send out branchlets of a like nature with themselves, and at much the same angles. The whole tree with its branches thus comes to be of the same general form as every individual branch, and every branch with its branchlets comes to be a type of the whole plant in its skeleton and outline.

Taking this idea of a plant along with us, let us now inquire whether there may not be a morphological analogy between the stems and the ribs or veins of the leaf. As these veins are vascular bundles, proceeding from the fibro-vascular bundles of the stem, they may be found to obey the same laws. Physiological confirmations of this presumption may be found in the following circumstances:—1. Both stem and vein are capable of becoming a spine, the stem as in the thorn, the vein as in the thistle. 2. It is also an unsettled question whether the inflorescence and seed-vessels in many cases are formed out of metamorphosed leaves or metamorphosed branches. The very fact that there is such a dispute, shows that there is an analogy between leaf and branch. 3. The vein of the leaf is capable equally with the stem of producing a leaf-bud, as in *Bryophyllum* and *Gloxinia*.

We begin with the examination of those plants which have a fully veined or reticulated leaf, and here we shall find a morphological analogy between the leaf and the branch, and the leaf and the whole plant. We are quite aware, that in respect of physiological development there is a wide difference between the two, but this will just render the morphological resemblance, if it exists, the more curious and striking. It should be noticed that this resemblance can be observed only when both the stems and the veins are fully and fairly developed.

In prosecuting this inquiry, let us first inspect in a general way the leaf of a tree with its central vein or veins, and its side veins. Even on the most careless inspection, the central vein will be found to bear a striking analogy to the central stem or axis of the tree, and the side veins to the branches. Having viewed the leaf in the first instance, let us then look at the tree when stript of its leaves in winter, and we shall see how like it is in its contour and skeleton to the contour and skeleton of a leaf. We shall be particularly struck with this if we view it in the dim twilight or the "pale moonlight" between us and a clear sky. In both leaf and tree we see a central stem or stems with ramified appendages going off at certain angles, and we may observe that the tree in its outline tends to assume the form of a leaf.

The general impression produced by a first glance will be confirmed on farther inspection. The analogy between the skeleton of the leaf and the skeleton of the branch may be seen in a number of points as well as in the general resemblance between the ramification of the plant and the ramification of the venation of the leaf. 1. Some trees, such as the beech, the elm, the oak, the holly, the Portugal and bay laurels, the privet, the box, will be found to send out side branches along the axis from the root, or near the very root, and the leaves of those trees have little or no petiole or leaf-stalk, but begin to expand from nearly the very place where the leaf springs from the stem. There are other trees, as the common sycamore (the Scotch plane-tree), the beech, the chestnut, the pear, the cherry, the apple, which have a considerably long unbranched trunk, and the leaves of these trees will be found to have a pretty long leaf-stalk. 2. Most of our low-branching herbaceous plants, such as the mallows, rhubarb, tussilago, marsh marigold, lady's mantle, hollyhocks, send out a considerable number of stems from near the root, and it will be found in exact accordance with this, that these set off from the base of the leaf, a considerable number of main veins or ribs, which, as they spread, cause the leaf to assume a rounded shape. In these plants the morphological resemblance between tree and plant is seen *horizontally* and not *vertically*. In this respect these plants are different from our forest trees, which send up commonly one main axis with lateral branches, and have in their venation one leading vein with side veins. 3. Some trees, such as the beech, the birch, the elm, send up one large main stem, from which, throughout its length, there proceed comparatively small branches, pretty equally along the axis, and it will be found in such cases that the leaf has a central vein with pretty equally disposed veins on either side. Other trees again tend rather to send off at particular heights a number of comparatively thick branches at once. This is the case for instance with the common sycamore, the chestnut, and the laburnum. The trunk of the sycamore (*Acer Pseudo-platanus*), about eight or ten feet above the surface of the ground, commonly divides itself into four or five large branches, and in precise analogy we find the leaf at the top of a pretty long leaf-stalk sending off four or five large veins. The chestnut tends to send off at the top of the unbranched trunk a still greater number of branches, and we find in correspondence with this, that its leaf is commonly divided into seven leaflets. The laburnum (and also the broom and clover) goes off in triplets in respect of leaflet and ramification. In such cases it will commonly be found that the leaf is compound, and we are to *regard all such compound leaves as one and representative of the whole tree.* Generally, it is the whole leafage coming off at a given place which represents the whole tree, and the single leaf, when there is a number of leaves, represents merely the branch. 4. Some plants, such as the rhododendron, the azalea, and the lupin, send off leaves which have a tendency to become whorled, and their branches have also a tendency to become verticillate. 5. The stems of some trees, such as the thorn and laburnum, are not straight, and the branches have a twisted form; and it will be found that the vein of the leaf of these trees is not straight, and that the leafage is not in one plant. This is also seen in the elm. 6. In some trees, such as the beech, the stems go off in nearly straight lines, and the leaves are found to have a straight venation. In other trees, again, such as the chestnut, the branches have a graceful curve, and the veins of the leaves are curved in much the same way. 7. In most plants the angle at which the side stems go off will be found to widen as we ascend to the middle, and thence to decrease as we ascend to the apex, and the venation of the leaves will be found to obey a similar law. This helps to give both to tree and leaf their beautiful oval outline. In some plants, again, such as the poplar and birch, the angles are widest at the base and tend to narrow as we ascend, and both leaf and tree in such cases assume a kind of triangular form. 8. Generally we shall find a correspondence between the angle of the ramification of the tree, and the angle of venation of the leaf. The following table gives the result of numerous measurements of the angles of branching and venation, where those were found to agree:—

Beech	45°	Rose	50°
Plane-tree	45	Laburnum (small branches)	60
Birch	40	Box (over)	60
Oak, 50 (large branches same venation).	65–70	Thistle	60–70
		Thorn (lowest branches)	35–50
Cherry	50	Ash	60
Portugal Laurel	50–60	Elm	45–50
Bay Laurel	50–60	Bird Cherry	60
Holly	55–60	Red Dog Wood	45
Rhododendron	60	Alder	50
Lime	40–45		

We have made a sufficient number of measurements to be able to say that there is often such a correspondence. But it should be acknowledged, that while it is not difficult to determine the angle of the venation of the leaf, it is most difficult to determine what is the normal ramification of the tree, for the angle at which the branch goes off is liable to be modified by a great number of circumstances. All that we argue for is a general correspondence between the tendency of the direction of the branches, and the tendency of the direction of the veins of the leafage; a tendency liable, however, to be affected by a great number of circumstances natural and artificial. It does not follow, because there is a correspondence between the venation of the leaf and the ramification of the tree, that therefore the two—the leaf and tree—must have the same form. The form of the leaf will be to some extent modified by the quantity of parenchyma, and the form of the tree by the weight of the branches; and there are other causes producing a discrepancy. But the two—the leaf and tree—will commonly assume the same form. Even when they differ, the correspondence will be seen in the *tendency*, apart from extraneous causes, to take the same form. *It is always to be remembered, that it is the whole leafage coming out at a given place which represents the tree, and the single leaf where there are more leaves than one, represents the branch or the young tree.* It is only thus that I can bring the ash and mountain ash into accordance with these views. The whole leafage with its stalk represents the tree, and the leaf-branch and leaflets the branches and branchlets, as also the young tree.

Such facts as these strongly incline us to the belief, that in plants with leaves that strike the eye, the leaf and plant are typically analogous. The leaf is a typical plant or branch, and every tree or branch is a typical leaf. I am quite aware of the differences between these two distinct members of the plant. In particular, we find in the case of the full tree, that the branches extend all round the axis, whereas in the leaf the fibrous veins all lie in one plane. But then we have a phænomenon to connect these two in the branch, the branchlets of which often lie in one plane. The principal difference between the tree and leaf may probably be found to be in this, that the cellular tissue or parenchyma, which in the tree and its branches is collected into the pith and bark (which are connected by the medullary rays), is in the leaf so spread out as to fill up the interstices of the fibrous matter which forms the veins.

The general order as thus stated applies only to the plants which have pith and bark, and fully formed leaves intended to strike the eye. There is no such special order in plants with linear, unbranched leaves, such as firs and pines. The leaf in these plants has no ramified venation, and seems to correspond, not to the whole tree, but to the stem, and in doing so it is more in accordance with the whole morphology of the tree than a veined leaf could possibly be. But while the general order is varied to suit the different physiological structure and form of the tree, we discover here the very same general principles of order as we have been discovering elsewhere; for in the firs and pines every internode is of the same structure with every other; every branch tends to assume the outline of the whole tree, *every topmost or growing internode with its leafage is of the same form as the tree or branch.* Herein does the special morphology approach nearest to that of the plants with ramified veins, and the very cones are often types of the whole tree and of every branch.

We are not prepared to say what is the special law of order in plants of the monocotyledonous class. Some of these, such as our ordinary lilies and grasses, send off no branches, and the leaves of these plants have their veins parallel or nearly parallel to the stem, and have no ramified venation. In regard to palms, they would require to be investigated in their native climes, before their special order could be discovered. Some plants of this class, the dictyogens of Lindley, to which belong the yams, have branches like our ordinary forest trees, and it is a curious circumstance and confirmatory of our theory, that the leaves of these plants have a reticulated structure.

So far as fungi, lichens, algæ, and the whole acotyledonous plants are concerned, it is evident that they present a repetition of parts homotypal in structure and form, and thus illustrate one general doctrine—that throughout the vegetable kingdom the parts are similar to one another, and in nice accordance with the whole.

Such facts as the above incline us to the belief that the fibrous veins of the leaf bear a morphological analogy to the stems of the tree. We are inclined to regard the root, the stem, and the leaf, as the three distinct members of the fully-developed plant, these three parts, however, being morphologically allied ; so that, to adopt the phraseology of Professor Owen, as applied to another subject, they may be call HOMOTYPES. The plant thus becomes a unity with innumerable interesting diversities.

The same general truth may be arrived at by a reverse process. Looking at the lowest plants in the scale, we at once perceive that they are made up of parts which are a repetition of each other. And we may remark, that not only is one part of the same structure as every other, but that when the parts are joined together, the parts that are joined are made to assume a set of forms, every one of which is the same as every other and as the whole. We see, for instance, that every internode of the horsetail is the same as every other, and that the topmost node is a type of the whole plant. We see that in the fern every leaflet is of the same shape as its branch, and that every branch is of the same shape as the whole plant. This, be it observed, is true not only of the structure of each part, but of the form which the compound structure assumes.

Rising upward let us now look at our common herbaceous plants. Some of them, such as the hollyhock, the crowfoot, the lady's mantle, send out a number of stems from near the root, and these plants send out about the same number of main veins or midribs from the base of the leaf. I examined a great many alchemillas and found the same number of stems from the root as of main ribs from the base of the leaf; the crowfoot sends out five stems or so from its root, and it has five main ribs in its leaf. Again, it may be observed how every branch with its leaves is of the same form as its leaf, and how the branch with its leafage and the leaf resemble the whole plant. The common wood anemone sends out three stems; at the top of each of these stems is a compound leaf, divided into three smaller leaves, and each of these smaller leaves has three main veins. Other plants, such as the common thistle and the rag-weed, send up one main stem from the root and have one main vein in the leaf. Observe, too, how in such plants every leaf with its ragged leaf is a type of the whole plant with its side leaves or branches. It may be observed, too, how in these plants last-named the lateral leaves and the lateral veins of leaves both come off at a pretty wide angle.

In such plants as these it will be acknowledged, I think, that the stems of the plant and the main veins of the leaf seem to follow the same laws, or rather that it is impossible to distinguish between them in some cases, and say what is the main vein and what is the stem. But we may mount higher and now examine our common trees, and inquire if the veins of their leaves do not follow the same law of direction as the lateral stems from the trunk and branches. No doubt we may expect here to find, owing to the more complicated structure of the plant and its greater exposure to external influences, that the phænomena will be more complicated, and all that we can expect to discover is a tendency on the part of the ramification of the branches to take the same form as the venation of the leaves. Let us take up a gooseberry leaf and examine it, and we shall find that at the top of a leaf-stalk there go off three very large veins with two other lesser veins from each of the outer of the three large veins, making in all seven veins from the base of the leaf, and we may notice how the gooseberry at the top of a short unbranched trunk sends off a large number of stems. We may now see, too, how the currant leaf at the top of a leaf-stalk sends off from its base three main veins (with two other less ones), and how some little distance above the ground the trunk commonly divides into three main branches.

I have already traced some points of analogy between the ramification of the branches and leaf-veins of our common trees. I have examined the mountain ash, and found that the angle of its leaf vein is 45°, and that the angle of ramification is also 45°. A dog-berry growing near was measured, and gave the angle both of ramification and venation as 64°. Here, then, are two trees differing in their angle by 20°, and in each case the angle of branch and vein corresponding. But in carrying out the principle, it is to be borne in mind that the full-grown tree is much more complicated than the young tree or the simple branch. In such cases I apprehend that the leaf represents exclusively the young tree or the branch. This is the case with the laburnum, where the individual leaf represents the branch, with veins going off at an angle of 60° or 70°. But the trefoil leaf will represent the whole tree, which tends to send off its main branches in threes.

I think it proper to add, that while strongly convinced that there is truth in this doctrine, I am at the same time prepared to believe that it may have to submit to modification, which may correct, but will not destroy, the general view.

XIX. *Notice of a new British* Viola. By Charles C. Babington, M.A., F.R.S.

Read 11th December 1851.

It gives me much pleasure to have to record the discovery of another violet to be added to the British flora, which I have recently obtained from my friend Mr. A. G. More of Trinity College, Cambridge. He gathered it in June 1851 on peaty ground in Garry Land Wood near Gort, co. Galway.

It is only recently that we have learned, from the writings of Fries and of Grenier, to distinguish the several species which, being apparently rare in Britain, may have been confounded under the name of *V. lactea* (Sm.); and more especially discovered the necessity of separating those of them which possess rhizomes from the non-rhizomatous species. Or possibly it would be more correct to say, that we did not know of the existence of any of the former as native plants. It is curious to observe that Fries (Summa Veg. Scand. p. 34) stated in the year 1846 as a well-ascertained fact, that the whole of his group of "*Pratenses* in Anglia desunt." At that recent date the remark was justly made, for not one species of this well-marked section of Violets had then been recorded from any British locality. In the third edition of my 'Manual' and also in the 'Botanical Gazette' (ii. 144 and 178), I have introduced *V. stagnina* as our only native representative of the group, but it had previously been noticed by Mr. H. C. Watson in his valuable 'Cybele Britannica' (iii. 179). The following is the species now to be added to that group:—

Viola stricta (Hornem.); *anther-spur* short broadly lancet-shaped *blunt* (about twice as long as broad), corolla-spur short blunt (green), *leaves cordate-ovate,* petioles winged at the top, *stipules oblong*-lanceolate leaflike incise-serrate ($\frac{1}{2}$-) shorter than the petioles "on the middle of the stem," primary and lateral stems flowering and elongated.

V. stricta var. humilis, *Fries Mant.* iii. 124.
V. stricta, *Gren. et Godr. Fl. Fran.* i. 180.
V. Ruppii, *Reichenb. Icon. Fl. Germ.* iii. t. 14. fig. min.

The habit is apparently very much like that of *V. stagnina.* Stems erect, in the rather young specimens before me they are 3 or 4 inches in height, slender, glabrous. Leaves shorter and broader than those of *V. stagnina,* and cordate at their base. Stipules, when well developed, large and broad, oblong or oblong-lanceolate, all (on our specimens) about half as long as the petioles, as they are stated to be upon the middle of the stem on the continental more fully grown plants, on the upper part of which they are described as being longer than the petioles. It is highly probable that if our specimens had been allowed to advance beyond the commencement of the flowering state in which they were gathered, they would have produced longer stipules and shorter petioles than those which they now exhibit, and so have quite agreed with the character given in foreign books. The flowers are stated by Fries to be "cœrulescentibus," by Grenier "blue violet;" on the dried specimens they are cream-coloured, but had a slight tinge of blue when fresh; this difference need not present any difficulty, as those of *V. stagnina* are pale blue when fresh but nearly white when dried: their spur is short, but manifestly longer than the appendages of the calyx, very blunt, and *nearly as green as the calyx.* This greenness of the spur is stated to be constant in this and one or two other species, but I have had no experience of it. The spurs of the anthers are decidedly blunt. The capsules I have not seen, but they are stated to be truncate-obtuse and without elevated nerves.

This species consists, as do most of its allies, of two forms, a larger and a smaller, between which there is often so much difference of appearance as at first sight to lead to the opinion that they are distinct specifically; but an examination of them shows that such is not the fact. Our present plant is the smaller form of what in its larger state is rather extensively distributed in Germany and France, and in its smaller is not very unfrequent in Scandinavia.

This plant is far more nearly allied to *V. stagnina* than to any of our other violets, but the green colour of the corolla-spur, the differently shaped leaves, and remarkably different stipules clearly distinguish it. The short corolla-spur, and also that of the anthers, would be quite a sufficient cause for separating it from *V. canina,* even if the presence of a rhizome (which however I have not had an opportunity of seeing) in *V. stricta* had not afforded so manifest a distinction between them. In *V. pratensis* (Koch), which is very nearly allied to our plant, the central stipules are longer than the petioles (not $\frac{1}{2}$ of their length), the limb of the leaves is markedly decurrent on to the petioles, and the spur of the corolla is not green.

In his invaluable 'Herbarium Normale' (iv. 44) Fries states that specimens of *V. lactea* from Smith himself are exactly *V. pratensis* which is there named by him *V. lactea* accordingly, but in his 'Mantissa tertia' (123) he corrects that error, which originated from his not having then learned to distinguish *V. lancifolia* (his *V. pumila*, not that of Villars, which is *V. pratensis*), my *V. canina β. lancifolia*, from *V. pratensis*.

In Hooker and Arnott's 'British Flora' (Addenda) I am stated to give the name of *V. stagnina* to the violet which they "and most others call *V. lactea*," but it seems to me that great difficulty exists in determining what "most" botanists really do call *V. lactea*. It is even difficult to tell what is the true plant of Hooker and Arnott, as in their text they seem to include under that name *V. lancifolia* and *V. stagnina*, but in their Addenda they state that their *V. lactea* is what I call *V. stagnina*, although many of the localities given for it manifestly are those of *V. lancifolia*. The *V. lactea* of British botanists is most frequently *V. lancifolia*, if specimens are to be trusted, and that is certainly the plant primarily intended by Smith. Continental authors do not show any such uniformity, for Smith's name has been applied to *V. pratensis* (*V. pumila*, Vill., not of Hook. and Arn., which is the true *V. canina*, Linn.), *V. stagnina*, and *V. lancifolia*.

P.S.—Since the above paper was printed in the 'Annals of Nat. Hist.' I have seen reason to suppose that too much dependence has been placed on the colour of the corolla-spur and the shape of the stipules, and to suspect that this Irish Violet may be only a state of *V. stagnina*. Mr. More has supplied me with Irish specimens of this supposed *V. stricta* having a very decided rhizome. They were gathered in Garry Land Wood on May 28, 1852, and were then in flower.

XX. *Descriptions of* Rubi. By CHARLES C. BABINGTON, M.A., F.R.S. &c.

READ 8TH JANUARY 1852.

IN the third edition of the 'Manual of British Botany' I have endeavoured to arrange and characterize the *Rubi* in a better manner than it was done in my former publications upon that perplexing genus, and as there are a few species which have not been brought under the notice of botanists in detailed descriptions, it seems desirable to publish such accounts of them.

