Kew. ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

1922.

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ERRATA.

Page 66, line 21 from bottom, for *Wageneriana* read *Wagneriana*.

Page 177, line 3 from top, for DE read DER.

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No. 1] [1922

I.—THE DROUGHT OF 1921 AT KEW.

The year 1921 will long be remembered as one of the most unfavourable for the cultivation of hardy trees and shrubs at Kew. At the best of times Kew has much to contend against The site is flat and low-lying and consequently late spring frosts are very common. Last spring they did great damage. The soil is thin and poor and but ill-adapted to resist the effects of drought, and the evil effects of the sulphur-laden smoke of London can only be realised by those who live on this or similar spots. These conditions are perennial, but added to them during 1921 was a drought unprecedented in the memory of living man. During most of the time from April onwards the weather was sunny. The hottest period of the year was from July 9th to July 20th. During these twelve days the thermometer registered over 85° on eight days, and on three days 90° or more. The hottest day was July 10th, when a temperature of 92·5° was reached. On many days the heat was accompanied by a dry east wind.

During the year the rainfall has been very far below the average as the following table indicates and the soil a few inches below the surface is still, at the close of the year, quite dry and powdery. It is probable therefore that the effects of the drought recorded during the year are unfortunately far from complete and that further losses will have to be recorded during the coming spring.

The table overleaf shows that the average monthly rainfall at Kew during fifteen years was 2·12 in., and that the rainy days per month were 13. For the year 1921 an average of 1·038 per month was recorded, with an average of 8·5 days per month with rain.

The following observations have been compiled by the Curator, Assistant Curator and the Foremen of the different departments and form a valuable, though lamentable, record of the disastrous effects of both the drought and salt water conditions from which the Royal Botanic Gardens have suffered.

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	Average of 15 years, 1906–20.		1921.	
	Inches.	Number of days.	Inches.	Number of days.
Jan. -	2·08	13	2·31	19
Feb. -	1·57	15	0·25	2
March -	2·03	16	1·22	11
April -	1·81	12	1·02	8
May -	1·75	11	1·09	12
June -	2·18	11	0·24	3
July -	2·45	13	0·10	4
Aug. -	2·26	14	1·33	10
Sept. -	1·84	11	1·62	6
Oct. -	2·44	14	0·48	6
Nov. -	2·13	13	1·80	10
Dec. -	2·93	14	1·00	11
Total	25·47	157	12·46	102

Trees and Shrubs.

Amongst evergreens nothing withstood the drought better than hollies, in fact scarcely a single tree has shown any signs of suffering. Yews also have got through very well but some have become thin in foliage. Of all evergreens rhododendrons suffered the worst. Even big bushes of common *R. ponticum*, planted at least fifty years ago, are quite dead in places where they could not be artificially watered. Although the plants in the Rhododendron Dell have made short growths and smaller leaves than usual, they have survived the ordeal very well. But it was only by watering that they were kept alive. It took the whole time of one man the summer through to keep them going. They were watered in turn, but often enough were flagging at one end of the Dell before he had got through to the other. Mountain top rhododendrons with small leaves such as *yunnanense, micranthum, yanthinum*, etc., have, as one would expect, stood the heat and dryness much better than the bigger-leaved species found in woodland.

Heaths have suffered badly on the whole but there are exceptions. One can understand native and other species from cool elevations suffering, but it might have been thought that *Erica mediterranea* from the hot hills of Spain and S. W. France would have stood the heat well, but more than half of the large groups growing at Kew have been killed outright and most of them injured. The useful hybrid from *E. mediterranea* we call *darleyensis* has suffered equally badly and breadths planted twenty years ago have had to be dug up. But *E. lusitanica*, *E. Veitchii* and especially *E. arborea alpina* have not been hurt. Another ericaceous plant for which the heat and drought have been too much is *Pernettya mucronata,* large groups of which have been cleared off. But Arbutuses seem to have enjoyed the conditions that have been fatal to so many of their allies.