1. *Rubus Leesii* (Bab.); caule suberecto tereti, aculeis setaceis rectis, *foliis 3-natis*, foliolis omnibus rotundato-ovatis subsessilibus imbricatis, *aculeis ramorum floriferorum* pedicellorumque paucis *setaceis basi bulbosis*, floribus axillaribus terminalibusque racemosis.

R. Idæus γ. Leesii, *Bab. Syn. Rubi*, 6.
R. Leesii, *Steele Handb.* 60; *Bab. Man.* ed. 3. 92.

Creeping very extensively. Stems erect, 2–3 feet high, clothed with short deflexed hairs and numerous very slender setaceous straight prickles with bulbous bases. Leaves all ternate; stipules subulate; petioles furrowed, with a few small prickles; leaflets similar, roundly ovate, dark green and rugose above, white and cottony beneath, midrib with few or no prickles, coarsely crenate-serrate-apiculate; lateral leaflets subsessile, overlapping the very shortly stalked terminal leaflet.

Flowering shoots short, clothed with hairs and prickles like those of the barren stem. Leaves mostly simple, cordate, slightly 3-lobed, very coarsely crenate-serrate-apiculate, green above, greenish white beneath; stipules very slender, subulate; petioles furrowed above; ternate leaves of three sessile obovate leaflets. Raceme lax, few-flowered, one or two of the lowest flowers axillary. Peduncles with very slightly curved subulate prickles. Sepals oblong, often more than five in number and then narrower, with long points, downy and whitish green on both sides. Petals spathulate, acute, white. Stamens and styles white.

It is worthy of remark, that in the Cambridge Botanic Garden the strong "canes" of *R. Leesii* nearly all produced a small panicle of flowers at their extremity in the month of October 1851, In one single instance a cane of *R. Idæus* did the same. Previously to that month, neither Mr. Stratton, the Curator of the garden, nor I, had ever noticed such an occurrence in the latter, and had not had the opportunity of doing so in the former. This is a curious illustration of the tendency of all *Rubi* to attempt to increase by some action at the end of the shoot of the year. In all the arching and prostrate species it is effected by the end of the shoot penetrating the surface of the ground and taking root; in these plants, the end of whose shoots never reaches the ground, the same is attempted to be effected by flowers. The mode in which the procumbent plants succeed in penetrating the earth may be worthy of notice, for the prostrate position of their shoots seems to present a difficulty. Although the shoot is really prostrate until the autumn, at that time its extremity forms a small arch and thus presents its point perpendicularly to the ground, which it easily penetrates.

The discovery of *R. Leesii* is due to Mr. Edwin Lees, whose practised eye at once saw its probable distinctness from *R. Idæus.* He noticed it in the woods at Ilford Bridges near Linton, in North Devon, in September 1843, but could find no flowers remaining at that late period of the year. In June 1849 the Rev. W. H. Coleman pointed it out to me growing upon a dry shingly bank at Bonniton near Dunster, Somerset, and flowering plentifully. These stations, separated from each other by the high ridge of Exmoor, are distant about fourteen miles in a direct line.

The specific character of *R. Idæus* will now stand as follows :

R. caule suberecto tereti pruinoso, aculeis setaceis rectis, foliis quinato-pinnatis ternatisve, foliolo terminali longe pedicellato *lateralibus dissitis, aculeis ramorum floriferorum* et pedunculorum multis *deflexis basi dilatato-compressis,* floribus axillaribus terminalibusque corymbosis.

2. *R. fissus,* Lindl.

R. fissus, *Lindl. Syn.* ed. 2. 92 ; *Leight. Fl. Shrop.* 225 ; *Bab. Man.* ed. 3. 93.
R. fastigiatus, *Lindl. Syn.* ed. 1. 91 ? not of *W. & N.* nor *Bab.*

A full description of this plant will be found in Leighton's 'Flora of Shropshire.' In the 'Phytologist' (iii. 72) he pointed out the character derived from the prickles on the barren stem by which it is well marked.

3. *R. latifolius* (Bab.) ; caule procumbente vel subarcuato anguloso sulcato, aculeis parvis subdeclinatis foliis quinatis utrinque pilosis grosse duplicato-dentatis, foliolo terminali cordato acuminato, infimis sessilibus imbricatis, paniculæ brevis foliosæ pilosæ ramis

ascendentibus paucifloris corymbosis apice pedicellisque tomentosis et hirtis, aculeis brevibus tenuibus declinatis.

R. latifolius, *Bab. Man.* ed. 3. 94.
R. Cramondiensis, *Bab. in lit.*

Stem usually quite prostrate, angular and furrowed throughout, nearly glabrous but with scattered subsessile glands, not stellately downy nor setose; prickles nearly all placed on the angles of the stem, rather few, moderately long, slender from a thick base, straight, declining, nearly equal. Leaves quinate, dull green and pilose above, paler and with more numerous hairs beneath, coarsely and irregularly doubly dentate; midrib and petioles yellowish beneath with a few small weak declining or slightly deflexed prickles; lower pair of leaflets broadly oblong, acute at both ends, sessile, overlapping the intermediate pair which are of similar shape but larger and shortly stalked; terminal leaflet with a stalk equalling one-third of its length, cordate-acuminate. Petioles furrowed above. Stipules leaflike, lanceolate-attenuate.

Flowering shoot long, surrounded at its base by short scales ashy with silky pubescence, angular, green, nearly glabrous; prickles few, short, weak, from an enlarged base, slender, declining, yellow tinged with purple. Leaves ternate, pilose on both sides but chiefly beneath; leaflets nearly equal, ovate, acute, deeply and doubly serrate, lower ones often strongly lobed on the outer edge below; petioles with very few slender declining prickles; midrib usually unarmed or with very minute prickles. Stipules linear-lanceolate. Panicle short, leafy below, pilose; the upper part and pedicels tomentose and pilose and with a few short sunken setæ or subsessile glands; prickles short, declining, slender, yellow; branches short, ascending, few-flowered, corymbose; bracts trifid with narrow lanceolate segments. Sepals ovate acuminate, woolly on both sides, whitish within, rather green and pilose externally, reflexed loosely from the fruit. Petals shortly ovate, clawed. Primordial fruit apparently hardly more than hemispherical. The flowers and fruit require more careful examination.

In the wood above Cramond Bridge on the Linlithgowshire side of the river; and in a wood just below the road from Kenmore to Acharn, Perthshire.

This bramble was noticed in my 'Synopsis of Rubi' (p. 10. Obs. 2) as a probable form of *R. Salteri*, but I have long been convinced that it is quite distinct from that species. It is a large straggling plant with strong but usually prostrate stems. The thin, singularly broad, and angular leaves, and the deeply furrowed stem would perhaps be in themselves sufficient to distinguish it from the other "Nitidi."

4. *R. imbricatus*, Hort.

Mr. Hort has published a full description of this plant (Ann. Nat. Hist. Ser. 2. vii. 374), and it is therefore unnecessary to notice it further in this place.

5. *R. mucronatus* (Blox.); *caule* arcuato *subtereti* patenti-piloso, *aculeis* paucis *parvis tenuibus* conicis basi dilatatis rectis subpatentibus, foliis 5-natis utrinque viridibus rugosis et pilosis *argute dentato-serratis, foliolo terminali* late obovato *abrupte cuspidato* basi cordato, paniculæ angustæ foliosæ laxæ pilosæ tomentosæ setosæ ramis longis 1–3-floris et aculeis paucis tenuibus declinatis, sepalis longe cuspidatis hirtis tomentosis setosis a fructu laxe reflexis.

R. mucronatus, *Blox. in Kirby's Fl. Leicest.* 43; *Bab. Man.* ed. 3. 97.
R. sylvaticus, *Bab. Syn. Rub.* 16 (excl. var. β).
R. vulgaris (in part), *Leight. Fl. Shrop.* 231.

Stem arched, nearly round, slightly angular with flat sides towards the end, densely hairy near the base but less so towards the end; hairs patent, not clustered; aciculi and setæ few or none; subsessile glands few; prickles chiefly on the angles of the stem, few, usually small, slender, conical from an enlarged base, patent or very slightly declining. Leaves quinate, rather thick, green rough and pilose on both sides, hairs more numerous on the under side, finely dentate-serrate; petiole midrib and primary veins yellow or reddish beneath, with a few small deflexed prickles; lower pair of leaflets shortly stalked, obovate-oblong, cuspidate; intermediate pair larger, stalked, obovate, abruptly cuspidate; terminal leaflet with a rather long stalk, broadly obovate with a cordate base, abruptly cuspidate. Stipules linear-lanceolate.

Flowering shoot long, with long fuscous scales at its base, slightly angular, green but tinged with purple, hairy; prickles few, generally very small and short, yellow, sometimes long, straight and declining but slender, their base enlarged and compressed. Leaves ternate or quinate, nearly equally hairy on both sides, rather paler beneath; leaflets of the ternate leaves nearly equal, oblong or obovate, finely serrate, lower pair often lobed externally; on the quinate leaves the lower pair of leaflets is small and oblong, intermediate pair and terminal leaflet broadly obovate and cuspidate. Petioles and midribs with few slender declining prickles. Stipules linear-lanceolate. Panicle narrow, very lax, leafy except at the top, hairy and tomentose, often with many setæ and aciculi; branches mostly axillary, ascending, shorter than the leaves, bearing a corymb of 1–3 long-stalked flowers; summit corymbose; terminal flower shortly stalked. Sepals ovate with a long subulate or linear point, hairy tomentose setose and greenish with a narrow margin of white tomentum externally, whitely tomentose but purple at the base within, loosely reflexed from the fruit. Petals oblong, narrowed at both ends but especially below. Primordial fruit small, hemispherical.

In woods and hedges. Twycross, Leicestershire; and Hartshill Wood, Warwickshire, *Rev. A. Bloxam.* Shawbury Heath, Salop, *Rev. W. A. Leighton.* Islay and Loch Eil in Scotland.

This plant has long been confused with *R. villicaulis*, and was included with it and *R. calvatus* under the name of *R. sylvaticus* in my 'Synopsis.' It is believed that the characters given above will always distinguish it from them. In the shape of its leaves and its very loose panicle with singularly long-stalked flowers, it closely resembles *R. Lingua*, as represented in the 'Rubi Germanici,' but the armature of its stem is very different.

6. *R. calvatus* (Blox.); *caule* arcuato anguloso *sulcato* patenti-piloso, aculeis crebris tenuibus compressis basi paululum dilatatis rectis subpatentibus, foliis 5-natis tenuibus utrinque viridibus in venis subtus pilosis grosse dentato-serratis, foliolo terminali ovato-acuminato basi cordato, paniculæ longæ foliosæ laxæ hirtæ brevi-setosæ ramis subracemosis et aculeis crebris longis tenuibus declinatis, sepalis longe cuspidatis hirtis tomentosis setosis a fructu laxe reflexis.

R. calvatus, *Blox. in Kirby's Fl. Leicestr.* 42; *Bab. Man.* ed. 3. 97.
R. sylvaticus, *Blox. MS.*

Stem arched, angular, furrowed, very slightly hairy, of a bright shining red when exposed, ultimately becoming quite glabrous; hairs patent, not clustered; aciculi and setæ very few; subsessile glands rather numerous; prickles less strictly confined to the angles of the stem than in its allies, many, slender, compressed, slightly enlarged at the base, very slightly declining. Leaves quinate, thin, green on both sides, glabrous above, shortly pilose on the veins and rough beneath, coarsely and doubly dentate or dentate-serrate; petiole and midrib coloured like the stem, with rather many long slender large-based declining or deflexed prickles; midrib with smaller prickles; lower pair of leaflets stalked, oblong, acute; intermediate pair stalked, obovate, subcuspidate, a little cordate at the base; terminal leaflet with a rather long stalk roundly oblong or slightly obovate, subcuspidate, cordate at the base. Stipules linear-lanceolate.

Flowering shoot long, rather angular, green, hairy; prickles many, rather long and slender, lengthening gradually from the base of the shoot to the panicle, purplish yellow, declining, their base enlarged and compressed. Leaves ternate or quinate, a little pilose above, scarcely paler but much more pilose beneath, doubly dentate; lower leaflets oval cuspidate, shortly stalked;

intermediate and terminal leaflets obovate cuspidate; on the ternate leaves the leaflets are nearly equal, broader and rounder, the lower pair being lobed on the external edge below. Petioles and midribs with many strong compressed but often rather small hooked prickles. Stipules linear-lanceolate. Panicle long, leafy often quite to the top, lax, hairy, scarcely tomentose, with very short setæ hidden amongst the hairs; rachis wavy (*i. e.* forming an angle at the origin of each leaf); branches mostly axillary, ascending, shorter than their leaves, racemose-corymbose; terminal flower of the panicle nearly sessile, the others shortly stalked. Sepals oblong, with a long narrow leaflike point, greenish, hairy, tomentose, setose, with a few aciculi, whiter within, loosely reflexed from the fruit. Petals oblong, clawed. I have not seen the fresh fruit which seems to be small.

Woods and hedges. Near Twycross on the Appleby road; near Ashby de la Zouch; and between Loughborough and Wymesmold; all in Leicestershire, *Rev. A. Bloxam.* Almond Park near Shrewsbury, *Rev. W. A. Leighton.*

This species was long considered by Mr. Bloxam as the true *R. sylvaticus* (W. & N.), but the plant of those authors seems probably to be a state of *R. villicaulis.* He has therefore given a new name to this species, derived from its barren stem becoming as it were bald at an early period. It does not much resemble *R. villicaulis* either in appearance or characters, and its true position in the genus is perhaps still to be decided.

XXI. *On the Growth of various kinds of Mould in Syrup.* By J. H. Balfour, M.D., F.R.S.E.. F.L.S., Prof. Bot. Edinburgh.

Read 8th January 1852.

Much interest has been recently excited by statements relative to the Vinegar Plant, as it has been called. This plant, which has a tough-gelatinous consistence, when put into a mixture of treacle, sugar and water, gives rise to a sort of fermentation by which vinegar is produced. After six or eight weeks the original plant can be divided into two layers, each of which acts as an independent plant, and when placed in syrup continues to produce vinegar, and to divide at certain periods of growth. The vinegar thus produced is always more or less of a syrupy nature, and when evaporated to dryness, a large quantity of saccharine matter is left. Various conjectures have been hazarded as to the origin of the so-called vinegar-plant, some stating that it came from South America or other distant regions, and others that it is a spontaneous production. Lindley states that it is a peculiar form of *Penicillium glaucum*, or common blue mould. There seems to be no doubt that it is an anomalous state of mould or of some fungus, and the peculiarity of form and consistence appears to be owing to the material in which it grows. In place of producing the usual cellular sporiferous stalks, the mycelium increases to an extraordinary extent; its cellular threads interlacing together in a remarkable manner and producing one expanded cellular mass, with occasionally rounded bodies like spores in its substance. The cellular filaments may be seen under the microscope. The tendency to divide in a merismatic manner is common in many of the lower classes of plants, and this seems to be what occurs at a certain period of growth, when the plant divides into two horizontal plates. If the plant is allowed to continue growing, it forms numerous plates one above the other. The anomalous forms of fungi in certain circumstances have lately excited much interest, and Mr. Berkeley has called attention to some of the remarkable transformations which they undergo. These are such, that many forms considered as separate genera are now looked upon as mere varieties of one species.

That mould of various kinds when placed in syrup shows the same tendency to form a flat gelatinous or somewhat leathery expansion is shown by the following experiments.

Some mould that had grown on an apple was put into syrup on the 5th of March, 1851, and in the course of two months, there was a cellular flat expanded mass formed, while the syrup was converted into vinegar. Some of the original mould was seen on the surface in its usual form.

Some mould from a pear was treated in a similar way with the same result; also various moulds growing on bread, tea, and other vegetable substances; the effect in most cases being to cause a fermentation, which resulted in the production of vinegar.

In another experiment on the 8th of November, 1850, a quantity of raw sugar, treacle, and water were put into a jar without any plant being introduced, and they were left untouched till March 5, 1851. When examined, a growth like that of the vinegar plant was visible and vinegar was formed. The plant was removed and put into fresh syrup, and again the production of vinegar took place.

It would appear from experiment, that when purified, white sugar alone is used to form syrup, the plant when placed in it does not produce vinegar so readily, the length of time required for the changes varying from four to six months. There may possibly be something in the raw sugar and treacle which tends to promote the acetous change.

XXII. *On the Uses of* Stillingia sebifera, *the Tallow Tree of China, being the substance of a Communication made to the Agricultural and Horticultural Society of India.* By D. J. Macgowan, M.D. Communicated by Dr. Coldstream.

Read 12th February 1852.

The botanical characters of this Euphorbiaceous plant are too well known to require description, but hitherto no accurate account has been published of its varied uses, and although it has become a common tree in some parts of India and America, its value is appreciated only in China, where alone its products are properly elaborated. Dr. Macgowan remarks :—

"The *Stillingia sebifera* is prized for the fatty matter which it yields; its leaves are employed as a black dye; its wood, being hard and durable, is used for printing blocks and various other articles; and finally, the refuse of the nut is employed as fuel and manure.

"It is chiefly cultivated in the provinces of Kiangsi, Kougnain, and Chehkiang. In some districts near Hangchan, the inhabitants defray all their taxes with its produce. It grows alike on low alluvial plains and on granite hills, on the rich mould at the margin of canals, and on the sandy sea-beach. The sandy estuary of Hangchan yields little else. Some of the trees at this place are known to be several hundred years old, and though prostrated, still send forth branches and bear fruit.

"In mid-winter when the seed-vessels are ripe, they are cut off with their twigs by a sharp knife, attached to the extremity of a long pole, which is held in the hand and pushed upwards against the twigs, removing at the same time such as are fruitless. The capsules are gently pounded in a mortar to loosen the seeds from their shells, from which they are separated by sifting. To facilitate the separation of the white sebaceous matter enveloping the seeds, they are steamed in tubs, having convex open wicker bottoms, placed over caldrons of boiling water. When thoroughly heated, they are reduced to a mash in the mortar, and thence transferred to bamboo sieves, kept at a uniform temperature over hot ashes. A single operation does not suffice to deprive them of all their tallow; the steaming and sifting is therefore repeated. The article thus procured becomes a solid mass on falling through the sieve, and to purify it, it is melted and formed into cakes for the press; these receive their form from bamboo hoops, a foot in diameter and three inches deep, which are laid on the ground over a little straw. On being filled with the hot liquid, the ends of the straw beneath are drawn up and spread over the top, and when of sufficient consistence, are placed with their rings in the press. This apparatus, which is of the rudest description, is constructed of two large beams placed horizontally, so as to form a trough capable of containing about fifty of the rings with their sebaceous cakes; at one end it is closed, and at the other adapted for receiving wedges, which are successively driven into it by ponderous sledge-hammers wielded by athletic men. The tallow oozes in a melted state into a receptacle below, where it cools. It is again melted and poured into tubs, smeared with mud to prevent its adhering. It is now marketable, in masses of about eighty pounds each, hard, brittle, white, opake, tasteless, and without the odour of animal tallow: under high pressure it scarcely stains bibulous paper: melts at 140° Fahr. It may be regarded as nearly pure stearine; the slight difference is doubtless owing to the admixture of oil expressed from the seed in the process just described. The seeds yield about eight per cent. of tallow, which sells for about five cents per pound.

"The process for pressing the oil, which is carried on at the same time, remains to be noticed; it is contained in the kernel of the nut, the sebaceous matter, which lies between the shell and the husk, having been removed in the manner described. The kernel and the husk covering it are ground between two stones, which are heated to prevent clogging from the sebaceous matter still adhering. The mass is then placed in a winnowing machine, precisely like those in use in Western countries. The chaff being separated, exposes the white oleaginous kernels, which, after being steamed, are placed in a mill to be mashed. This machine is formed of a circular stone groove, twelve feet in diameter, three inches deep, and about as many wide, into which a thick solid stone wheel, eight feet in diameter, tapering at the edge, is made to revolve perpendicularly by an ox harnessed to the outer end of its axle, the inner turning on a pivot in the centre of the machine. Under this ponderous weight, the seeds are reduced to a mealy state, steamed in the tubs, formed into cakes, and pressed by wedges in the manner above described; the process of mashing, steaming, and pressing being repeated with the kernels likewise. The kernels yield above thirty per cent. of oil. It is called Ising-yu, sells for about three cents per pound, and answers well for lamps, though inferior for this purpose to some other vegetable oils in use. It is also employed for various purposes in the arts, and has a place in the Chinese Pharmacopœia, because of its quality of changing gray hair black, and other imaginary virtues.

"Artificial illumination in China is generally procured by vegetable oils, but candles are also employed by those who can afford it. In religious ceremonies no other material is used. As no one ventures out after dark without a lantern, and as the gods cannot be acceptably worshiped without candles, the quantity consumed is very great. With an unimportant exception, the candles are always made of what I beg to designate as vegetable stearine. When the candles, which are made by dipping, are of the required diameter, they receive a final dip into a mixture of the same material and insect-wax, by which their consistency is preserved in the hottest weather. They are generally coloured red, which is done by throwing a minute quantity of alkanet root (*Anchusa tinctoria*), brought from Shantung, into the mixture. Verdigris is sometimes employed to dye them green."

XXIII. *On a supposed new species of* Eleocharis. By Charles C. Babington, M.A., F.R.S. &c.

Read 10th June 1852.

My attention has been recently directed by Mr. H. C. Watson to the British species of *Eleocharis*, and, having been led to concur with him in the idea that there is an undescribed plant belonging to that genus which inhabits the western coast of Scotland, I purpose pointing out in this paper the respects in which it differs from our known species included in the genus, and adding a few remarks upon them.

In the autumn of the year 1844, I had the pleasure of accompanying Professor Balfour of Edinburgh in a tour through the district of Cantyre in Argyleshire. At Tayanloan, on the western coast of that peninsula, he gathered two or three specimens of the plant upon which this paper is founded, but did not observe its difference from *Scirpus pauciflorus*, in company with which it was growing, owing to the similarity of their outward appearance. Doubtless plenty of it might have been obtained if it had been looked for.

To Mr. Watson we are indebted for the knowledge of this new species, as he received two small specimens from Dr. Balfour, and forwarded the fruit of one of them to me, with a request that I would endeavour to ascertain its identity with any known species. Through the liberality of Dr. Balfour I have had an opportunity of examining all the plants belonging to this group which are contained in his herbarium, but have only succeeded in finding one additional specimen of the Tayanloan plant; for the permission to retain a portion of it I am much indebted to him.

The similarity in outward appearance of the species included in the groups named *Eleocharis* and *Bæothryon* renders it necessary to pay close attention to the structure and form of their several parts: thus the form of the mouth of the sheaths which surround the base of the stem, the form of the nut, that of the base of the style and of the outer glume, and the length of the hypogynous bristles, have been carefully examined, and found to afford distinctive characters when the more conspicuous organs do not present any describable or constant differences.

I propose the following as a provisional name and character for the plant, as I have totally failed in finding any described species to which it can be referred. The name is given in commemoration of the gentleman to whose acuteness of observation we owe its discovery, and who deserves so well of botanists from his researches concerning the geographical distribution of plants.

Eleocharis Watsoni; spicis terminalibus solitariis oblongis, glumis acutis (?) infima obtusiuscula basin spicæ circumcingente, stylo bifido, *achenio* utrinque convexo *oblongo* obtusissimo basi paululum attenuato angulis rotundatis tenuissime *punctato-striato*, basi styli persistente late depresso, *setis hypogynis* 4–6 *achenio brevioribus*, culmis basi vaginatis, vagina abrupte truncata.

Radix ignota. Squamæ radicales latæ, obtusæ, rubescentes. Culmi 3–4 unciales, tenuissime striati, erecti, nudi, tenues, basi vagina viridi inferne rufescente superne fusco-marginata circumdati. Setæ hypogynæ breves, retrorsum hispidæ, achenio dimidio breviores.

Hab. in palustribus maritimis prope "Tayanloan" in com. "Argyle" Scotiæ.

It might be allowable to stop here, but I think it desirable to add a few remarks concerning the differences between this and the allied plants.

1. The lowest glume is larger than the others, and surrounds the base of the spike in *E. uniglumis, E. Watsoni* and *E. multicaulis,* but does not do so, and is not larger than the others in *E. palustris.*

2. The stigmas are two in all except *E. multicaulis,* which possesses three. They have not been seen in *E. Watsoni,* but the lenticular nut renders it nearly certain that they are two in number.

3. The nut is more or less compressed, but variable in shape, in all except *E. multicaulis,* in which it is acutely triangular and topshaped. In *E. palustris* it is roundish, with or without a slight narrowing or stalklike point at the base. In *E. uniglumis* it is pearshaped. In *E. Watsoni* it is oblong, but a little narrowed at the base. In all of them it is smooth, with the exception of *E. Watsoni,* where its surface is closely punctate-striate throughout.

4. The nut is shorter than the hypogynous bristles in *E. palustris* and *E. uniglumis*; equals them in *E. multicaulis*; and exceeds them in *E. Watsoni.*

5. The sheath surrounding the base of the stem is transversely truncate, but having a very obtuse point on one side in all except *E. multicaulis,* where the point is acute.

It is thus seen that there are very considerable differences between the several plants under consideration, and it is with them alone that *E. Watsoni* is likely to be confounded, since its generic character separates it from the group *Bæothryon*. The other European species of *Eleocharis* are *E. ovata* and *E. atropurpurea*, which form the genus *Eleogenus* of Esenbeck, where the glumes are all equally large and more densely imbricated than in the typical group of species; and *E. carniolica* and *E. acicularis* (to which our plant shows some resemblance in its short bristles), which constitute the genus *Scirpidium* of Esenbeck, where the bristles are deciduous, not persistent, as in *E. Watsoni*. The *Scirpidia* also are trigynous, and their nuts are obovate, much narrowed below and trigonous; *E. acicularis* has a ribbed and transversely striated nut, and *E. carniolica*, which closely resembles it in appearance, has short subulate leaves terminating the sheaths.

It does not seem desirable to extend this paper by discussing the distinctions between *E. Watsoni* and the North American species of *Eleocharis*; let it suffice to state that every endeavour has been made to ascertain if our plant could be identified with any of them, but that none such has been found.

It is earnestly hoped that Scottish botanists will not long allow this curious plant to continue in the dubious position of a species, founded upon so small a number of specimens as hardly to justify its separation from its allies; indeed, could it with any probability have been considered as a state of any one of them, this dissertation would not have been written.

XXIV. *On the presence of Iodine in various Plants, with some remarks on its General Distribution.* By Mr. Stevenson Macadam.

Read 8th July 1852.

The present paper owes its origin to some observations lately made by M. Chatin of Paris, and communicated by him to the French Academy of Sciences.

Chatin is of opinion, that in the atmosphere, in rain-water, and in soils there is an appreciable amount of iodine; that the quantity of this element present in one district differs from that in another; and that the relative amount of iodine in any one locality determines to a great extent the presence or absence of certain diseases. For instance, in the district of country which he classifies under the general title of the "Paris zone," the quantity of iodine present in the atmosphere, in the rain-water, and in the soil is comparatively great, and to this he ascribes the absence of goitre and cretinism; whereas in the zone corresponding to that of the "alpine valleys," the amount of iodine has diminished to one-tenth of that found in the "Paris zone," and to this scarcity of the element he attributes the prevalence of goitre and cretinism, which in that zone are endemic. Considering that the subject was one of great importance, more especially if the conclusions arrived at by Chatin (in reference to the functions fulfilled by iodine in preventing the occurrence of the diseases referred to) could be legitimately deduced from the experiments which he performed, the author has this summer undertaken a series of analyses in reference to the general distribution of iodine. Mr. Macadam's researches have as yet been mostly directed to the atmosphere and to rain-water, and he considered that a notice of the results obtained might be interesting to the Society, alike from the intimate connexion which exists between the plant and the atmosphere, and from the fact, that he has been led to seek, and to detect, the presence of iodine in a department of the vegetable kingdom in which it has not hitherto been observed.

Chatin has not published a detailed account of the processes adopted by him; but from the manner in which he speaks of the good effects produced by the addition of potash to substances under examination, which, to use his words, "arrested the complete decomposition of the iodine compounds whilst the waters were evaporating," and by the addition of carbonate of potash and carbonate of soda, which "rendered the iodine present in soils much more easily extracted," the author was led to believe that the fixed alkalies had been largely employed by him. Accordingly, in the first experiments, the alkalies were used in their caustic condition, for the purpose of fixing any free iodine, and retaining any compound of iodine which might be encountered.

Mr. Macadam commenced with an examination of the atmosphere. By the arrangement he employed, the air was made to traverse,—1st, a tube containing slips of paper, which had been previously dipped in a solution of starch; and 2nd, a double-necked gas bottle, containing about 3 oz. of a dilute solution of caustic soda. A continuous stream of air was drawn through the arrangement for some hours. This experiment was conducted in the morning, and in the afternoon a stream of air was for several hours drawn through the same arrangement, caustic potash being substituted for the caustic soda. The starch-papers did not exhibit the slightest coloration, even when moistened with distilled water. The solutions of potash and soda, however, on being treated with starch and nitric acid, at once exhibited the rose colour characteristic of the presence of iodine in small quantity. So far the experiments seemed to lead to the desired conclusion; but when portions of the original alkaline solutions, which had not been subjected to a current of air, were carefully tested, it was found that iodine was present in them, in quantity to all appearance as great as it was in those portions which had been used in the experiments.

Wishing to trace back the iodine to its source, samples of the carbonate of potash, carbonate of soda and lime, which had been employed in the preparation of the caustic solutions, were analysed, and in all three iodine was present in perceptible quantity. Desirous of making certain that the reagents used in the investigations were as pure as other commercial substances of the same kind, various specimens were procured from different sources, and in every sample which was subjected to examination the presence of iodine was detected. So far then as the determination of iodine in the atmosphere is concerned, the experiments were of no value. The alkalies through which the air had been drawn undoubtedly contained iodine originally, and therefore no certain conclusion could be drawn as to the probability of their being more highly iodized by contact with the atmosphere. To the presence of iodine in *potashes*, or, to use words more strictly botanical, in the *ashes of forest timber*, further reference will be made in a subsequent part of this paper.

In the next experiment the alkalies were dispensed with, the air being drawn through—

1. A tube with slips of starched paper, kept somewhat damp.
2. A gas-bottle immersed in a freezing mixture; and
3. A gas-bottle containing a solution of nitrate of silver.

A continuous current was kept up for fully five hours, commencing at mid-day. At the conclusion of this experiment, the papers were not altered in the slightest degree; the gas-bottle (2) contained about a quarter of an ounce of liquid, and the nitrate of silver (3) had not been perceptibly changed. The condensed liquid was neutral to test-papers; a drop of starch was added to it, and subsequently nitrite of potash and hydrochloric acid, which together form a most delicate means of detecting iodine; the result was negative. The nitrate of silver solution was cautiously evaporated to one half-ounce; sulphuretted hydrogen added to precipitate the silver, and liberate as hydriodic acid any iodine which might be present; the liquid raised in temperature, carefully avoiding ebullition, and filtered. The filtrate, on the addition of starch, nitrite of potash and hydrochloric acid, did not exhibit the slightest trace of iodine. Mr. Macadam therefore concluded, that in the large volume of air which he had drawn through the arrangement, there had not been an appreciable amount of iodine.

The experiments as yet referred to were made at different heights on Arthur's Seat, and their negative results led to arrangements being made for a trial on a scale much more extensive. Through the kindness of the proprietor of Kinneil Iron Works, the author was enabled to proceed to Borrowstowness, and attach his apparatus to the receiver from which the air under great pressure is forced into the blast-furnaces. By means of a stop-cock fixed in the receiver and a long flexible tube, the air was conducted to the following arrangement:—

1. A wide tube containing slips of paper dipped in starch.
2. A condensing worm, surrounded by a freezing mixture and attached to a receiver.
3. A tall jar containing chips of pumice-stone and a few iron filings, with sufficient water to cover them.
4. A similar jar with pumice-stone, scrapings of clean lead and a solution of acetate of lead.
5. A condensing worm immersed in a freezing mixture and attached to a receiver.

The air, under a pressure of 3 lbs. on the square inch, was allowed to traverse the arrangement for fully four hours, when the apparatus was taken asunder, and the contents of the vessels being placed in stoppered bottles, the whole was brought to Edinburgh for examination. The slips of paper (1) were not sensibly altered in tint, and did not betray the slightest indications of even a rose colour when moistened with distilled water. The condensers (2 and 5) contained each a very small quantity of liquid, which, on being tested, did not show a trace of iodine. The small quantity of liquid in the condensers may be accounted for by the comparatively high temperature possessed by the air rushing through so quickly as it did. The contents of the jar (3) were thrown on a filter, and washed with cold water. To the filtrate was added half an ounce of a solution of carbonate of potash, and the whole evaporated to a quarter of an ounce; no iodine was present. The carbonate of potash used in this trial was prepared by calcining cream of tartar, and was so far free from iodine, that none could be detected in 2 oz. of the solution, of which half an ounce was employed. There was therefore no likelihood of iodine being added in the alkali used, even though the analysis of the contents of the jar had shown its presence. The jar (4) with the lead solution was treated in the same manner as described in a former part of this paper, when referring to the employment of silver, and the result was also negative. Notwithstanding the large scale on which this experiment was conducted, a volume of air of not less than 4000 cubic feet having been forced through the arrangement, Mr. Macadam has been unable to verify the results of Chatin, yet he feels disinclined to pronounce those results unwarranted, and has therefore resolved to make another trial on a still larger scale. It is proposed to fit up an apparatus of a stronger and more durable nature, and to allow a volume of air of not less than 100,000 cubic feet to pass through.

Whilst the experiments on the atmosphere were proceeding, Mr. Macadam was also examining large quantities of the rain-water which fell in Edinburgh for the last two months. For this purpose, he added to 3 gallons of the water some ounces of a solution of acetate of lead. On standing twenty-four hours, a precipitate had fallen to the bottom, from which the liquid was drawn off. The precipitate was treated as formerly described, and no iodine was detected. As the iodide of lead is slightly soluble in water, and as it might be present in the liquid which had been removed from the precipitate, the whole was evaporated to 1 oz., and afterwards tested for iodine, but none was present. A second experiment was tried with a similar volume of rain-water, viz. 3 gallons, substituting nitrate of silver for the acetate of lead; a precipitate was observed after standing for twenty-four hours, but neither it nor the liquid contained a trace of iodine. Another experiment, made with 3 gallons of rain-water, which had been collected at Unst in the Shetlands, and to which acetate of lead was added, gave the same negative results.

Mr. Macadam is well aware, that, consequent on the evaporation of water from the surface of the ocean, portions of the salts contained in it are carried up and disseminated through the atmosphere, ready to be rained down upon inland places, and that in this way iodine, most probably as iodide of sodium, will be present in the air. Accordingly at first he was confident that he should succeed in verifying Chatin's observations in a district so near the sea as that around Edinburgh, and more especially in the water obtained from Unst, which had fallen in the immediate vicinity of the ocean; but when we consider what a very small per-centage of iodine is present in the water of the ocean, many gallons being required to give even a faint indication, equal to that exhibited by $\frac{1}{500,000}$th of a grain of an alkaline iodide, and if, further, we suppose that when the water rises in vapour from the sea, it carries up the salts in the same proportions as they exist in sea-water, it is evident that it would be requisite to evaporate some hundred gallons of rain-water, before even a minute trace of iodine could be obtained.

At a former part of this paper reference was made to the presence of iodine in the potashes of commerce. The samples first tested were those usually to be purchased in Edinburgh, but subsequently genuine and authenticated specimens of both crude and refined potashes were procured from Glasgow. It is to Canada and the United States that we owe our supplies of these materials. As imported into this country, they are contaminated with many foreign ingredients, and amongst the rest the author has detected iodine. The most ready means for separating and recognising this substance is to heat a considerable quantity of the salt with a minimum of water. On cooling the solution, the greater portion of the carbonate of potash, as well as the impurities, falls to the bottom of the vessel, whilst the iodide of potassium remains dissolved in the water. When testing for the iodine in the potashes, this solution was evaporated to dryness, treated with alcohol, boiled and filtered. The filtrate, on being evaporated to dryness, left a residue, which on resolution in water acted distinctly with the starch-test for iodine.

The presence of this element in potashes leads the author to believe that iodine will be found more generally distributed in the vegetable kingdom than it has formerly been supposed to be. The potashes from the States and from Canada are principally the dried lixivium of the ashes of forest-trees; but whilst by much the greater portion is so, the parties in charge are not very scrupulous about what plants they employ, and occasionally everything which comes in the way, and which will burn, is added to the pile. It may therefore be objected to the statement, that forest-trees contain iodine, that the iodine found in the ashes may be derived from the succulent herbs and shrubs, and not from the trees themselves; but this objection will be at once removed when it is stated, that in the lixivium of charcoal the author has obtained very distinct traces of iodine. Now the charcoal sold and used in this country is principally oak, with a little birch, elm and ash.

The amount of iodine in forest-trees must be comparatively small. When experimenting with the potashes, one is apt to forget the small bulk into which a large quantity of timber falls when the organic matter is expelled, and the saline ingredients are alone left. So far as can be estimated from the present qualitative experiments, the relative quantity of iodine in forest-trees is much less than that in succulent plants growing in marshy places.

In conclusion, it was mentioned that the presence of iodine in some freshwater plants was now generally recognised, and that the author is at present engaged in testing the various plants growing in the lochs in the neighbourhood of Edinburgh. The method employed in their analysis is to dry the plants, and burn them cautiously; indeed the *burning* should be rather termed *charring*; the ashes are reduced to fine powder, digested in water and filtered; the clear liquid evaporated, and subsequently treated like the potashes. In every case the process used for the liberation of iodine is that suggested by Dr. Price, viz. nitrite of potash and hydrochloric acid; and in many cases where no indications of iodine could be obtained by the ordinary methods, good results were procured with Dr. Price's process.

In the following plants, hitherto not known to contain iodine, Mr. Macadam has detected that element:—

Myosotis palustris	Duddingstone Loch.
Mentha sativa	Ditto.
Menyanthes trifoliata	Ditto.
Equisetum limosum	Ditto.
Ranunculus aquatilis	Dunsappie Loch.
Potamogeton densus	Ditto.
Chara vulgaris	Ditto.