As one might expect, it has been a bad time for many conifers. Pines have got through very well although they could not be watered; and on the whole, although there are exceptions, our fine collection of cypresses, Thuyas and Taxineae have also got through very well. Of hemlocks (*Tsuga*) and spruces—essentially wet country trees—many have died. Even *Picea Omorica* and *P. orientalis,* the two best spruces for the Thames Valley, have had their numbers sadly reduced. The firs (*Abies*), but ill-suited at Kew in the wettest years are of course more debilitated even than usual. The past summer has shown more than ever how desirable is the foundation of a national pinetum in some more favoured spot.

Owing no doubt to the heat of the summer *Prumnopitys elegans* bore hundreds of its small plum-like fruits, and *Taxodium distichum* carries a good crop of cones. Neither of these, so far as we know, has borne fruit at Kew before, although the larger, older trees of *Taxodium* in the neighbouring Syon Park have done so. The production of a large number of pomegranates on a bush outside the south end of the Mexican House was an unprecedented event at Kew and aroused much popular interest. A good crop of fruit such as was to be seen on the Californian buckeye (*Aesculus californica*) is rare. But on the whole it has not been a good year for ornamental fruit bearers. The precocious growth and late frosts of spring destroyed much bloom and young fruit and the drought prevented the proper development of such as survived. The thorns were fairly good, but neither barberries, cotoneasters nor crabs have been up to the average. Amongst barberries the best have been the *Wilsonae* group from China which includes *subcaulialata* and *Stapfiana.*

It was the same with the autumn colouring of the foliage. A fine summer is usually conducive to high colouring but this year the leaves of many trees seem to have been too desiccated for the necessary chemical changes to take place. *Rhus cotinoides,* usually one of the most beautiful and regular of autumn colouring trees at Kew, had its leaves shrivelled or fallen before the ordinary season of colour.

It is often difficult to estimate the damage done to deciduous trees and shrubs. On some of the large beeches in the woods the leaves have withered and remained on the branches—always a bad sign, but it has happened before and they have survived. We shall not be able to tell what the effects of 1921 have been on the woods at Kew till next year, but no doubt the end of many old trees there that were already failing will be hastened, even if they survive for the present. Many birches, poplars and elms had become denuded of foliage in July and tulip trees lost their leaves early. This premature autumn and fall of leaf probably saved the lives of many of these trees.

The flowering of some July and August blooming shrubs like *Eucryphia* and *Oxydendron* was much shortened by the dryness of the atmosphere, but on the other hand some sun-lovers like *Vitex Agnus-Castus, Hibiscus syriacus* and *Clematis paniculata* were never so good. The curious *Ephedra campylopoda* also produced its yellow flowers in abundance—a rare occurrence at Kew—and was very pretty. On the whole the effects of the intense heat and dryness were bad for the development and duration of flowers the summer through—some rhododendrons for instance never opened their flowers fully—but there is every likelihood of a splendid show of bloom next spring and summer on those trees and shrubs that have passed through the ordeal safely. A curious effect of the summer has been the autumnal blooming of a good many shrubs whose normal time is spring. *Hamamelis japonica* was in full bloom at the end of October and earlier in the month several hybrid rhododendrons whose proper season is April and May were in flower.

Lawns.

It is not likely that the lawns at Kew have ever been so scorched since the Gardens became public. Those who have known the place for over forty years can remember no similar effects of drought and heat. It is too early yet to tell how many of the patches at present bare and lifeless looking will recover but it is certain a great change for the better will take place when the ground is once more thoroughly moistened. There are some places, however, like the south end of the Lake, the Berberis Dell, the Cedar Avenue and other routes where there is a concentration of traffic which are worn bare and cannot recover of themselves. It was hoped that a good amount of grass seed might have been sown during the autumn but the continuation of the drought through October, when less than half an inch of rain fell, debarred this method of renovation. Re-sowing with grass seed next spring is the only remedy, but the necessary roping-off until the young grass is strong enough to bear traffic again, restricts the free circulation of visitors on crowded days.