The author has also confirmed the presence of iodine in the following plants, in which it had been previously found by other observers ; the specimens, however, are from different localities :—

Iris pseud-acorus .... Duddingstone.
Phragmites communis .... Ditto.
And in the ashes of coal.

As having some connexion with the subject treated of, the author intimated that he had obtained distinct indications of the presence of bromine in the crude potashes. It is unfortunate that our tests for bromine are so much inferior in delicacy to those of iodine, that it is necessary to operate upon very large quantities before the tests are distinct. There is no doubt that from its presence in trees, it will be found in greater abundance in the more succulent plants ; but the few trials yet made have been unsuccessful in determining its presence in any but the crude Canadian and American potashes.

The experiments (excepting those pursued in the open air) were conducted in the laboratory of Dr. George Wilson, to whom the author feels deeply indebted for the kind manner in which he has afforded him every assistance in his power during the whole course of the investigation.

XXV. *On the presence of Fluorine in the Stems of Gramineæ, Equisetaceæ, and other Plants, with some Observations on the sources from which Vegetables derive this element.* By George Wilson, M.D.

Read 8th July 1852.

The author commenced by stating, that the earliest observer of the presence of fluorine in plants was Will of Giessen, who found traces of it in barley, the straw and grain of which were analysed together. The author reported to the Botanical Society, some four years ago, the results of his earlier researches into the distribution of this element throughout the vegetable kingdom, which were not very numerous or very encouraging. One reason of this was the small extent to which fluorine occurs in plants; another, and practically as serious a reason, was the difficulty of separating and recognising fluorine when accompanied by silica. The presence of this body in a plant, besides greatly complicating the investigation, rendered the employment of platina vessels essential, and thus limited the amount of material which could be subjected to examination, besides making it difficult or impossible to observe the progress of an analysis.

The author then stated, that, in the course of some recent investigations into the presence of fluorine in siliceous rocks, he had succeeded in devising a process which was also applicable to plants, and could be carried on in the ordinary glass vessels of the laboratory. The process in the case of plants was as follows:—The plant under examination was burned to ashes as completely as possible. The ashes were then mixed in the cold with oil of vitriol, so as to secure the decomposition of the salts of volatile acids present. The mixture was then transferred to a retort, or flask, provided with a bent tube dipping into water, and the liquid raised to the boiling-point, when fluorine, if present, was evolved in combination with the silicon of the silica, as the gaseous fluoride of silicon, which dissolved in the water with separation of some gelatinous silica. The resulting solution was neutralized with ammonia and evaporated to complete dryness, when the whole of the silicon passed into the condition of insoluble silica, and water dissolved the fluoride of ammonium. The solution of this fluoride could then be dried up and moistened with sulphuric acid, when hydrofluoric acid was evolved, which might be made permanently to record its presence by causing it to etch glass in the usual way. The author has in the meanwhile applied this process almost solely to the stems and trunks of plants, especially to those containing silica, reserving for subsequent investigation their other organs, especially their seeds and fruits. The following were the results obtained:—

Table of Plants examined for Fluorine. The numbers represent grains of ashes, except in the case of Tabasheer and Wood Opal. The blanks imply that the weight was not known:—

Ashes in grains.	Name of plant.	
200	*Equisetum limosum*	Distinct etching.
	Bambusa arundinacea	Ditto.
	Charcoal (derived chiefly from Oak, and to a smaller extent from Birch)	Ditto.
	Coal	Ditto.
	Barley straw	Ditto.
	Hay (Ryegrass)	Ditto.
35	*Equisetum variegatum*	Faint etching.
19	——— *hyemale*	Ditto.
255	——— *palustre*	Ditto.
	Dactylis cæspitosa	Ditto.
99	*Elymus arenarius*	Ditto.
495	*Saccharum officinarum*	Ditto.
1040	African Teak	Ditto.
	Smilax latifolia	No etching.
	Rosmarinus officinalis	Ditto.
235	*Bambusa Nepalensis*	Ditto.
	Polypodium vulgare	Ditto.
537	Tree Fern	Ditto.
24	*Phalaris arundinacea*	Ditto.
240	Malacca Cane	Ditto.
50	Cocoa-nut shell	Ditto.
127	*Tectona grandis*	Ditto.
80	Tabasheer	Ditto.
1680	Wood Opal	Ditto.

On this table the author remarked, that the siliceous stems which he had found to abound most in fluorine, were exactly those which contained most silica. In particular, deep etchings were procured from the Equisetaceæ and from the Gramineæ, especially the common Bamboo. The last was known to contain silica in such abundance that it collected within the joints in white masses, nearly pure, and had long, under the name of Tabasheer, been an object of interest to natural philosophers. The horse-tails were scarcely less remarkable for the amount of silica contained in their stems, which had led to the employment of one of them (*Equisetum hyemale*) in polishing wood and metals. The African Teak, which like the Bamboo is known sometimes to secrete silica, was also found to contain fluorine, though much less largely than the plants named; whilst the strongly siliceous stems of Barley and Ryegrass also yielded the element in marked quantity. The Sugar-cane, however, gave less striking results than might have been expected, and the same remark applied to the Malacca-cane. Two specimens of silicified wood and one of Tabasheer gave no evidence of the presence of fluorine. So far, however, as the plants named in the preceding table are concerned, the author does not wish it to be inferred from the negative results which are detailed, that the plants in question are totally devoid of fluorine. With larger quantities of their ashes, positive results would, in all probability, be obtained.

The author's general conclusions were as follows:—1st, that fluorine occurs in a large number of plants; 2nd, that it occurs in marked quantity in the siliceous stems of the Gramineæ and Equisetaceæ; 3rd, that the quantity present is in all cases very small; for although exact quantitative results were not obtained, it is well known that a fraction of a grain of fluoride will yield with oil of vitriol a quantity of hydrofluoric acid sufficient to etch glass deeply, so that the proportion of fluorine present, even in the plant-ashes which contain it most abundantly, does not probably amount to more than a fraction per cent. of their weight. The proportion of fluorine appears to be variable, for different specimens of the same plant did not yield concordant results.

In this, however, there is nothing anomalous, for some Bamboos yield *Tabasheer* largely, whilst others are found to contain none. It seems not unlikely that soluble fluorides ascending the siliceous stem of a plant, on their way to the seeds or fruits in which they finally accumulate, may be arrested by the silica, and converted into insoluble fluosilicates (fluorides of silicon and of a metal); and a Bamboo, for example, secreting Tabasheer, may effect this change where one less rich in silica cannot determine it. The slow or quick drying of a stem may also affect the fixation of fluorides in the stems or trunks of plants.

The sources of the fluorine found in plants may be regarded as preeminently two,—1st, simple fluorides, such as that of calcium, which are soluble in water, and through this medium are carried into the tissues of plants; and 2nd, compounds of fluorides with other salts, of which the most important is probably the combination of phosphate of lime with fluoride of calcium. This occurs in the mineral kingdom in apatite and phosphorite, and in the animal kingdom in bones, shells and corals, as well as in blood, milk, and other fluids.

A recent discovery of the author, communicated to the Royal Society of Edinburgh, has shown that fluorides are much more widely distributed than is generally imagined, and that the trap rocks near Edinburgh, and in the neighbourhood of the Clyde, as well as the granites of Aberdeenshire, and the ashes of coal, contain fluorides, so that the soils resulting from the disintegration of those rocks cannot fail to possess fluorides also. All plants accordingly may be expected to exhibit evidence of their presence in the following portions of their tissues or fluids:—

1. In the ascending sap, simple fluorides.
2. In the descending sap, in association with the albuminous vegetable principles, and in the seeds or fruits, in a similar state of association, fluorides along with phosphates.
3. In the stems, especially when siliceous and hardened, fluorides in combination with silica. The investigation is still in progress.

XXVI. *Remarks upon British Plants.*
By Charles C. Babington, M.A., F.R.S., F.L.S. &c.

Read 10th February, 10th March, and 14th April 1853.

Since the publication of the third edition of my 'Manual of British Botany,' my attention has been directed to several groups of plants, either by the discovery of new native species, or by finding that I have taken an erroneous view of them in that work. In this paper the results of the study which I have devoted to the plants included in it are presented to the Botanical Society.

1. Thalictrum majus and T. minus.

The *Thalictra,* which usually pass under the names of *T. majus* and *T. minus* in Britain, seem to be very imperfectly understood, and probably constitute three distinct species. In my 'Manual' (ed. 3) I have given *T. minus, T. flexuosum, T. saxatile,* and *T. majus* as native species, but now think that that is one too many, and that the so-called *T. majus* is formed out of larger states of each of the others, but especially of *T. saxatile* and *T. flexuosum.* I must however protest against the extreme measure of joining all these *Thalictra* under the name of *T. minus,* as is done in the 'British Flora' (ed. 6), and can only account for it by supposing that the justly celebrated botanists who are the authors of that work were unacquainted with some of the plants.

In drawing up the following revised characters for our plants I have been greatly assisted by my friend Mr. F. J. A. Hort, who has paid much attention to these species, and freely communicated to me the results at which he has arrived.

Attention should be especially directed to the presence or not of leaves from the lower joinings of the stem, as it appears to be quite certain that some species are when young always furnished with leaves quite down to the ground, whilst others have only scales in their place. The former at the flowering season present a deceitful appearance, for then the lower leaves have usually faded and often quite disappeared. A careful examination is therefore requisite before deciding upon their presence or absence; also, those joinings that are covered with soil are usually, even in the leaf-based species, devoid of leaves and furnished with scales alone. Dried specimens of the leaf-based species are therefore very liable to be mistaken for leafless-based plants.

My observations do not lead me to place much dependence upon the hollowness or otherwise of the stem, as it often, I think, seems to be hollow, owing to the vigour of its growth having distended and broken the pith. I am not prepared to say that none of the species are normally hollow-stemmed.

The auricles of the larger stipules, especially the lower ones, are well deserving of attention, as they seem to furnish valuable characters.

The direction of the subdivisions of the petioles is deserving of attention, but the form of the leaflets and their size appear to be very inconstant.

The direction of the branches of the panicle should be noticed.

The form of the carpels is probably of little value, but before this can be stated with confidence, they must be subjected to careful study when fresh. The process of drying appears to alter their form considerably.

1. *T. minus* (Linn.); stem zigzag striated branched solid *leafless at the base, stipules with inflexed auricles,* leaves 2–3-pinnate, leaflets ternate 3-cleft glaucous, petioles with angular ascending branches, panicle leafless with divaricate branches, flowers drooping, carpels fusiform 8-ribbed subcompressed ventricose below externally.

T. minus, *Koch, Syn.* ed. 2. 4; *Fries, Summa,* 135; *Reich. Icon. Fl. Germ.* iii. t. 27!

T. majus, *Reich. l. c.* t. 30.

This plant varies very much in size, but is usually about 18 inches in height. Its leaves are rather small, with short intervals between the leaflets; but this is not constantly the case, as in specimens gathered in Cambridgeshire the leaflets are distant, and thus cause the plant to present a different appearance. There is usually a very marked interval between the root and the lowest leaf, the lower joinings of the stem being furnished with sheathing rather lax scales, but no leaves. The main branches of the panicle usually spring from the axils of very small leaves, at the secondary divisions there are rarely more than scales, therefore the upper part of the stem looks naked and the panicle may be described as leafless. The panicle is usually small relatively to the size of the plant, but in a specimen from the Great Ormes Head it is very large and very much more branched than is usual. In this last-mentioned instance, and in some from other parts of Caernarvonshire, the stem is much softer and almost might be called hollow when the plant is in fruit.

The *T. majus* of Reichenbach (*l. c.*) seems to be a large form of this species; that of Gren. and Godr. (Fl. de France) is rendered doubtful by the statement that it is "sans stolons." When this plant is clothed with minute stalked glands, it is the *T. pubescens* of Schleicher and DeCandolle.

T. minus appears to be pretty generally distributed, but seems to prefer the neighbourhood of the sea. It is found upon sandhills adjoining the coast, and also in hilly or even mountainous situations.

In the 'Botanical Gazette' Mr. J. Ball informs us that M. Jordan of Lyons considered that a plant gathered upon Ben Bulben, in the county of Sligo, is his *T. calcareum* (Obs. sur Pl. de la France, v. 9). Not having seen either the Irish plant or that of M. Jordan, I am unable to form a clear idea of it, but suspect that it is very nearly allied to *T. minus*.

2. *T. flexuosum* (Reichenb.); stem zigzag striated branched *leafy to the base, stipules with reflexed auricles,* leaves 2–3-pinnate, leaflets 3–5-cleft paler beneath, *petioles with patent divaricate branches,* panicle leafy elongated with patent often reclinate branches, flowers drooping, carpels narrowly oblong subcompressed sub-10-ribbed gibbous within upwards.

T. flexuosum, "*Bernh. Cat.*" ex *Reich. Fl. excurs.* 728, et *Ic. Fl. Germ.* iii. 14. t. 28; *Fries, Summa,* 136, et *Herb. Norm.* vii. 24!
T. collinum, *Wallr. Sched.* 259. teste *Reich.*
T. capillare, *Reich. Fl. excurs.* 729, et *Ic. Fl. Germ.* iii. 15. t. 36.
T. majus, *Sm. Eng. Bot.* t. 611, et *Eng. Fl.* iii. 42.

Varying greatly in size, but usually a taller plant than *T. minus,* often 3 feet in height. In the lesser forms the leaves are rather small, and the leaflets placed rather closely; but in the larger plants the latter are often very distant. The leaflets are very inconstant in size, they are usually roundish, and on the same plant vary from subcordate at the base to wedge-shaped; the lobes are very blunt and cuspidate, or in the larger forms, and especially in *T. capillare,* the lobes of the upper leaflets are lanceolate-cuspidate. All the sheaths that are not subterranean are furnished with leaves; but the lower leaves soon decay, and thus it is rendered difficult at an advanced period of the year to ascertain their former existence. The primary and secondary branches of the panicle are usually to a far greater extent furnished with leaves, which are also larger, than is the case in *T. minus,* and small ones, consisting of from one to three small leaflets, are frequently found subtending even the ultimate branchlets. This tendency of the panicle to become leafy distinguishes the present plant from both *T. minus* and *T. saxatile,* in which it always looks naked. The panicle is rather large, usually very much subdivided, and in the larger forms has very long pedicels.

My specimens named *T. majus* from North Queensferry in Scotland (Hook. Fl. Scot. i. 172), and Ulleswater (Sm. Eng. Fl. iii. 42, and Eng. Bot. t. 611), are, I am confident, the *T. capillare,* although I only possess a portion of the upper part of these large plants. I quite agree with Fries in thinking that they are a luxuriant state of *T. flexuosum.*

There is much reason to suppose that what is called *T. minus* in the interior of England chiefly consists of this plant, but I can only state the certain presence of its smaller form in Cambridgeshire and at Cheddar in Somersetshire, and its larger form in Fifeshire and Cumberland. I am informed that Mr. D. Oliver, jun., has observed it upon Ben Bulben in the county of Sligo; and Mr. Shuttleworth found it at Curragh More, Lough Corrib, Co. Galway; Mr. Brand at Grey Mare's Tail, Dumfriesshire; and Dr. Greville (I believe) at Far Out Head, Sutherlandshire.

3. *T. saxatile* (DC.); *stem* rather zigzag *smooth* but striated below the striated sheaths branched hollow *leafy to the base,* "stipules with horizontal auricles" (Fries), leaves 2–3-pinnate, leaflets 3–5-cleft paler beneath, petioles subterete with patent *not divaricate branches, panicle* leafless *erect pyramidal* with patent straight branches, flowers drooping (?), *carpels regularly oval.*

T. saxatile, *DeCand. Fl. Fr.* v. 633; *Reich. Ic. Fl. Germ.* iii. 15. t. 34; *Gren. et Godr. Fl. Fr.* i. 7 (excl. syn.).
T. Kochii, *Fries, Mant.* iii. 46, et *Summa,* 136.
T. collinum, "*Wallr.*" teste *Fries, Herb. Norm.* vii. 25; *Koch, Syn.* ed. 1. 4.

A large plant with stems often 4 feet in height. Leaves very large, with long intervals between the leaflets. Leaflets large, broad, closely resembling those of *T. flexuosum.* None of the sheaths are leafless, they are furrowed, and the furrows descend a short distance upon the stem, which is elsewhere without furrows. The secondary branches are so generally unfurnished with leaves that the panicle may be called leafless, although there are leaves at the origin of the principal branches. It is not quite certain if the flowers are erect or drooping; in a plant gathered by myself in Cumberland they appear to have been erect, but it is difficult to determine from a dried specimen; they are figured and described by Reichenbach as erect; Fries states that they nod, and his specimen seems to confirm him. The fruit of this plant differs from that of *T. minus* and *T. flexuosum* in being scarcely at all compressed and very regularly oval in its outline.

I have only seen this plant from the Lake district of the north of England, where it is found in damp situations, such as Brathay near Ambleside, and St. John's Vale near Keswick. Mr. J. Ball appears (Bot. Gaz. i. 313) to have found it "abundantly on the shores of the lakes . . . . of the limestone districts of the west of Ireland," for I presume that this is the plant which he there calls *T. majus*.

The locality in Somersetshire recorded for this species in my 'Manual' (ed. 3. 4) belongs to *T. flexuosum*.

2. Polygala.

The discovery of *Polygala uliginosa* of Reichenbach, a probable variety of *P. austriaca* of Crantz, upon the elevated mountain limestone of Teesdale by my valued friends Messrs. James Backhouse, sen. and jun., has led me to a more careful examination of the plants referable to that genus that are natives of Britain, and as I have considerably altered the technical characters of *P. vulgaris* and *P. calcarea* from those given in the third edition of my 'Manual' (p. 38 & 39), it seems desirable to give the new specific definitions of them in conjunction with that of *P. austriaca*. Much difficulty attends all the supposed species of *Polygala*, and probably their number will ultimately be much reduced, but we are not as yet in a position to do so satisfactorily.

It will be seen that attention should be especially paid to the mode in which the leaves are arranged, and to the appearances caused by the different lengths to which the stems extend each year. In some cases the leaves are pretty regularly scattered over the stems; in others some are scattered, but the larger ones are collected into a marked tuft arranged in the form of a rose at the end of the growth of the year. When this extension is slight, the rosette appears to be radical and includes all the foliage of the true stem, as is the case in *P. austriaca*; when it is elongated its lower part bears small scattered leaves, and the rosette of larger ones is placed at its extremity, a habit presented by *P. calcarea*. In *P. vulgaris* a third condition is seen, where there is no marked distinction between the persistent part of the stem and the deciduous floral portion. The stems of *P. vulgaris* seem usually to die back nearly to the crown of the root, so as to leave only two or three of the lowest buds to produce the shoots of the succeeding year; but sometimes they retain life to a considerable distance from their origin, and then the new growth is far distant from the root-stock and prostrate stems are produced. In this plant, and others of similar habit, there is no rosette.

1. *P. vulgaris* (Linn.); *leaves scattered, lower leaves smaller* oblong, upper leaves lanceolate, wings of the calyx obovate mucronate their *nerves branched the lateral looping with a branch of the central nerve,* capsule obcordate, lobes of the arillus unequal, lateral bracts shorter than the pedicels.

P. vulgaris *auctorum.*

Stems weak, prostrate or ascending, without any clear separation between the persistent part and the annual flowering shoot; sometimes branching so as to make some of the really terminal racemes appear to be lateral. Leaves all scattered, the lower ones much the smaller. Flowers blue, pink or white, with intermediate shades. The central nerve of the wings of the calyx is very nearly simple, only branching slightly near the top, and ending in a mucro. The lateral nerves are much branched, but only on their outer side, where the branches join in loops, as do the nerves themselves with a branch of the central nerve. The lobes of the arillus are unequal, the two lateral being longer than the central one, and half as long as *the seed,* which *has a kind of stalk* that raises it so as to leave a space between its base and the inside of the arillus.

β. *depressa*; lower leaves crowded and often opposite but small, stems long wiry prostrate, racemes ultimately lateral.

P. vulgaris* depressa, *Fries, Mant.* ii. 41.

P. depressa, "*Wend.*" ex *Koch, Syn.* ed. 2. 99; *Coss. et Germ. Fl. Par.* 56. t. 8; *Bromf. in Phytol.* ii. 966; *Gren. et Godr. Fl. Fr.* i. 196.

P. serpyllacea, "*Weihe*" ex *Sond. Fl. Hamb.* 388.

I have examined this plant with care, but do not find any cause for deviating from the opinion of Fries, confirmed as it is by the accurate observations of my lamented friend Dr. Bromfield. As has been remarked in the preliminary observations, the long wiry character of the stems is caused by some of the buds more distant from the root remaining alive through the winter and producing shoots in the succeeding spring. Similar wiry stems are occasionally, although rarely, found in typical *P. vulgaris.*

γ. *oxyptera*; flowers smaller, fruit broader than the wings of the calyx.

P. oxyptera, *Reich. Iconog.* i. f. 46!

P. multicaulis, *Tausch.*!

This appears to be only a variety of *P. vulgaris,* the proportional width and length of the calyx-wings and capsule not being to be trusted.

In my 'Manual' I have directed attention to a plant that grows on the limestone ledges of Ben Bulben in the county of

Sligo, and which I have long suspected might be a distinct species. It is remarkable for having deep blue flowers, upright stems, much larger leaves than the typical *P. vulgaris*, and the lateral nerves of the calyx-wings joining the central nerve itself instead of a lateral branch of it. Although looking very different, and being even more beautiful than the common *P. vulgaris*, I have now arrived at the conclusion that it ought not to be separated from that species. Is its situation upon the ledges of limestone in a damp country a sufficient cause for the abovementioned differences? I am inclined to answer that it is.

P. vulgaris is found throughout the British Isles, upon every kind of soil, and from near the level of the sea to a high elevation on mountains.

2. *P. calcarea* (Schultz); *leaves chiefly in an irregular terminal tuft large* obovate obtuse, leaves on the flower-shoot smaller lanceolate, wings of the calyx oblong their nerves branched the lateral looping with a branch from near the middle of the central nerve, capsule oblong obcordate, lobes of the arillus unequal, lateral bracts shorter than the pedicels.

P. calcarea, *Schultz in Bot. Zeit.* (1837) 752, et "*Exsic.* ii. 15"; *Koch, Syn.* ed. 2. 100; *Bab. Man.* 39; *Gren. et Godr. Fl. Fr.* i. 196!; *Walp. Rep.* i. 232.
P. amara, *Reich. Fl. exc.* 350, et *Fl. exsic.* 749!; *Eng. Bot.* t. 2764!
P. amarella, *Reich. Iconog.* i. f. 43, 44; *Coss. et Germ. Fl. Par.* 56. t. 7.

Stems weak, prostrate or ascending, *nearly naked below*, producing simple flower-shoots from the terminal rosette which loses its leaves and disappears. Racemes terminal. Flowers blue. The central nerve of the wings of the calyx branching considerably, one of its lower branches joining in a loop with the lateral nerves, which are much branched, but only externally. The lobes of the arillus are unequal, blunt, the two lateral being longer than the central one, and half as long as the seed, which is sessile.

This plant is closely allied to *P. vulgaris*, and is joined to it by some authors of eminence; but it is perhaps as frequently, and by botanists of equal authority, combined with *P. amara*. Fries expresses his opinion strongly that the former is the correct view to take of it (Summa, 154), and similarly Arnott (Brit. Fl. ed. 6. 52). Bertoloni combines it and *P. uliginosa* and *P. austriaca* with the true *P. amara* (Fl. Ital. vii. 321); as is also done by the editors of the 'Compendium Fl. German.' (ed. 2. 157).

In my opinion it is equally distinct from each of them. Its naked elongated true stems, bearing a rosette of leaves at their extremity from the axils of which the simple flower-shoots spring, seem to separate it clearly from the former in which no such rosette is found, and at the flowering season the lowest leaves are very markedly smaller than those above them.

With *P. amara* it agrees in possessing a rosette; but in that species the true stem is very short, and therefore the rosette and flower-shoots seem to be radical. Here also the central nerve of the calyx-wings is branched even as low down as its middle, and these lower branches join with the lateral nerves; in *P. amara* the central nerve is unbranched up almost to its apex, although it usually does there join the lateral nerves.

P. calcarea is found on the chalk hills of Surrey and Berkshire.

3. *P. austriaca* (Crantz); *leaves in a rosette* obovate obtuse *larger* than the oblong-lanceolate ones on the flower-shoot, wings of the calyx oblong or obovate obtuse their *nerves simple or slightly branched free,* capsule wedgeshaped below roundish broader than the wings, *lobes of the arillus nearly equal,* lateral bracts shorter than the pedicels.

[α. *genuina*; leaves of the rosette smaller than those of the branching flower-shoot, flowers smaller, capsule rounded below.
P. austriaca, "*Crantz, Aust.* v. 2"; *Reich. Iconog.* i. 23. t. 21. f. 39, et *Fl. excurs.* 350, et *Fl. exsic.* 1923!]

β. *uliginosa*; leaves of the rosette larger than those of the nearly constantly simple flower-shoot, flowers larger, capsules wedge-shaped.
P. uliginosa, *Reich. Iconog.* i. 23. t. 21. f. 40, 41, et *Fl. excurs.* 350, et *Fl. exsic.* 52!; *Fries, Summa,* 154, et *Herb. Norm.* iii. 14!
P. myrtifolia, *Fries, Nov.* ed. 2. 227; *Wimm. et Grab. Fl. Siles.* iii. 24.
P. amara, *Sven. Bot.* t. 484; *Fl. Dan.* t. 1169.
P. austriaca, *Coss. et Germ. Fl. Par.* 56. t. 7, not *Reich.*

Root slender. Root-stock short. Lower leaves collected into a rosette and seeming to be radical, larger than the others, broadly obovate, narrowed below, rounded at the end, but often with a minute apiculus. Flowering shoots short, springing from the axils of the rosette, straight, unbranched; their leaves oblong-lanceolate, upper ones acute. Flowers small, pale lilac, or at length tinged with green. Wing of the calyx longer than the capsule in our plant, and in that of Scandinavia (Fries, Nov. et Herb. Norm.) shorter than it in southern countries. The valueless character of the proportion between these parts is well pointed out in the 'Flora Silesiæ' (*l. c.*).

Fries considers this to be the plant called *P. myrtifolia palustris humilis et ramosior* by Dillenius (Raii Syn. *287), and found by Sherard "in the bog beyond the wood going from John Coals to Croydon bogs." It is quite possible that his idea may be correct, as the description accords pretty well with *P. uli-*

ginosa. It may however be doubted if Sherard's plant was not *P. calcarea,* which inhabits the range of chalk hills to the south of Croydon, and agrees even better than *P. austriaca* with the description given in the 'Synopsis.' Smith takes no notice of this Dillenian plant; it is mentioned by Hudson, and in the second edition of Withering's 'Botanical Arrangement,' but neither botanist seems to have known more about it than may be learned from Ray's 'Synopsis.' It is to be feared that the neighbourhood of Croydon is far too much altered to allow of the discovery of the spot visited by Sherard, and unless a specimen is preserved at Oxford, the *P. myrtifolia palustris humilis et ramosior* can never be identified with modern species.

Much doubt exists concerning the propriety of separating *P. uliginosa* from *P. austriaca.* The true *P. austriaca* does not seem to grow in the north of Europe. The recorded differences between them are very slight, and are of a kind that is likely to be variable. In *P. austriaca* the lateral nerves of the wings are usually branched and their points incline towards the central nerve: in *P. uliginosa* these lateral nerves are, I believe, nearly always simple and do not curve inwards, but continue to diverge up to their extremity. The true *P. austriaca* has not been found in this country.

This plant was discovered "at the back of Cronkley Fell, Upper Teesdale, Yorkshire, at an elevation of about 1500 feet above the sea," on May 24, 1852, by Messrs. James Backhouse, sen. and jun.

The presence of this plant; of *Myosotis alpestris,* which was discovered by the same botanists, during the same excursion, at an elevation of 2500 feet upon Micklefell; and their previous detection of *Alsine stricta* upon Widdy-bank Fell in June 1844; all places in the same mountainous district of the north of England; is a subject of much interest in connection with the geographical distribution of our plants. It is the most southern extension in Britain of the three species (indeed the only station known for two of them), each of which appears to have derived its origin from Scandinavia, or perhaps, to use more correct terms, is a remnant of that ancient flora of Britain which inhabited the country when its climate nearly resembled that now found in Norway.

3. Hypericum Androsæmum.

In the recently received Fasciculus (vol. viii. fasc. 3) of Bertoloni's valuable 'Flora Italica,' it is stated that the *Hypericum Androsæmum* of Smith and other British botanists is not the plant so called by Linnæus. Bertoloni does not say that he has received the *H. anglicum* (Bert.) from Britain, but probably we ought to believe him to have done so. An examination of the materials within my reach has led me to a different conclusion from that arrived at by Bertoloni. I find that all the British specimens called *H. Androsæmum* that I possess belong to the true plant of Linnæus. I also believe that Bertoloni has rather too hastily quoted Curtis (Fl. Lond. i. t. 164) as giving a figure of his *H. anglicum,* for that plate well represents *H. Androsæmum.* Sowerby's plate (Eng. Bot. t. 1225) does indeed appear to be derived from some other species. Unfortunately Smith does not tell us, in his text to that plate, from whence the specimen there figured was obtained; but refers especially to Norfolk (N. Walsham, Wood Dalling, Costesy) for localities for his *H. Androsæmum*; stating that in that county it is most frequent.

Bertoloni also quotes the *Androsæmum grandifolium* of Reichenbach (Icon. Fl. Germ. vi. 70. t. 352) as belonging to *H. anglicum.* That figure is very incomplete, and seems not to represent the winged pedicels or acute leaves of *H. anglicum,* but may perhaps be intended for it. Reichenbach states that his plant came from Switzerland, and adds, "Etiam planta anglica 'Isle of Arran, Buteshire,' huc pertinet." The *H. grandifolium* (Chois.) is an Azorean plant which I possess from Madeira.

Under these circumstances it becomes desirable to ascertain what plant is called *H. Androsæmum* in different parts of Britain: my specimens, correctly so named, are from Caernarvon, Tenby, Dunstafnage in Argyleshire, and Burrishoole in the county of Mayo. Dr. Balfour possesses it from Isles of Arran and Bute in Scotland.

In the month of August 1852, Dr. Balfour gathered at Glanmire near Cork, a large plant which is manifestly distinct from *H. Androsæmum,* and probably may be the *H. anglicum.* It is far more nearly allied to *H. hircinum* than to *H. Androsæmum,* from which latter species its winged pedicels, much larger flowers, much narrower and more pointed sepals which do not enlarge with the ripening capsule, relatively much longer petals, which are more than double the length of the calyx, styles equalling the stamens, or even exceeding them, and pointed oblong capsules, clearly distinguish it.

From *H. hircinum* it is separated by its flower-buds being considerably broader in proportion to their length, the petals clawed rather than narrowed to their base, the leaves broadly cordate-ovate-acuminate and pellucidly veined but only slightly pellucidly punctured. In *H. hircinum* they are (even when slightly cordate at the base, as is sometimes the case) almost exactly ovate-oblong and much both pellucidly punctured and veined. These differences are slight, and it is therefore quite possible that the plant found in Ireland may prove to be a state of *H. hircinum.*

The habit of the plants is (I believe) so different that I am rather inclined to look upon them as distinct.

H. grandifolium (Chois.) has terete branches and peduncles, blunt leaves which are very much pellucidly punctured, narrow petals, and an ovate-conical capsule, *i. e.* apparently only slightly narrowed at its base. As Bertoloni justly remarks, the figure given by Choisy (Prod. d'une Monog. de la Famille des Hypericinées, t. 3) clearly shows that it is not the same as our plant, and this is confirmed by my specimen from Madeira.

Bertoloni appears to consider his *H. anglicum* as very much more closely allied to *H. Androsæmum* than is the case with the Irish plant, to which I provisionally apply the name of *H. anglicum,* and it is thus possible that he may have had something else in view when he conferred that name upon the plant before him; nevertheless his quotation of Reichenbach's plate is in favour of his plant being the same as ours.

H. Androsæmum and *H. anglicum* may perhaps be characterized as follows:—

1. *H. Androsæmum* (Linn.); stem shrubby compressed, leaves broadly subcordate-ovate blunt, cymes few-flowered, sepals broad unequal, *styles falling much short of the stamens, capsules* pulpy *blunt.*

H. Androsæmum, *Linn. Sp. Pl.* 1102, et *Auct.*

This plant is usually only slightly branched in its upper part. There is but little trace of a wing upon its stem or even upon its pedicels. The sepals and petals are of about equal length, and the former are afterwards much enlarged, so as greatly to exceed the very blunt globose capsule.

2. *H. anglicum* (Bert.?); stem shrubby 2-edged much branched, pedicels 2-winged, *leaves broadly cordate-ovate*-acuminate, cymes few-flowered, sepals ovate-lanceolate unequal, *styles equalling or exceeding the stamens, capsules oblong acute.*

H. anglicum, *Bert. Fl. Ital.* viii. 310?
H. Androsæmum, *Eng. Bot.* t. 1225.

Stem terete with two slight wings, erect, much and repeatedly branched, 3–4 feet high, reddish; branches opposite, terete below, 2-winged above. Leaves alternately opposite, large, sessile, broadly cordate-ovate-acuminate, acute, entire, with many fine pellucid net-veins, in the centre of each mesh of which near to the edge of the leaf there is a pellucid puncture, these punctures becoming more and more rare as the midrib is approached, green on both sides; ribs prominent and reddish beneath. Cymes terminating the stem and branches, small, once or twice triradiate, having sometimes below them one or two simple axillary solitary peduncles. Peduncles and pedicels 2-winged, jointed at some distance below the flower, thickened above the joining, at which there are two small deciduous bracts. Sepals unequal, ovate-lanceolate, acute, reflexed, not enlarged on the fruit, deciduous (?), with a few pellucid punctures, the larger ones 3 lines long and 1 line broad. Petals yellow, reddish externally, about three times the length of the sepals (I cannot satisfactorily determine the exact proportion in the dry specimens before me), broad, rounded at the end, shortly clawed, many-veined. Filaments exceeding the corolla. Styles about equalling the stamens. Capsules oblong, narrowed at both ends, with a long point formed of the persistent base of the styles. Mature capsules I have not seen.

Flowering in August. "In great quantity, apparently wild, on the banks of the Glanmire river near Cork." Dr. Balfour.

My friend Mr. J. Ball gave to me an imperfect specimen of an *Hypericum* gathered by him in the county of Dublin in 1837, which may prove to be *H. anglicum,* for it more resembles that plant than either of the allied species. I have a slight suspicion that Mr. Ball's plant did not grow in such a spot as to be satisfactorily considered as indigenous. Dr. Balfour informs me that he gathered the plant called *H. anglicum* in this paper at Culross in Scotland in July 1833, also that he has a specimen from the county of Galway "very like it."

It may be well to add the specific character of *H. hircinum* as follows:—

H. hircinum (Linn.); stem shrubby 2-edged much branched, pedicels 2-winged, *leaves ovate-oblong,* cymes few-flowered, sepals lanceolate unequal, styles equalling or exceeding the stamens, capsules oblong acute.

H. hircinum, *Linn. Sp. Pl.* 1103 et *Auct.*

4. Agrimonia odorata.

Until recently the only authority for the introduction of *Agrimonia odorata* into British botany was a single specimen gathered in 1842 in the island of Jersey by the Rev. W. W. Newbould. On the 9th of September 1852 I had the pleasure, in company with that gentleman, of finding it growing rather abundantly amongst bushes on the rocky shore of Lough Neagh in the county of Antrim, and within a few hundred yards of Shane's Castle. There it was intermixed with *A. Eupatoria,* and they conspicuously differed. They were out of flower at that season.

I learn from a letter addressed by Mr. Borrer to Mr. Newbould that Mr. Joseph Woods found *A. odorata* in the autumn of 1852 near to the Start Point in Devonshire, and near Gwithian in Cornwall.

A. odorata may be characterized as follows :—

A. odorata (Mill.) ; leaves interruptedly pinnate coarsely serrate hairy and with many minute glands beneath, calyx-tube of the *fruit bellshaped not furrowed,* exterior spines of the fruit declining.

A. odorata, *Mill. Dict.* n. 3 ; *Koch, Syn.* 245 ; *Mert. et Koch, Deutschl. Fl.* iii. 376; *DeCand. Prod.* ii. 587 ? ; *C. A. Mey.* "*Bull. St. Pet.* x. 344," and *Ann. Sc. Nat.* ser. 2. xviii. 375 ; *Guss. Syn.* i. 527 ; *Ledeb. Fl. Ross.* ii. 31.
A. procera, *Wallr. in Linnæa,* xiv. 573.

This plant closely resembles *A. Eupatoria* in most of its characters, but is manifestly distinct when the fruit is observed. The bellshaped form of that part in the present species is very different from the obconic fruit of its ally. In this the outer rows of the spines of the calyx are directed downwards, and the inner rows exceed the limb of the calyx ; the whole plant also is considerably larger than *A. Eupatoria,* which has its outer spines patent, but not having a downward tendency (although sometimes the act of pressing them for the herbarium pushes them in that direction), and its inner ones scarcely equal the limb of the corolla in length. The fruit of *A. Eupatoria* is deeply furrowed almost to its base, and becomes more manifestly so as it ripens ; that of *A. odorata,* which has short shallow furrows on its upper half when young, usually altogether loses them as it advances to maturity. MM. Cosson and Germain (Fl. de Paris, 182) attempt to account for the difference of form, &c. of the fruit by attributing the presence of two achenes to the *A. odorata,* and of only one to *A. Eupatoria.* Undoubtedly such is generally the case, but I have found that the latter is often furnished with two achenes, and yet its fruit retains the usual form and sculpture.

A. odorata is usually larger in all its parts than its ally ; its leaves are much more thickly covered with hairs, and have very many minute glands on their under side. These glands are the organs from which the rather agreeable scent proceeds which has caused the specific name.

The description of *A. odorata* in DeCandolle's 'Prodromus' (ii. 587) contains the words "foveolis obovatis usque ad basin productis, setis adscendentibus brevibus." In neither of these respects does it agree with the plant of more recent authors, except G. Don (Syst. of Gard. and Bot. ii. 563), who has translated that definition.

5. Matricaria maritima.

Much doubt has long attended the *Matricaria maritima*; and numerous attempts have been made to discover distinctive characters between it and *M. inodora*; but experience has uniformly shown that those pointed out were too inconstant to be of any value. Nevertheless most authors have retained them as species, and although, as will be seen below, I am persuaded that many of the plants called *M. maritima* are referable to a maritime state of *M. inodora,* still I am not as yet prepared to give up the original Dillenian species upon which the Linnæan plant is founded, but do not pretend to have succeeded any better than others in providing a specific character for it.