Rock Garden.

In the Rock Garden, although it was watered freely, Primulas, Ramondias, Gentians, and other plants of a similar nature suffered badly, many being killed outright. Generally speaking the plants were more stunted in growth than usual, and many kinds ripened off prematurely. Zauschnerias in common with other kinds from warmer countries enjoyed the heat and flowered more freely than they have done for many years.

In the frame ground many of the higher Alpine subjects grown in pots and pans succumbed to the excessive heat.

Herbaceous plants in the Natural Order beds were all more or less stunted in growth, Campanulas and other shade-loving subjects being amongst the worst sufferers. Half hardy or tender annuals like *Martynia proboscidea* flowered well and produced fruits, but in many cases the seeds of spring-sown annuals failed to germinate.

Herbaceous Borders and Flower Beds.

The effect of the long drought was very marked on the herbaceous borders. In spite of frequent watering most of the plants were very much stunted in growth and in many cases the foliage was scorched and dried. Even such things as Asters (Michaelmas daisies), although watered, felt the effects of the continued drought and their flowering period was much shorter than usual. Kniphofias were also poor for although they dislike damp during winter, they enjoy and are always at their best during a wet summer. Dahlias as a rule grew much taller than usual and generally did not flower with their usual freedom.

Some summer bedding subjects, such as Heliotropes, *Salvia splendens*, *Begonia semperflorens*, Verbenas, *Phlox Drummondii* and Zonal pelargoniums, seemed to enjoy the exceptionally hot and dry conditions. Of course they were watered, but never overhead, so that the foliage did not suffer from the effects of brackish water.

Hardy Annuals generally proved failures more or less, with the exception of *Eschscholtzia californica* and *Hunnemannia fumariaefolia* which, in common with other Californian plants enjoyed the hot and dry conditions. Seeds of such plants as wallflowers and sweet williams germinated very slowly and irregularly, whilst seeds of daisies and Myosotis failed to germinate at all except under glass. Cannas enjoyed the heat and have never been so fine before out of doors.

Roses were already weakened by a severe frost in December, 1920, which caught them whilst their wood was still soft and unripened, and they suffered again from late spring frosts. They were thus in poor condition to cope with the abnormal summer and in consequence made little or no growth until autumn, when heavy dews and cooler conditions came.

The Water Supply from the Thames.

As a result of deficient rainfall on the watershed of the Thames, for many weeks the quantity of water coming over Teddington Lock was negligible, in consequence of which the sea-water gradually found its way farther and farther up the river. The water used for plants at Kew is nearly all obtained from the Thames, being first let into the Lake and pumped thence to the filter-beds and reservoir. On the water from the Lake and from the Thames being analysed it was found that a considerable quantity of saline matter was contained therein. Owing no doubt to evaporation, the water in the Lake was found to be even more salty than the Thames (*see* p. 13). The effects on the roots of trees and shrubs watered out-of-doors were not noticeable although they were no doubt harmful. But the only alternative to using Thames water was to let them die of drought. The injury was far greater among plants grown in pots and surface rooting herbaceous plants in the open which had to be supplied with water daily. This no doubt resulted in a gradual " salting " of the soil. Its effects were evident early in July when many plants showed signs of ill-health, but this was attributed to the exceptional heat experienced about that time. By the end of August the collections generally showed in the dead and dying leaves of many plants which had previously been in vigorous health that something unusual was happening to them. The exceptional heat made it necessary to water and syringe often and copiously, and in the belief that drought was the evil the gardeners were instructed to supply more and more water both at the root and overhead.