The *M. maritima* appears under that name in 'Linn. Sp. Pl.' (ed. 1. p. 891), where the *Chamæmelum maritimum perenne humilius, foliis brevibus crassis, obscure virentibus* of Dillenius (Raii Syn. ed. 3. 186. t. vii. f. 1) is quoted as its source. In that place Dillenius has given a description of it, to which, as the Synopsis is a common book, this reference will be sufficient. Linnæus also quotes his own 'Iter Westgothicum' (p. 148), where he had described the plant. That work is not of easy access, but a copy of this description will be found in Richter's useful 'Codex Botan. Linnæanus' (n. 6437). Linnæus there expresses his belief that if its radiant florets had not been toothed, it would have agreed with the plant of Ray's 'Synopsis,' and as that is now decided to be a character of very little value, we may consider his opinion as favourable to the identity of the plants. It is remarkable, that in the 'Sp. Pl.' ed. 3. he has *Chrysanthemum inodorum* (the *M. inodora* of Fl. Suec. ed. 2), and places under it "*β. Chamæmelum maritimum,* It. w. goth. 148," but also describes *M. maritima* as the plant of Ray's 'Synopsis,' and again makes the same reference to the 'Iter west-gothicum.' As these references necessarily belong to the same plant, it is manifest that an error has occurred which has naturally caused much of the doubt expressed by succeeding botanists; those who only knew the maritime form of *M. inodora* thinking that the reference was correctly placed under *C. inodorum,* and consequently *M. maritima* was an accidental repetition. As very few botanists appear to have been acquainted with the Dillenian plant, or that found at Billingen in Sweden by Linnæus, it has happened that the true *M. maritima* has nearly disappeared from books. Even those modern authors who separate the *M. maritima* from the *M. inodora* have usually described the maritime form of the latter under the former name. To Fries the credit is due of first, in modern times, directing attention to this fact, and making us acquainted with the true *M. maritima.* His valuable remarks upon the plants will be found in his 'Mantissa tertia' (pp. 115–117) and 'Summa Veg. Scand.' (p. 186). In the latter work he observes, that M. Gay of Paris thinks that two species are included under the name of *M. maritima* in Sweden. If, as is most probable, the two plants are the *M. inodora β. salina* and the true *M. maritima*, there seems no difficulty in acceding to M. Gay's views, although not allowing that the former of these plants is separable specifically from *M. inodora*. It is proper to remark, that Wallroth appears to have known that the *Matricaria* of saline districts was not necessarily the maritime plant of Dillenius, for in his 'Schedulæ Criticæ' (p. 485) he points out differences between his *Pyrethrum inodorum β. salinum* and the *P. maritimum* of Smith.

The following are as good specific characters as I have succeeded in drawing up for the plants. Taken as a whole I think that they may be so distinguished, but it is to be feared that no one part alone can be implicitly depended upon :—

1. *M. inodora* (Linn.); st. erect, leaves sessile pinnate, leaflets with many usually alternate capillary pointed segments, basal leaflets crowded clasping the stem not separated from the others, heads solitary, phyllaries lanceolate blunt with a fuscous scarious torn margin, fruit with two glandular spots just below the elevated border.

M. inodora, *Linn. Fl. Suec.* ed. 2. 297; *DeCand. Prod.* vi. 52; *Fries, Mant.* iii. 115; *Hook. and Arn. Brit. Fl.* 242; *Gren. et Godr. Fl. Fr.* ii. 149; *Lloyd. Fl. Loir.-inf.* 139.

Chrysanthemum inodorum, *Linn. Sp. Pl.* ed. 3. 1253; *Koch, Syn.* ed. 2. 419.

Pyrethrum inodorum, *Sm. Fl. Brit.* ii. 900, and *Eng. Fl.* iii. 452; *Eng. Bot.* t. 676.

Tripleurospermum inodorum, *C.H. Schultz* ex *Koch Syn.* ed. 2. 1026; *Walp. Rep.* vi. 196.

Chamæmelum inodorum annuum humilius, foliis obscure virentibus, *Dill. in Raii Syn.* ed. 3. 186.

Stem smooth, angular, 12 to 18 inches high; the branches spreading. Rachis of the leaf enlarged at the base and furnished with many closely-placed leaflets which clasp the stem, and, as Wallroth justly remarks, resemble a comb; the next leaflets generally small and short, simple or simply forked; succeeding leaflets becoming gradually longer and more compound; all placed on the rachis at pretty regular intervals, except the closely-placed *basal ones, which are not separated from the lowest of the others by any markedly greater interval than those others are from each other*. Involucre flat. Phyllaries with the scarious border broadly fuscous. Radiant florets linear-oblong, blunt, 3-toothed at the end, white. Disk yellow. Receptacle (when the florets are all expanded) often twice as long as broad. Fruit with three prominent smooth ribs; having two internal and narrow, and one external and broad, rough spaces between the ribs; the glandular spots round.

β. salina; stem more diffuse often nearly prostrate, leaflets short fleshy, involucre umbilicate, disk broader, fruit with only the one external rough space and oblong glandular spots.

M. maritima, *Linn. Herb.*!; *Gren. et Godr. Fl. Fr.* ii. 149 (exc. Syn.).
Pyrethrum inodorum β. salinum, *Wallr. Sched. Crit.* 485.
Pyrethrum maritimum, *Sm. Fl. Br.* ii. 901, and *Eng. Fl.* iii. 452; *Eng. Bot.* t. 979; *Wilson in Hook. Journ. of Bot.* i. 271.
Tripleurospermum maritimum, *Koch, Syn.* ed. 2. 1026?

This plant is often very spreading and very fleshy. Its central upright or ascending stem does not bear nearly so large a proportion to the spreading and usually prostrate branches as is the case in typical *M. inodora*. In that the branches are usually very short absolutely, or at all events relatively to the upright central stem, and usually, if not always, ascend; in the variety *salina* the branches are frequently so much developed as to greatly exceed in length the primary stem, which is thereby weighed down and rendered distinguishable by careful observation alone. From inhabiting the sea-shore it has usually been called *P. maritimum*, but seems to differ materially from the plant of Dillenius to which that name was intended to apply. The receptacle is scarcely twice as long as broad, but is not constant in shape. Segments of the leaves furrowed beneath and opposite or alternate. Rachis of the leaves with a broad furrow enclosing a keel beneath.

Smith's *P. maritimum* is placed under this variety on account of his description and the figure in 'English Botany' agreeing far better with it than with the *M. maritima*. He intended to include the Dillenian plant, but appears to have been scarcely, if at all, acquainted with it. In Hooker's 'Journal of Botany' (*l. c.*) the accurate Mr. W. Wilson remarks, "Stem certainly not hollow. Segments of the leaves not wholly destitute of points. Seeds [fruits] of the ligulate florets with a deeply 4-lobed cup-shaped crown, below which, externally, are two yellow oblong bodies extending halfway down the seed, which is not in that part furrowed, though it is deeply so on the other side. Segments of the tubular florets keeled at the back, the line very prominent just below the apex of the segment. I consider it a mere variety commonly found on the sea-shore." An authentic specimen from him is the *M. inodora β. salina*.

M. inodora grows on cultivated land and waste ground. *β.* is found by the sea.

2. *M. maritima* (Linn.); stem diffuse, leaves pinnate, leaflets and segments opposite fleshy linear bluntish short, basal leaflets few small separated from the others, heads solitary, phyllaries oblong blunt with a scarious (pale) entire margin, fruit with two elongated glandular spots just below the elevated lobed border.

M. maritima, *Linn. Sp. Pl.* ed. 1. 891, ed. 3. 1256; *Fries, Mant.* iii. 115, et *Summa*, 186, et *Herb. Normale*, xii. 2!

Chamæmelum maritimum perenne humilius, foliis brevibus crassis, obscure virentibus, *Dill. in Raii Syn.* ed. 3. 186. t. 7. f. 1; *Linn. Iter w. goth.* 148.

Stems much more branched near to the base, often prostrate, much shorter than those of *M. inodora.* Rachis of the leaves only slightly enlarged at the base, and furnished there with very few and short leaflets; these are followed by a long naked space, after which the rest of the leaflets are placed at pretty regular intervals and are nearly equal in size. The involucre appears to be flat. Phyllaries with their scarious border pale or narrowly fringed with pale purple. Radiant florets oblong, shorter in proportion than those of *M. inodora,* notwithstanding the heads being usually smaller, rounded and entire, or faintly 3-crenate at the end, white. Disk yellow. Receptacle hemispherical. Fruit with three prominent smooth ribs; an intermediate rough space externally, but no internal spaces (the whole internal surface being occupied by the smooth ribs); less compressed at the border, and more square than that of *M. inodora.*

I had the pleasure of having this plant shown to me by my friend Mr. Borrer growing at the place, Cockbush near West Wittering, on the coast of Sussex, where Dillenius found it; and am indebted to him for pointing out to me the probability of its being distinct from the *Pyrethrum maritimum* of Smith. I am also much indebted to the celebrated Fries for a specimen of the authentic *M. maritima* of Linnæus. These two plants agree very well, although it may be doubted if the Swedish plant is not more upright than that of England. Fries lays much stress upon the "ligulis nervoso-striatulis" of his *M. maritima,* a character which is well shown in his specimens. I do not find that the *M. maritima* of Sussex is so characterized. I possess a specimen, gathered in the island of Lewis, one of the Hebrides, which has its rays marked in that manner, but it is certainly not the *M. maritima* of Fries, and does not appear to be distinguishable from *M. inodora β. salina,* with which it agrees in having large flowers with long rays, umbilicate involucres, fuscous-edged (but usually entire) phyllaries, and similar leaves.

I have not seen any specimens of the true *M. maritima* from any British locality except West Wittering.

I may be allowed to express a hope that these remarks will direct the attention of botanists to the maritime *Matricariæ*, and thereby determine the points that remain doubtful, the value of their claims to distinction, and also their true distribution in Britain.

6. Myosotis alpestris.

Having had occasion to refer to the *Myosotis alpestris*, it may be allowed, and indeed seems desirable, to take this opportunity of correcting an error into which I have fallen concerning it. A careful examination of the materials in my possession, combined with a belief that good botanists who were acquainted with *M. suaveolens* and *M. sylvatica* could scarcely fail to see their distinctness, caused me to express an opinion that the *M. alpestris* of Schmidt, which so many authors of high repute have combined with *M. sylvatica*, was probably a mountain form of it, and to be specifically separated from *M. suaveolens* (Kit.). In that view I was confirmed by specimens of *M. montana* of Besser, which is usually placed under *M. alpestris*, being apparently a form of *M. sylvatica*, with which Besser himself (Prim. Fl. Gal. Aust. i. 142) identifies it; and also examples of *M. lithospermifolia* (which is usually considered as identical with *M. alpestris*), gathered in Lucania and sent to me under that name by Prof. Gasparrini, proving to be *M. sylvatica*. Having now acquired much fuller information upon the subject, I find that *M. alpestris* of Schmidt and *M. suaveolens* of Kitabel must be considered as identical; and the mistake of separating them may be perhaps excused by the difficulties caused by wrongly named specimens and the insufficient descriptions of the older botanists. Tausch has done his best to separate them (Bercht. Fl. Böhm. ii. pt. 2. 123 & 124), but, notwithstanding his long descriptions, has failed to point out any available differences; indeed he has quite overlooked the attenuated base of the calyx and the absence of a keel from the fruit; although these are apparently the points upon which the most confidence is to be placed as distinguishing *M. alpestris* from *M. sylvatica*. It should be added, that for the latter character we are indebted to Dr. Godron (Fl. Lorr. ii. 129; Fl. Fr. ii. 533).

7. Thymus Serpyllum.

Fries, in the year 1814, in the 1st edition of his 'Novitiæ' (p. 35) gave a short but very imperfect character of a new plant named *Thymus Chamædrys*, reserving, as he states, the description of it for a future opportunity. This opportunity does not seem to have occurred until 1828, when, in the second edition of the same work (p. 195), he treated at considerable length upon the *T. Serpyllum* of Linnæus and his own *T. Chamædrys*. Since the latter period these plants have been a subject concerning which botanists have greatly differed in opinion, most writers considering that they were only varieties of one species, but a few following the example of Fries and distinguishing them. This diversity of view has probably originated from that majority not being acquainted with the living plants: the attainment of such a knowledge has been the cause of my own change of view. These plants well illustrate the difficulty which those solely, or chiefly, acquainted with allied species as preserved in an herbarium may have in appreciating their real distinctness. In this instance the technical characters to be found in books are scarcely sufficient for the separation of the plants, even when specimens of each are before the student; for it is found that the differences in the shape of the leaves, calyx, corolla, &c., and the distribution of the pubescence, are not so constant as to allow of certain dependence being placed upon them. It is to the habit of the plants that we must turn for a satisfactory distinction, and unfortunately that is seldom to be well seen in a dried specimen, although most marked in the growing plant. In *Thymus Serpyllum* there is a manifest difference between the flowering shoot and that which is intended to extend the plant. Quite prostrate and rooting shoots are produced each year, which grow from the end of the shoots of the preceding year, and do not flower: also there spring from the other axils of those old prostrate parts of the plant short erect or ascending shoots, which form a linear series, and of which each terminates in a capitate spike consisting of a very few whorls, and which die back to their base after the seed has fallen. The growing shoot is thus seen to be perennial and ultimately becomes woody, but the flowering shoot is annual. In very vigorous plants the growing shoot is sometimes seen to branch in a pinnate manner, and the flowering shoot similarly to produce short branches terminating in small capitate spikes, but their character as essentially growing and perennial, and flowering and annual shoots, is not altered by their luxuriance. This mode of growth causes the plant (especially if kept clear from weeds, as is the case in a garden) to present the appearance of a cushion of flowers surrounded by a prostrate fringe of leafy shoots.

In *T. Chamædrys* there is no such manifest separation into flowering and growing shoots, but they all are alike in their origin and appearance. The terminal bud often produces the strongest shoot, which itself ends in flowers, but has usually barren branches from some of its axils. It thus differs most materially from the *T. Serpyllum*, in which the terminal bud always produces a flowerless shoot to form the foundation for the flowering shoots of the succeeding year, and to terminate in a similar leaf-bud to that from which it sprung. A tuft of *T. Chamædrys* therefore has none of the beautiful regularity possessed by one of *T. Serpyllum*, but presents, from the centre to the circumference, a dense irregular mass of leafy shoots and flowers intermixed. In the autumn or winter these leafy shoots fall towards the ground, and such of them as become buried produce a few roots, increase in a cæspitose manner in the succeeding year and throw up intermixed leafy and flowering shoots. The flowering shoots do not usually die back to their base, as in *T. Serpyllum*, but only as far as the first axil in which a leaf-branch or its rudiment has been formed.

If these differences in the mode of growth be attended to, there can be no difficulty in distinguishing the plants, and, as I think, in being convinced of their specific distinctness. Unfortunately, however, it often happens that the plants grow so closely packed with other plants, that they have not room in which to show their true habit, and it is then not unfrequently rather difficult for an inexperienced person to determine which of the species is before him. This cannot take from the value of the difference of growth, but only adds to the difficulty of the botanist.

It has been already stated that the whorls of the flowers of *T. Serpyllum* are often so closely packed as to look like a short glomerule or head, although generally the one or two lowest placed whorls are at rather a greater distance apart than the rest. In *T. Chamædrys* the head is oblong, being formed of very much more numerous whorls, its lower part is usually much more lax, and there are several, often many, distant whorls below it.

The plants may be characterized as follows:—

1. *T. Serpyllum* (Linn.); *stems prostrate creeping*, leaves oblong or lanceolate narrowed into the flat fringed stalk, floral leaves similar, *flowering shoots ascending, flowers capitate*, upper lip of the calyx with three short triangular teeth, lower lip of two subulate teeth, *upper lip of the corolla oblong.*

T. Serpyllum, *Linn. Fl. Suec.* ed. 2. 208, et *Sp. Pl.* ed. 1. 590; *Sven. Bot.* t. 320; *Wahl. Fl. Suec.* 377 (excl. var. β.); *Reich. Fl. excurs.* 312, et *Fl. exsic.* no. 187!; *Fries, Nov. Fl. Suec.* ed. 2. 195, et *Herb. Norm.* v. 7!, et *Summa*, 197; *Eng. Bot.* t. 1514; *Curt. Fl. Lond.* i. 120; *Gren. et Godr. Fl. Fr.* ii. 657; *Hook. and Arn. Br. Fl.* 311; *Guss. Syn. Fl. Sic.* ii. 95.

T. angustifolius, *Pers. Syn.* ii. 130; *Reich. Fl. excurs.* 312, et *Fl. exsic.* no. 186!; *Wimm. et Grab. Fl. Siles.* ii. 165; *Ledeb. Fl. Alt.* ii. 390; *Spr. Syst. Veg.* ii. 696.

T. Serpyllum γ. angustifolius, *Koch, Syn.* ed. 2. 641.

Stem woody, much branched, prostrate, rooting, producing in its second year the erect annual usually short flowering shoots from the lower joinings, and a prostrate flowerless woody and persistent shoot resembling itself from the terminal or a few other buds at its end. Leaves narrowed in their lower half which together with the petiole is often fringed, rather conspicuously nerved beneath, often narrow. Whorls of flowers collected into a small terminal head, the lower ones being usually only slightly separated from the others. Upper lip of the corolla quadrangularly-oblong, conspicuously notched. Nuts globose, mealy, with a basal scar.

This plant varies considerably in appearance owing to the breadth of its leaves being inconstant, and individuals of it differing greatly in hairiness, but it is believed that the character derived from its habit may be depended upon. The nuts afford an apparently constant although minute distinction. The form of the upper lip of the corolla is stated by Bentham to vary, but it has proved constant as far as my observations have extended.

It appears to be quite certain that this is the true and exclusive *T. Serpyllum* of the 'Fl. Suec.' and the 1st edition of the 'Sp. Pl.' of Linnæus. His words in both of those works are—"T. floribus capitatis, caulibus repentibus, foliis planis obtusis basi ciliatis." In the 2nd edition of the 'Sp. Pl.' he altered the word "repentibus" into "decumbentibus," intending perhaps thereby to include the plant now called *T. Chamædrys*, in which the stems cannot well be said to creep, although they do ultimately become decumbent. In his herbarium there are several specimens upon papers pinned together; they consist of examples of the plants called *T. Serpyllum*, *T. angustifolius* and *T. Chamædrys*, but that which is marked with pencil and also with ink as intended to correspond with the 'Sp. Pl.' ed. 1. is the *T. angustifolius* of Persoon, and therefore the plant described above as the true *T. Serpyllum*. The above synonymy also shows that this is the plant called *T. Serpyllum* by the best writers. Bentham (Lab. 343, 344, and in DeCand. Prod. xii. 201) combines the *T. Serpyllum* and *T. Chamædrys* of Fries to form his *T. Serpyllum*, but doubtfully separates from it the *T. angustifolius* of Persoon. It will have been already seen that I believe him to be in error (resulting from a neglect by most authors of the habit of the plants); for although he has rightly separated the *T. angustifolius* from *T. Chamædrys*, he has erroneously distinguished it from *T. Serpyllum*, and also incorrectly joined the *T. Chamædrys* with the latter.