The Temperate House is provided with four large storage tanks for conserving rain water, and this supply held out until mid-August, when Thames water had to be used. In no house was the damage more in evidence than in the section which is filled chiefly with Himalayan Rhododendrons. The foliage of many was badly injured within a few days after the Thames water was used, and in some cases the young shoots were killed outright; this continued for at least two months after the use of the Thames water had ceased. In addition to the leaf injury there is the very serious effect the salt has had on the health of the plants. A large number of seedlings of new Chinese Rhododendrons were killed, although kept carefully shaded.

On the other hand many Australian, New Zealand and Tasmanian plants in the Temperate House do not appear to have been injured by the water. These include the Australian Acacias, Callistemons and other myrtaceous plants.

In the Mexican wing of the Temperate House many plants were injured, some of them being entirely denuded of foliage at an early stage of the trouble. The worst sufferers were *Jacobinia, Strobilanthes, Psidium, Oreopanax* and *Trevesia*. Several of these were handsome specimens and they were entirely ruined. A tree of *Ficus religiosa* 30 feet high lost every leaf, and a large specimen of *F. lyrata* was killed outright. Tree ferns, which have been a striking feature in this house for many years, showed early signs of injury. The specimens of *Cyathea Dregei* and *Hemitelia capensis* lost all their leaves. Other tree ferns which were damaged were *Dicksonia antarctica*, and *Cyathea medullaris*. *Cyathea dealbata* was not injured. Of the smaller ferns *Pteris semipinnata* var. *gigantea* and *Davallia platyphylla* were killed to the ground.

Among Chilean plants, two out of three examples of *Embothrium coccineum* were killed; a bushy specimen of *Tricuspidaria dependens* was killed, and *T. lanceolata* was badly injured. Four out of five plants of *Lomatia ferruginea* were killed; the only surviving plant has never been watered with Thames water and is quite healthy.

The importance of providing an adequate supply of rain water for plants cultivated under glass at Kew was clearly demonstrated in the Temperate House. Plants which were supplied with rain water only have thriven throughout the whole of this extraordinary hot and dry year, whilst the same kinds of plants which were watered with Thames water are either dead or badly injured.

The collection of Orchids comprises many species of such large genera as *Coelogyne, Dendrobium, Cattleya, Masdevallia, Odontoglossum* and *Catasetum*, many other smaller genera being represented by only a few or even a single example. Orchids generally require water that is pure, and they object to lime and salt. The collection has suffered severely from salt poisoning, and it is doubtful if many of the plants can recover. The need for an increased storage of rain water for the T Range is abundantly evident in the effects produced by using Thames water for the Orchids. Tropical plants in the same group of houses, most of which require abundance of moisture both at the roots and overhead, have suffered severely from damage by the salt water. The Nepenthes made very little growth and few pitchers compared with those of previous summers. *Marantaceae, Musaceae* and *Scitamineae* were greatly damaged by the salt, only very few of the large number of plants belonging to these three orders being sufficiently presentable to be left in the houses open to the public. The collection of Begonias has been utterly ruined, the bulk of the plants being either killed or very much injured. Many tropical *Leguminosae* were injured. The large plant of *Amherstia* in House No. 1 had all its leaves damaged, except those near the top, which the water from the syringe did not reach. *Camoensia* lost nearly all its leaves, as also did the Heveas. All the species of *Coffea* and a large bush of *Cacao* were among the worst sufferers.

Aroideae in House No. 1 have with few exceptions escaped injury, the Alocasias being the worst sufferers. The succulents in House No. 5 show no ill effects although they were regularly watered and hosed with Thames water. They include *Cactaceae, Euphorbiaceae, Liliaceae, Amaryllidaceae, Bromeliaceae, Solanaceae, Crassulaceae, Saxifragaceae, Geraniaceae, Compositae, Cucurbitaceae, Asclepiadaceae, Dioscoriaceae*, etc. Tropical Ferns were fortunately watered with rain water only, there being a large and ample supply collected from the roofs of the houses and stored in large tanks. The growth and general health of these plants have been unusually good this year.