This plant inhabits heaths and dry barren ground, flowering throughout the summer. I have specimens from Thetford, Suffolk; Gogmagog Hills, Cambridgeshire; Isle of Wight; Bath;

West Cornwall; Barmouth; Snowdon; Orkney Isles; S. Isles of Arran, Co. Galway; and the coast of the county of Antrim.

2. *T. Chamædrys* (Fries); *stems similar* diffuse ascending 2–4-fariously hairy, leaves broadly ovate with a flat winged stalk, floral leaves similar, flowers whorled and capitate, upper lip of the calyx with three triangular teeth, lower lip of two subulate teeth, *upper lip of the corolla semicircular.*

T. Chamædrys, *Fries, Nov.* ed. 1. 35, ed. 2. 197, et *Summa,* 197, et *Herb. Norm.* v. 6!; *Reich. Fl. excurs.* 312, et *Fl. exsic.* no. 188 et 189!; *Gren. et Godr. Fl. Fr.* ii. 658.

T. Serpyllum, *Wimm. et Grab. Fl. Siles.* ii. 163; *Ledeb. Fl. Alt.* ii. 391; *Spreng. Syst. Veg.* ii. 696; *Bieberst. Fl. Tauro-Cauc.* iii. 402 (non *Linn.*).

Stems woody, slightly and irregularly branched, procumbent or ascending, not creeping but rather cæspitose, producing leafy stems and flowering shoots irregularly. Leaves ovate, usually broad (and some rounded) below, or very shortly narrowed into the petiole which is fringed, less prominently nerved than those of *T. Serpyllum.* The lower whorls of flowers distant, the uppermost usually forming a large oblong head. The upper lip of the corolla is semicircular and appearing to be quite entire, but has usually a deep notch in its centre, having the sides so placed as to touch each other and become unapparent except upon minute inspection. Nuts roundish, a little compressed, with a basal apiculus, reddish.

The plant now under consideration varies even more than *T. Serpyllum,* but the variations are unfrequent. In its usual state the stems ascend with a curve so as to present the top of the spike to the eye. This spike, of which the joints are shorter than the length of each of the cymes forming the false whorl, is generally about an inch in length (rather more than less), and has below it from one to four distant whorls of flowers. The extreme variation from this type is seen in a plant called *T. sylvestris* by Schreber as we learn from Reichenbach, which was gathered by Mr. Borrer and myself in a damp hollow on Box Hill. In this curious plant the stems are long filiform and nearly simple, with very many distant whorls of flowers and no trace of a terminal spike or head. Its leaves are all large and very broad (the length being to the breadth relatively as three to two in many instances), and their presence at the end of the stems where they quite hid the young flowers gave a very peculiar appearance to the plant. The shape of the leaves, the structure of the flowers, and the form of the seeds, show that this singular plant is a state of *T. Chamædrys.*

In this species also the form of the upper lip of the corolla and that of the nuts has proved constant in every specimen that I have examined, although the notch in the former is sometimes found to be open. The general shape also of the leaves is probably to be trusted, viz. that their broadest point is above the middle in *T. Chamædrys* and below that point in *T. Serpyllum*. It does not appear to me that the same confidence can be placed in the distribution of the hairs upon the stem; for I find that although the stem of *T. Serpyllum* is often uniformly hairy, its hairs are also not unfrequently arranged in two or four rows, the intermediate spaces being glabrous. It was this fact which led me erroneously to suppose that the common British plant ought to be considered as the *T. Chamædrys* of Fries, and caused me to so name it in the 3rd edition of my 'Manual.' In the 'Fl. Silesiæ' (p. 167) attention is justly directed to the fact that in *T. Serpyllum* the elongated forms have the more slender shoots, whilst in *T. Chamædrys* the more extended the shoots the thicker they become.

I possess *T. Chamædrys* from the Devil's Ditch in Cambridgeshire; Box Hill, Surrey (*T. sylvestris*); and How Capel, Herefordshire. It flowers throughout the summer, and, I think, likes rather a damper and more shaded situation than its ally.

In all probability these two species will be found throughout the kingdom, but it is to be desired that botanists should carefully note their presence in all parts of the country in order that their true distribution may be ascertained.

XXVII. *On the Occurrence of Palms and Bambus, with Pines and other Forms considered Northern, at considerable elevations in the Himalaya.* By Major Madden, H.E.I.C.S., F.R.S.E.

Read 10th March 1853.

Having resided for several years in the British portion of the Himalaya Mountains, and more especially in the province of Kemaon, which borders on the Nepalese territories, I possessed opportunities for examining its botany, which up to that period had been investigated by native collectors only, and was thus enabled to determine the western extension of a number of plants, the existence of which had hitherto been supposed to be limited by Nepal. Among these were several palms, on the distribution and association of which, and the inferences to be drawn therefrom, I propose to lay before the Botanical Society a few facts for its consideration.

1. The most common of these palms is one which Dr. Royle has designated *Phœnix humilis,* and which he supposes may be identical with *Ph. acaulis* of Roxburgh, and which is probably a mere variety of *Ph. sylvestris,* the wild date tree of India, useless for its fruit, but yielding abundance of sap, which, in Bengal, is largely employed in the manufacture of sugar. *Phœnix humilis* occurs in great abundance and beauty in the forest belt all along the base of the mountains, up the warm valleys of the great rivers, and ascends the mountains to 5500 feet, being plentiful at that elevation in the vicinity of Almorah, the capital of the province, and in one or two instances which came under my observation reaching even a thousand feet higher. In its dwarfed form, *Phœnix humilis* is found at least as far N.W. as the Sutluj river, and is the only one of the family which, probably owing to the aridity of the climate, is to be met with in that region*. In several places in Kemaon (Dwarahat for instance)

* Advancing to the N.W. however, in the Khybur Pass, and generally in the low, arid, mountainous parts of Eastern Afghanistan and Beloochistan, in north latitude 26°–35°, we find abundance of *Chamærops Ritchiana,* Griffith, *Maizurrye* of the Afghans, a dwarf species seldom above 2–3 feet high, and if not identical with, closely allied to *Ch. humilis,* the only European palm flourishing in very nearly the same latitudes, and in a very similar climate.

I noticed its arborescent state (*Phœnix sylvestris*), attaining the height of 40 to 50 feet at an elevation of 5000 feet above the sea, surrounded at no great distance by extensive forests of *Pinus longifolia* and *Quercus incana,* the inferior limit of the former tree being about 2000 feet above the sea-level.

2. *Harina* (*Wallichia*) *oblongifolia,* a very beautiful palm, first described by Mr. Griffith, and observed by him in Assam. This I found in abundance in the damp and very warm valleys of the Surjoo and Kalee rivers, near the Nepalese frontier at Burmdeo, and for many miles up the interior, but never ascending higher than 3500 or 4000 feet on the mountain sides, and only where the localities afforded abundance of shade and moisture. To the N.W. of the province it occurred in the Bumouree Pass, and in the valleys below the recently formed station of Nynee Tal; and still further west, it just reaches the Patlee Doon, a valley in the S.E. of Gurhwal, beyond which a careful examination failed to detect any trace of it. This palm, the leaves of which bear a great resemblance to those of *Corypha* or *Arenga,* and afford a very durable thatch, forms dense thickets, and never attains the arborescent form.

3. *Chamærops Khasyana* (Griffith), of which a plant raised from seeds sent home in 1847 is before the Meeting, was first met with and described by Mr. Griffith in the Khasya (or Cosseeah) Hills between the plains of Bengal and the Burhampootra river. As this eminent botanist remarks, it comes very near *Ch. Martiana* of Wallich, a native of Nepal, at 5000 feet elevation; and further researches will, in my opinion, tend to the conclusion that they are, in fact, one and the same species.

Mr. Griffith's description as detailed in the Calcutta 'Journal of Natural History' is appended, with a few observations of my own to justify the opinion which I have formed of their identity.

As defined by this botanist, *Chamærops Khasyana* occurs in four localities of Kemaon, besides another (the Dhuj mountain), where I was informed on good native testimony of its presence in considerable quantities. Of these stations, the most remarkable for its elevation and the abundance and perfection of the palm is the Thakil mountain, named from it, an enormous mass of magnesian limestone reposing on clay-slate, in the eastern extremity of Kemaon, its loftiest summits attaining the elevation of 8221 feet above Calcutta: the base of the mountain, as marked out by the deep gorges of the Surjoo and Kalee rivers, only 1500 feet above the sea, and occupied by a tropical vegetation, cannot be under sixty miles in circuit. The zone of *Pinus longifolia,* which forms vast forests on its declivities, extends vertically from 2000 to about 7000 feet; the summits, for perhaps 400 feet, are denuded of all arboreous vegetation, and exhibit, as usual in the Himalaya, bare tracts of mere rock*, or meadows of luxuriant grass (*Rhaphis Roylei, Arundinella, hirsuta,* &c.), *Ophelia, Gentiana, Saxifraga, Primula,* &c. Below these comes the zone where flourish luxuriant forests of *Quercus incana, lanata* and *floribunda, Acer, Ilex, Pavia, Rhododendron, Andromeda, Symplocos, Taxus, Berberis,* and other northern forms; amidst these, in damp shady glens on the north and south-east, but chiefly on the north-west exposure, the *Chamærops* is found in great numbers, forming clumps and rows, the trees rising from 30 to 50 feet high, each with its superb crown of large flabelliform leaves, rattling loudly to the breeze. At 6 feet from the ground the stems are 2 feet in circumference, but become thicker above. The flowers appear in April and May, and the fruit, which is of a dark glossy blue, about half an inch long, ripens in October, and at the period of my visit (March 20, 1847) lay strewed in abundance at the foot of the trees, where large beds of snow remained unmelted, and where rich beds of *Primula denticulata* were in full bloom. The lowest specimens observed were at about 6500 feet, but they reached their perfection in numbers and stature at 7800, from which we may fairly infer, that had circumstances been favourable by the addition of some thousand feet to the altitude of the mountain, they would have ascended considerably higher. But in the site actually occupied by them, the mean annual temperature cannot be under that of London†, and though the summer be very warm, snow generally covers the ground from November till March. On the ascent of the mountain, *Phœnix* was abundant both in its dwarf and arboreous forms at 4000 feet, while *Harina* forms extensive thickets in the river valley at its base.

The presence of *Chamærops* at such an elevation has its parallel in America, where, on the Andes of Quindiu and Tolima, in about 4° north latitude, Humboldt discovered *Ceroxylon Andicola* at from 5800 to 9500 feet, associated with a genus of Bambusidæ (*Chusquea*), which, as we shall presently observe, has more than one representative in the Himalaya also. He also informs us that on the western slope of Mexico, *Corypha dulcis* is mixed up in the forests of *Pinus occidentalis.*

Chamærops Khasyana appears also to occur on Dhuj mountain, a few miles north-east of the Thakil; on the Kaleemoudee range between the rivers Ramgunga and Goree; and in the valley

* A phænomenon, by the way, which illustrates the prophecy in Micah, iii. 12. "Therefore shall Zion for your sake be plowed as a field, and Jerusalem shall become heaps, and the mountain of the house as *the high places of the forest.*"

† *Ch. Martiana* has proved perfectly hardy at 19° Fahrenheit during the past winter. (Gardeners' Chronicle, April 9, 1853, p. 230.)

of the Surjoo near Bagesur. In the north-west of Kemaon I discovered dwarf specimens in two localities, viz. at the base of the Sutboonga mountain south-east of the Gagur Pass, in very dense forest at 6500 feet elevation; and on the Berchoola, a spur of Bhutkot mountain, considerably further in the interior, and at about 8000 feet elevation. In neither of these stations could I find any examples with stems beyond a foot or two high, and this circumstance, as well as the fact that inquiry and investigation failed to detect any trace of their extension to the north-west, leads me to conclude that these points form the limit of the species in longitude. I must add, however, that in a paper addressed to Baron von Humboldt, the late Dr. W. Hoffmeister states that in the province of Gurhwal, on the descent from Dhunpoor to the Alacananda river (the main arm of the Ganges), he came upon a forest of *Pinus longifolia* at 6800 feet; "and it is very remarkable that the *Chamærops Martiana* (Wallich) is here in immediate contact with it, some tall stems of that palm being even scattered in among the pines" (Travels in Ceylon and India, English Translation, p. 495). But in 1849 I went over this very ground, and on the most careful scrutiny no such trees were to be seen or heard of; and it is certain that in his letters written on or near the spot, as well as in the 'Synopsis of Vegetation' (pp. 307, 507) for this very route, no palm is mentioned except *Phœnix humilis*, which I myself also found to be common and occasionally arborescent; and such I doubt not is what Dr. Hoffmeister really intended. I had the pleasure of meeting him at Simla the same year (1845) that he made his journey, and being then engaged in some researches on the Coniferæ of the Himalaya, and having never then visited Kemaon and south-east Gurhwal, he very kindly furnished me with some brief memoranda on their occurrence in those districts; and here too I find *Phœnix humilis* alone mentioned in the locality specified. Hence I am justified in considering the stations on Bhutkot and Sutboonga in Kemaon, as the most westerly at which *Chamærops* has hitherto been observed*. A species of *Musa* (plantain or banana) is indigenous and abundant at a considerable elevation (7000 feet) in the eastern Himalaya north of Assam, and nearly to the same level in Sikkim: I have observed it only in one spot

* A species of *Chamærops*, called Hemp Palm, has recently been discovered by Mr. Fortune in the northern provinces of China, Chekiang and Kiangnan, where the winters are excessively cold. Plants sent to Kew in 1848 have "braved unharmed, and unprotected by any sort of covering, the severe winter now passed, 1849–1850" (Bot. Mag. March 1850, quoted in Proceedings of Bot. Soc. May 13, 1852). If this be *Ch. Martiana*, it proves the great extension and hardiness of that species; if different, it affords an additional corroboration of the line of argument adopted in the text.

in Kemaon, the Bylchheena Pass, at about 4000 feet elevation, and was told that it occurred much more abundantly at a short distance, in the valley of the Kalee; but as I had not time to verify the report, it need not be more than thus briefly alluded to*.

There is however one more genus of the Monocotyledones, and allied to the Palms, worthy of introduction here, from the very great elevation to which it reaches in the Himalaya, and from its affinity and resemblance to the tropical genus *Bambusa*; I allude to the genus *Arundinaria* of the section Bambusidæ, of which at least four very distinct species occur in the Himalaya, and which have been referred to a new genus (*Thamnocalamus*) by my friend Dr. Falconer. They are familiarly known to European residents in the mountains as the "hill bamboo," and to the mountaineers of Gurhwal as the "Ringal," altered to "Ningala" in Kemaon. Of these, the lowest species in the vertical section is *Arundinaria falcata*, growing from 3500 to 8500 feet, and, like the rest, forming extensive and close thickets. The second is the *Arundinaria utilis* of Mr. Edgeworth, the Deo Ningala (or divine Ningala) of the natives, occurring from 7000 to 9000 feet. The third is variously named Geewasa, Purkha, Jhoomra, Surura (Jurboota in Nepal, where all these species are also found); I am not aware that this is yet described; but its principal difference from the next is that the stems are solitary, not in clumps: it occurs from 7000 to 10,000 feet. The fourth species is the Tham, in Nepal Khaptur, also undescribed, at least unpublished, which has its zone from 8500 to 11,500 feet; only 500 feet, or less, below the inferior limit of the perpetual ice of the glaciers, and, with the second and third species, occupying nearly the entire zone of *all* the coniferous trees of the Himalaya, *Pinus longifolia* excepted, which is below them†. The most useful and remarkable of the four is *Arundinaria utilis*, which grows in fine clumps of many slender stems, from 20 to 40 feet high, ex-

* I am not aware of the exact locality in Nepal of the arborescent fern, *Alsophila gigantea*, but near Darjeeling in Sikkim, immediately to the east of that country, Dr. Hooker states that it flourishes between 4000 and 7000 feet above the sea; 6500 being there the upper limit of the palms; a species of *Caryota* reaching up to 6000, and *Calamus* as high, forty miles within the mountains; while *Pothos, Musa, Ficus, Piper* have species from 2000 to 7000 feet, and *Ficus* one species to 9500. But in the humid equable climates of the southern hemisphere, Australia, New Zealand, Tasmania, the arborescent ferns reach a much higher parallel of latitude, and attain the height of 40–50 feet.

† "Bamboos in the general acceptation of the term (for remotely allied genera bear the same trivial English name) occur at all elevations below 12,000 feet, forming even in the pine woods, and above their zone, in the skirts of the Rhododendron scrub, a small, and sometimes almost impervious jungle." (Dr. J. D. Hooker, Excursion to Tonglo Mountain in Sikkim: Journal As. Soc. Bengal, May 1849, p. 424.)

tremely durable and applied to a great variety of purposes. The plant, like the true bambu, flowers but rarely, and the stems then die and fall. I was fortunate enough to collect considerable quantities of the seed near Pindree in 1846, which has, I believe, produced all the plants living in Great Britain and Ireland: three years afterwards, in a second visit to the alpine Himalaya, the stems which had fallen and died in that season were still perfectly sound, and I believe that the third and fourth species are nearly if not altogether as durable, but they never attain the stature of the Deo Ningala.

The bearing of the foregoing facts on the phænomena of geology is so obvious as to require little comment; the considerations most pressing on our attention being the necessity of great caution in drawing inferences as to the nature of climate from the presence of supposed tropical forms in ancient rock formations, and the facility with which we can now account for the juxtaposition of those forms with those of known temperate regions.

Here are palms, bambus, bananas growing amongst and above pines, firs, cedars, cypresses, yews, oaks*, maples, hazels, ash,

* It must be remarked, however, that the oak, the pine, and other common Northern forms are even less justly adduced as the criteria of a cold climate than the palms are of a hot one. Our own *Quercus robur*, the Himalayan *Q. semecarpifolia*, with several Mexican and other species, flourish exclusively in low temperatures, but the great majority of the Indian species are natives of the moist warm regions of Nepal, Silhet, the Garrow and Khasya hills, Chittagong, Tenasserim, Martaban, Penang, &c. Such are sixteen out of the seventeen species enumerated by Roxburgh in the 'Flora Indica.' Professor Liebmann remarks (Oak-Vegetation of America, translated in Hooker's Journal of Botany and Kew Miscellany for 1852, p. 322): "It has hitherto been a prevailing notion that the oak-form is peculiarly characteristic of the temperate zone. But whether we look at the number of species, the beauty of the forms, or the size of particular organs (leaves, fruits, cups), we shall find their maximum in the tropical zone, that is, in the Sunda Islands of the Old World and tropical Mexico of the New." So also in the Himalaya, *Ulmus erosa* occurs at from 8000 to 10,000 feet; another species, erroneously as I think identified with the Chinese *Ulmus virgata*, between 6000 and 7000 feet; a third in the hot valleys of Kemaon at 3000 feet; and a fourth, *Ulmus integrifolia*, allied to the last, abounds at the base of the mountains and all over the plains of India down to Coromandel and Guzerat. In the same warm plains we find *Ranunculus sceleratus*, as common and as luxuriant down the Ganges to Bengal as in Scotland: a *Clematis* (*C. Gouriana*) is so named from the old capital of Bengal where it was first discovered: a fine rose (*R. involucrata*) is wild in Behar at the foot of the Rajmahal hills: a blackberry (*Rubus distans*, Don) is found below the base of the Himalaya; while *Potentilla supina* and *Heynii* abound along the Ganges to Calcutta. Of the Coniferæ, several genera and species are confined to high temperatures; *e. g. Pinus longifolia* grows well at Calcutta, but perishes in our climate. *P. sinensis* flourishes on the coast of China, at Canton, and south of it. "One true pine is shown to be a native of Sumatra, *Pinus Merkusii*, Jungh. et De Vriese, Pl. Ind. Or. fasc. 1. tab. 1, probably the *P. Finlaysoniana* of Wal-

and almost all the deciduous trees proper to a cold region of the globe. During violent storms and heavy rains it cannot but happen that some of these should be overthrown and buried beneath the huge landslips so prevalent at such crises, and there become fossilized to the perplexity of a succeeding race of geologists! Their difficulties and their errors might easily be enhanced and fortified by the addition of a very possible contingency in the animal kingdom, viz. the presence of the larger carnivora. The leopard is a constant and only too troublesome inhabitant of the Himalaya up at least to 9000 feet, and commits great depredations on the flocks. The tiger, too numerous at the base, and in the hot valleys of the Kemaon and Gurhwal mountains, is, I think, merely an occasional, though by no means very rare, visitor at that altitude in search of the

lich, Cat. no. 6062, from Cochin China " (Kew Miscellany and Journal of Botany for April 1851, p. 127). The genera *Dammara, Podocarpus, Dacrydium,* have their greatest number of species in Nepal, Khasya, Malacca, Java, Penang, and Amboyna; even *Juniperus* has a species in Barbadoes (*J. Barbadensis*), and another (*J. aquatica*) at Canton; while *Cupressus glauca* is a native of Goa; *C. sempervirens* is quite at home at Agra, with *Thuja orientalis.* The Coniferæ, in short, are, as Dr. Lindley remarks (Vegetable Kingdom), "natives of various parts of the world, from the perpetual snows and inclement climate of Arctic America to the hottest regions of the Indian Archipelago."

On the other hand, several tropical genera besides those noted in the text have species at great altitudes in the mountains. Thns *Indigofera* has in the Himalaya *Indigofera pulchella* at 5000 feet, *I. heterantha* at 7000, and *I. Gerardiana* (*Dosua*, Don?) to 10,000; all large shrubs and forming extensive thickets. The beautiful *Acacia Julibrissin* ascends to 6500 feet. Dr. Hooker remarks (Journal of As. Soc. Bengal for May 1849, p. 426), that the general prevalence of bamboos, figs, and their allies the nettles, is a remarkable feature in the botany of the Sikkim Himalaya up nearly to 10,000 feet; "one species of this very tropical genus (*Ficus*) ascends almost to 9000 feet, on the outer range of Sikkim;" as *F. laurifolia* does to 6500 feet in the N.W. Himalaya. Gardner notices with surprise and admiration the prevalence of numerous species of this genus forming splendid trees in the forests of the Organ mountains, near Rio Janeiro. Of Laurineæ, *Cinnamomum* has one species in Sikkim to 8500 feet, and *Tetranthera* another to 9000 (Hooker, *l. c.*); while in the N.W. Himalaya, *Daphnidium, Litsæa,* &c. have species to the same elevation. In Sikkim, Dr. Hooker mentions *Balanophora* with species at 6000, and one even to 8000 feet; and Dr. Thomson found it near Kotgurh, thirty miles north of Simla, between 6000 and 7000. Of the generally tropical family Cinchonaceæ, the true Cinchonas reach 10,000 feet or more in South America; just as in the Himalaya I found *Leptodermis lanceolata* at 10,000 feet on Dudutoli mountain in Gurhwal. But these anomalies are far too numerous for a note. I must add, however, that the physical conformation of the Himalaya of itself greatly favours the probability of tropical and temperate forms becoming associated by storms, torrents, &c.; for while the deep warm valleys which penetrate fifty or sixty miles towards the summit line are filled with a tropical or semitropical vegetation, the lofty ranges which divide them are clothed with forests of the temperate types.

larger deer; I have myself several times seen their footprints on the snow, with other marks of their having passed between 8000 and 9000 feet; at which elevation one friend of mine *met* a tiger in a thicket of Deo Ningala; and another who was on a shooting excursion fired at and wounded one up as high as 10,000 feet. Now, it is not at all impossible that one or more of these should perish in a storm and be buried in the same deposit as the palms and conifers, &c., and thus render the problem greatly more complicated.

So much for the mountains and the subtropical forms which flourish there; but the same result will be equally brought about in the hot plains of India by the transport of the northern plants through the agency of rivers and torrents. The Khasya hills, where Griffith first met the *Chamærops,* rise like a wall from the flats of Bengal, and in many parts of the Himalaya the exterior range rises in precipices to the height of 6000 to 8000 feet, clothed to the brink with oak, ash, maple, pine, cypress, Siberian crab, &c.: immediately beneath is the vegetation of the tropics. The cliffs are wearing slowly back, and many of these oaks, &c. must be carried down by their own weight and by the torrents to form the most heterogeneous mass with the Naucleas, Cinchonas, Vaticas, of the *Terai* Belt.

These reflections are forced on the mind at once in such localies as Nynee Tal Station in Kemaon.

But we may safely extend our view to the lower course and deltas of the three great rivers which ultimately drain the Himalaya, the Indus, the Ganges, and the Burhampootra. Mooltan and Sindh, on the first of these, are in many places covered with groves of *Phœnix dactylifera* and a forked palm, which I suppose to be *Hyphæne Thebaica,* the Doom palm of Upper Egypt: Behar on the Ganges, in like manner, abounds in the fine palm *Borassus flabelliformis*; and in Bengal, *Phœnix sylvestris* and *paludosa, Areca Catechu,* and *Cocos nucifera,* often form great woods. Annually, during the floods, the great rivers bring down numbers of the Himalayan Coniferæ, which, were the country uninhabited, would be carried to the sea and deposited with the spoils of the deltas themselves in the new formations, which the mud and silt of these great rivers are known to be slowly depositing*. We should thus be presented with the association of

* I can speak from observation as to the number of pines brought down by the Sutluj; and as long since as the age of Alexander the process must have been the same, for the fleet with which he descended to the mouth of the Indus was constructed of them. There is a regular business in catching the floating trees, and not a very safe one; for such is the impetuosity of the rivers, that the men employed are sometimes drawn by the timber (to which they have fixed large hooks) into the current, and are infallibly lost.

palms and pines, the occurrence of which is so well ascertained in the coal-measures and far up into the tertiary series; and even though we were able to demonstrate that these trees were *in situ,* we have still the alternative to dispose of, that to the present day palms and pines actually flourish on the same ground, before we can legitimately argue from their juxtaposition any anomalous conditions of the atmosphere, differing greatly from our present experience. The existence of the mammoth in the cold regions of Northern Asia, provided with hair and fur to protect it from the severity of the climate, might, *à priori,* warrant a presumption of an analogous fact in the vegetable kingdom, namely the existence of palms, or other tropical families, so organized as to enable them to contend with a very low temperature.

This phænomenon now rests on actual observation, and is quite in accordance with facts in other branches of natural history, zoology, ornithology and conchology, where several familiar instances might be alleged of tropical genera with few, or even solitary species extending far into the arctic and antarctic zones, where their occurrence and discovery immediately and extensively modified, or even reversed, conclusions drawn from the presence in geological formations of cognate forms. And such uncertainty must continue to rest on the result of our researches, till, abandoning the maxim, absurd in science, that "the exception proves the rule," we cease to look too exclusively to genera, and allow to species their proper place and weight in our systems.

Description of the Palm referred to in the Text, from Griffith.

CHAMÆROPS KHASYANA.

"*Nov. Spec.* Trunco mediocri, petiolis per totam longitudinem denticulato-scabris, fibrillitio e fibris erectis rigidiusculis lamina reniformi-flabelliformi, profunde 60–65 partita laciniis induplicatis bilobis vel bipartitis lobis centralium brevibus obtusis recurvis, spadice (fructus) bipedali ramis primariis tribus, spathis subternis (basilaribus 2 rameo 1) pedunculum communem omnino tegentibus, fructibus oblongis livido-cæruleis.

"*Hab.* Khassya hills, on precipices at Moosmai and Mamloo. Alt. 4000 feet: not observed in flower or fruit.

"*Desc.** A palm of moderate height (the specimen measures 9–10 feet), the trunk 5 inches in diameter in the thickest parts, obscurely annulate. Under the *crown,* which is thick, is an

* Entire? specimen of a trunk and crown, and two fruit-bearing spadices; these have been unnoticed since the return of the Assam Deputation in 1836: seeds since received have germinated.

oblong mass (2 feet long) of flattened bases of petioles and their retia, which are of stiff fibres.

"Leaves about $3\frac{1}{2}$ feet long; *petiole* 18 inches long, with irregular denticulate margins; *lamina* flabelliform reniform (so is the entire part of the leaf), 2 feet long by $3\frac{1}{2}$ feet wide; divisions about sixty-five, the lateral ones shortest, 12 to 14 inches long, but the deepest divided (viz. to within 5–6 inches of the apex of petiole), linear, their segments $1\frac{1}{2}$–2 inches long, narrow, acute; central, ensiform, reaching to within 10–12 inches of the apex of the petiole, about 16 inches long, shortly and obtusely bilobed, segments about half an inch long, with recurved points; intermediate divisions also ensiform, about 18 inches long, their segments narrower and deeper than those of the central; young leaves covered with thick, white, paleaceous tomentum.

"*Spadix* (fruit-bearing) 2 feet long, nodding, compressed; the lower half concealed by the *spathes*, of which there are three, two common ones, and one to one of the main branches. They are coriaceous, brown, with oblique mouths and bilobed limbs: the lowest is about a foot long. *Branches* of the *spadix* quite exserted, quite naked, the terminal one quite dichotomous; divisions many.

"*Spikes* 4 to 6 inches long.

"*Fruit* scarcely baccate, $\frac{1}{2}$ inch long, $2\frac{1}{2}$ lines broad, solitary or 2–3 together, but of distinct carpels, oblong, inequilateral, obliquely apiculate at the apex, surrounded at the base by the calyx, which has a stout cylindrical base, and three deep, broad, oblong divisions, by a corolla of three cordate ovate petals, equal in length to the calyx, and by six sterile stamina; on one side may be found two abortive villous ovaries. *Seed* oblong, with the ventral face rather deeply furrowed, the furrow not reaching quite to the apex, reniform on a transverse section. *Albumen* with a scaly surface, along this line presenting a cavity filled with spongy tissue; horny, otherwise equal. Embryo in the centre of the dorsal face.

"This species is closely allied to *C. Martiana*; it differs in its shorter stature, the petioles toothed throughout, in the nature of the rete and the texture of the leaves, which is more like that of *C. humilis*. The paleaceous tomentum much more developed, and the berries are bluish, not yellow. The divisions of the leaves are much the same, excepting the secondary segments of the central division, which are shallow, obtuse and recurved." (The Palms of British East India, by W. Griffith, in M'Clelland's Calcutta Journal of Natural History, No. 19. October 1844, pp. 341, 342.)

Chamærops Martiana is described at length in the pages immediately preceding the above, and is said to occur at Bunipa in the valley of Nepal, at about 5000 feet above the sea-level. As Mr. Griffith observes, the two palms are very closely allied: in my opinion they may still turn out to be identical. Among the supposed differences, that of "shorter stature" in *C. Khasyana* is quite unfounded: as I have already noticed, it occurs on Thakil mountain 50 feet high, whereas *C. Martiana* is only quoted at 20: the differences in the leaves may be accidental, for while Mr. Griffith states the laciniæ of *C. Martiana* to be "glaucous underneath," and omits any mention of it in the description of *C. Khasyana*, I found it equally true of the latter on the Gagur range. His description of the inflorescence and fruit is (note to page 340) chiefly from Martius in 'Pl. As. Rar.' iii. p. 5. t. 211, where, however, Mr. Griffith pronounces that "the representation of the inflorescence is probably quite wrong" (p. 341): and I suspect that the "yellowish," not "blue" fruit, may merely be due to the immature stage in which the former were observed; such at least is the case in others of this family: for instance, *Phœnix humilis*, before mentioned as common about Almorah, which exhibits various shades of yellow when unripe, but as it matures becomes of a dark blue. This plant Mr. Griffith was inclined to identify, very justly I believe, with *Phœnix acaulis*, from which to *Ph. sylvestris*, the common wild date tree of India, he observes (p. 352) that *Ph. dactylifera* and *farinifera* form complete transitions. I adopt Dr. Royle's specific name *humilis*, in preference to *acaulis*, as the shrub has frequently a stem several feet high, and may occasionally be observed in all gradations up to a tree of 50 feet. Young plants of the dwarf variety proper to Almorah are now flourishing at the Botanic Gardens, Edinburgh, and Glasnevin near Dublin.

XXVIII. *Remarks on some Algæ belonging to the Genus* Caulerpa. By R. K. Greville, LL.D. &c.

Read 14th April 1853.

Among the Algæ collected by Dr. Wight on the shores of the Peninsula of India are various *Caulerpæ*. Of described species the following may be enumerated: *Caulerpa Lessoni*, Bory; *plumaris*, Ag.; *scalpelliformis*, Ag.; *sedoides*, Ag.; *Chemnitzia*, Lamour., and *Freycinetii*, Ag.

There are also two or three other species upon which I propose to offer some remarks. The first of these is the plant described by Agardh as var. *β. crassifolia* of his *Caulerpa taxifolia*; at least there can be no doubt that it is the form quoted by him, and figured by Turner in 'Historia Fucorum,' tab. 53, as *Fucus pinnatus* of Linnæus. I am, however, very sceptical of its having any specific relation to *C. taxifolia*, typical specimens of which I possess from Agardh and Hornemann. The frond of the latter is pinnated in a definite, symmetrical and uninterrupted manner, answering well, in fact, to Agardh's description: "pinnis æqualibus simplicibus fere horizontalibus, parallelis . . . . basi apiceque attenuatis, oppositis, approximatis." The Indian plant, on the contrary, is remarkably straggling and irregular in its habit; the pinnæ remote, often interrupted, unequal in length, and instead of being nearly horizontal are given off at a considerable angle, with a decurrent base. Turner has well remarked of this plant, that "young specimens are entirely destitute of pinnæ, and resemble in their naked filiform branches, as well as in their colour, texture and substance, battered plants of *Chara flexilis*." Judging from some of Dr. Wight's specimens, it is not improbable that even older individuals may retain this form when vegetating in situations unfavourable to their perfect development. It may be added, that, as far as I am aware, the true *C. taxifolia* is a native of the West Indies, while the Alga under consideration has only been found in the Red Sea and in the East Indies.

Presuming then that Turner and Agardh are correct in regarding our plant as the *Fucus pinnatus* of Linnæus, I venture to suggest that it take its place in the genus as *Caulerpa pinnata*. A figure representing the frond in a somewhat younger state than in Turner's work will be found in one of the plates which accompany this paper (Pl. I.).

Before I proceed to describe the remaining *Caulerpæ* referred to in Dr. Wight's collection, there is another Alga of which it is desirable to take some notice in connexion with the preceding species. This is a very beautiful plant which was communicated to me by Professor Mertens, many years ago, as collected at the island of St. Thomas in the West Indies, and likewise named *Fucus pinnatus* of Linnæus. It is, nevertheless, as far removed from *Caulerpa pinnata* above mentioned as from *C. taxiformis.* It is closely and regularly pinnate, the pinnæ oblong-obovate and more or less falcate as in *C. scalpelliformis,* but (unlike those of the latter) given off horizontally; and the frond is besides truly pinnate, not pinnatifid. For this plant I propose the following character :—

Caulerpa asplenioides (nobis) ; frondibus pinnatis, pinnis oppositis, subhorizontalibus, obovato-oblongis, falcatis, obtusis, abrupte apiculatis.
Caulerpa taxifolia, var. *crassifolia,* Ag.
Fucus pinnatus, L. Mertens in litt.

Although my friend Agardh has in his description of *C. taxifolia* quoted Turner's figure of *Fucus pinnatus* as a representation of his variety *crassifolia,* I cannot help assuming that he included our present plant also, for under *Caulerpa scalpelliformis* he remarks, " Simillima Caulerpæ taxifoliæ, var. crassifoliæ, sed distincta fronde magis confluente, potiusque pinnatifida quam pinnata, pinnis obtusis, crassis." I may add in conclusion that the stems and branches of *C. asplenioides* are comparatively tough and opake, and bear no resemblance to those of *C. pinnata,* which Turner has so graphically compared to battered plants of *Chara flexilis.*

In order to assist in confirming my views regarding these species, I refer to the illustrations on Plate III., viz.—

Caulerpa taxifolia. Fig. 1. A portion of the frond, natural size. Fig. 2. A portion magnified.
Caulerpa asplenioides. Fig. 1. A portion of the frond, natural size. Fig. 2. A pair of the pinnæ magnified.

Caulerpa laxa (nob.) ; frondibus simplicibus, ramentis lineari-clavatis apice rotundatis undique laxe imbricatis.
Hab. in mari Peninsulæ Indiæ Orientalis ; Wight.

This species is allied to *Caulerpa clavifera,* but is altogether a more slender plant. It has, indeed, a moss-like habit, at least after having been dried, quite unlike *C. clavifera,* with authentic specimens of which I have compared it ; and still more unlike

Fucus Lamourouxii and *Fucus uvifer* of Turner, which are considered as varieties of that species by Agardh. The ramuli vary considerably in different individuals with regard to their length and in the degree in which they are thickened upwards; but they are always gradually clavate and rounded at the extremity; a double character which at once separates it from *Caulerpa Selago* and its allies, including a beautiful new species (*C. furcifolia*, Harv.) collected in New Zealand by Dr. Sinclair, and presented to me by my friend Mr. William Gourlie.

Plate IV. fig. 1. *Caulerpa laxa*, natural size. Fig. 2. Ramuli magnified.

Caulerpa fissidentoides (nob.); frondibus compacte pinnato-pectinatis; pinnis adscendentibus, linearibus, obtusis, apiculatis, oppositis.

Hab. in mari Peninsulæ Indiæ Orientalis; Wight.

It is with very considerable hesitation that I venture to separate this plant from *Caulerpa plumaris*, and I confess that I am unable to define it satisfactorily. At the same time the habit is very different, closely resembling that of a gigantic *Fissidens*. It is more rigid and less slender in all its parts than *C. plumaris*, the pinnæ shorter and much less capillary, and although given off horizontally as in that plant, they immediately assume a more upward direction. The rachis too (if I may be allowed the term for convenience sake) is relatively broader, so that the pinnæ are often not more than equal to twice or thrice the width of that part. I am not disposed, however, to lay much stress upon the length of the pinnæ, because this character is extremely variable. In specimens of *C. plumaris* from the West Indies communicated by Agardh and Mertens, the pinnæ are very nearly twice as long as in other specimens from the East Indies and the Cape of Good Hope; and we must not forget that their extreme length (nearly 1 inch) forms the only specific difference of *Caulerpa longifolia*, an Australian species. With regard to the pinnæ of these perplexing forms I may further add, that, in not being attenuated at the base, they are completely separated from *Caulerpa taxifolia*.

Plate IV. fig. 1. *C. fissidentoides*, natural size. Fig. 2. A portion of the frond magnified.

END OF VOLUME IV.

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