The following is a list of greenhouse plants which were injured by Thames water :—

Abutilons,	Leaves injured
Achimenes	„ „
Agapetes buxifolia	„ „

Asystasia bella	Leaves injured
Begonias	,, ,,
Bouvardias	,, ,,
Bredia hirsuta	Plants nearly killed
Buddleia officinalis	Leaves injured
Calceolarias	,, ,,
Calceolaria Burbidgei	Killed outright
Capsicum annuum	Growth arrested and leaves injured
Centropogon Lucyanus	Leaves injured
Coleus Blumei vars.	Growth arrested.
,, shirensis	Nearly all killed
Cuphea micropetala	Leaves injured
Cytisus fragrans	,, fell off, growth stunted.
Ericas	Growth arrested, young small plants killed.
Fuchsias	Leaves injured and growth arrested
Impatiens Sultanii, and Holstii vars.	Growth arrested, leaves fell off
Isoloma hirsutum	Leaves injured
Jacobinia chrysostephana	,, ,,
Loropetalum chinense	,, ,,
Luculia gratissima	,, ,,
Plumbago capensis	,, ,,
Pomaderris phylicaefolia	Young plants killed
Primula sinensis	Leaves injured
Reinwardtia tetragyna	,, ,,
,, trigyna	,, ,,
Rhododendrons	Nearly all show leaf injury. This is very marked in R. indicum vars. and R. Oldhami, which lost most of their leaves
Roupala Pohlii	Leaves injured
Salvia rutilans, splendens, leucantha, and involucrata	All more or less injured
Senecio grandifolius	Leaves injured
,, Petasites	,, ,,
,, cruentus vars.	Many plants killed
Streptosolen Jamesonii	Leaves injured, many plants nearly killed
Strobilanthes isophyllus	Leaves injured
Tetratheca pilosa	Nearly all killed
Tibouchina semidecandra	Young plants all killed
Musa Ensete	Leaves injured
Freesias	A large batch of seedlings much injured

On syringing overhead being discontinued, the plants made healthier growth, but in most cases they are spoilt for this year.

Among the plants that do not appear to have suffered from salt poisoning although regularly watered with Thames water are :—

Coleus barbatus
,, thyrsoideus
Pycnostachys Dawei
Moschosma riparium

These are among the first to suffer from unfavourable conditions, such as fog.

Acacias
Carnations
Grevilleas
Buddleia asiatica
Boronias
Camellias

Chrysanthemums
Cyclamen
Epacris
Eranthemum pulchellum
Eupatoriums
Humea elegans
Kalanchoes
Leptospermums
Nerium
Pelargoniums
Phaenocoma prolifera
Pimeleas
Statices

In the Herbaceous and Alpine department many of the plants were watered overhead almost every morning with Thames water. A large collection of Saxifrages grown in pots was severely damaged by the salt and many other plants in pots were either killed outright or much injured. These included the following :—

Androsace Laggeri
Asperula cynanchica
Androsace pyrenaica
Dianthus alpinus
Douglasia laevigata
,, Vitaliana
Geranium subcaulescens
Globularia bellidifolia
,, nana
Lewisia Cotyledon
Lithospermum graminifolium

Pentstemon arizonicus
,, Davidsonii
,, Menziesii
,, ovatus
,, pubescens
,, rupicola
Potentilla nitida
Phlox Douglasii
Shortia galacifolia
Spiraea pectinata

In the Rock Garden much damage was done by the water. Some of the worst affected were :—

Achillea argentea
,, umbellata
Dryas lanata
,, integrifolia
,, vestita
Dracocephalum Isabellae
Calceolaria plantaginea
,, polyrrhiza
,, John Innes
Douglasia Vitaliana
Gentiana sino-ornata
,, Farreri

Hypericum confertum
Lysimachia Henryi
Inula ensifolia
Primula, nearly all the species
Rhododendron kamtschaticum
Saxifraga cordifolia
,, oppositifolia (large patches killed entirely)
,, cuneifolia
,, caesia
,, squarrosa
Tiarella cordifolia

The effect of the water on growth was in many cases very marked; some plants went to rest prematurely whilst others grew stunted and weak. The effect in the Herbaceous Ground was pretty much the same, Campanulas being among the worst sufferers.

II.—THE KEW LAWNS AND THE DROUGHT.

(*An account of observations made during the second and third weeks of August*, 1921.)

W. B. Turrill.

The abnormally dry summer of last year provided the opportunity for making, at the suggestion of the Assistant Director, a number of observations on the resistance of lawn plants to drought. While the results of these observations are in no way unexpected it has been thought advisable to place them on record in a short article.

It is well known that grasslands require constantly recurring, rather than heavy, precipitation to reach perfection or to keep continuously green. This fact has been well emphasised by A. W. F. Schimper, Plant Geography, p. 174, and is further illustrated by the distribution of the best grasslands in the British Isles. This being so, it would naturally be expected that lawns, meadows and pastures would be amongst the first plant associations to suffer in a prolonged spell of dry weather. On the other hand, relatively quick recovery usually follows a sufficient rainfall, the rain soon reaching to the roots and stimulating the development of fresh vaginal shoots in the perennial species, and the germination of dormant seeds of some of the annual ones. Even after last summer's drought the turf at Kew was becoming green again by Aug. 19th after the showers of the preceding week, and numerous new green shoots, an inch or more high, were to be found on many of the lawns

Most of the Kew lawns at the beginning of August looked parched and dry, and onlyin a few hollows, or in places artificially watered, was the grass as a whole really green. In hollows the water in the soil and subsoil would naturally be greater in amount than where the surface is level. Again, the presence of a conspicuous green margin to or ring around those flower-beds, trees or shrubs, which were watered during the dry weather, showed how a comparatively small sum total of water is required to keep grass fresh. A bright green patch of grass during the drought and away from a watered bed, tree or shrub, was almost invariably found to indicate the presence of a hydrant from which water had been withdrawn. Two conclusions are obvious, that the drying up of the grasses was due directly to lack of water in the soil and subsoil, and that the survival in a green state of any portion of lawn is due mainly, not to a difference in floristic composition, but to position in regard to water supply or conservation. Nevertheless, detailed investigations of typical portions of the Kew lawns revealed some facts indicating that there are differences between species of grasses and other lawn plants in their power of drought resistance.

One of the commonest of the grasses in the Kew lawns is *Lolium perenne*, and green plants and even dull green patches of this could be found in most areas where excessive tramping by visitors had not worn the turf away. Indeed, of the grasses normally present, the perennial rye-grass claims first place as a drought-resister. Yet, on many of the fully exposed lawns, it eventually became, last summer, as parched as its associated species. Species of *Poa* and *Festuca* were almost entirely absent in the green state from unwatered spots. Only one patch, not far from the Main Gate, of *Festuca ovina*, remained partially green, and individual plants were also found near the Temperate House. That *Lolium* should often survive green while species of *Festuca* should almost always become parched is difficult to explain. Anatomically the leaves and shoots of *Festuca ovina*, *F. duriuscula* and other species, are xeromorphically constructed with their often subulate, rolled or folded leaves, in which the stomata are well protected in grooves on the inside of the leaf which possesses much sclerenchymatic tissue around the vascular bundles. *Lolium perenne* has, on the contrary, leaves and shoots typical of a mesophytic grass, being glabrous with shallow grooves, not specially protected stomata and very little sclerenchyma, that which is present not forming girders to the vascular bundles. It is possible that an explanation is to be found in the root-system, for *Lolium* is a deep-rooted, generally tufted grass, and its subterranean system would appear to be more extensive than that of some, at least, of the common species of *Festuca* and *Poa*. That the root and rhizome system is of considerable importance is also shown by the survival of *Agropyron repens*. This plant is, of course, not a normal constituent of lawns, but some considerable patches occur in the grass near the Herbarium. The grass here was, in spring, chiefly composed of *Arrhenatherum avenaceum*, *Alopecurus pratensis*, *Festuca duriuscula*, *Poa pratensis* and *Dactylis glomerata*. Hay was cut early in June and by August very few remains of the named grasses were to be seen above ground. A tall green growth of *Agropyron repens* had taken their place over part of the ground which had certainly not been watered. The leaves of the couch-grass are not markedly xeromorphic in structure and the extensive underground stolons are its most noteworthy characteristic and would also account for its vegetative development during dry weather. Partly green specimens of *Agrostis*, which were found in the lawn near the Kew Palace and others near the Temperate House, would also appear to owe their preservation to nodal rootings and stolon production. A few of the coarser grasses survived in places. A green patch of *Dactylis glomerata* was observed near the Pagoda and isolated plants of *Holcus mollis* and *H. lanatus* no doubt survived owing to their hairy covering on stems and leaves.

It was to be expected that annual grasses, even including the ubiquitous *Poa annua,* should disappear and, though not without exceptions, it seems a rule that amongst the perennial grasses the earlier flowering species can least withstand drought. Thus *Poa pratensis, Alopecurus pratensis, Phleum pratense, Arrhenatherum avenaceum, Avena pubescens, Cynosurus cristatus, Bromus* spp. and other grasses which are common constituents of the Kew turf had quite died down by the middle of August. *Lolium perenne* flowers most of the summer and *Agropyron repens* is a later flowering grass than those mentioned above.

The Sun Dial Lawn, in front of Kew Palace, was ploughed up during the war but has now been completely resown. A portion laid down with seed in the spring of the year before last was much dried up but was still greener than similar areas of old lawn. *Lolium perenne* was the most conspicuous grass, and associated with it were green, low-growing plants of *Medicago lupulina, Trifolium repens* and *Trifolium pratense.* The second portion, resown last spring, had not yet been cut and was the greenest part of the Gardens, *Lolium perenne* was again the dominant grass, with patches of *Holcus lanatus.* From amongst the green *Lolium,* dried up and dead plants of a species of *Poa* were picked out. The dying out of these, and doubtless individuals of other species, had retarded the formation of turf and allowed the entrance of many weeds of which numerous individuals of the following species were green and flourishing: *Nasturtium sylvestre, Coronopus didyma, Solanum nigrum, Polygonum aviculare, P. persicaria, Plantago lanceolata* and *Chenopodium album.* A small patch of vivid green surrounding a hydrant within this sown portion showed what the turf would have been had the summer been a wet one. That newly-sown lawns remain green longer in drought than established ones, is probably due to the looser nature of the soil in the former, allowing the roots to penetrate more deeply and to spread further. Telluric water can also rise by capillary action more easily to the superficial layers in which the plants are rooted.

In conclusion, a few facts may be recorded regarding plants other than grasses. The greenest constituents of the turf were members of the *Compositae. Achillea millefolium* retained its leaves green throughout the drought, and other, less valuable lawn plants, which remained fresh were *Hypochaeris radicata, Hieracium pilosella, Crepis virens,* and also *Plantago lanceolata.* Near the T-range a portion of lawn has been invaded by the chamomile, *Anthemis nobilis.* This remained as fresh as *Achillea* and was flowering and fruiting vigorously. Many of the patches appeared to indicate circular spreading from a centre and a few showed "fairy-ring" structure quite well. All of these plants have deeply penetrating tap-roots or, like *Achillea,* a much developed system of stolons beneath the surface of the soil, again indicating the importance of the underground system in drought resistance.

III.—SALT IN THE KEW WATER SUPPLY.

W. B. Turrill.

At the request of the Director a series of analyses to determine the salt-content of the Kew Water Supply was commenced by the writer in September 1921, and continued intermittently till the end of the year. Since some of the results obtained were striking, at first unexpected, and have a practical bearing, it has been thought advisable to publish a short summary of them. Copies of the reports, giving full details of the collection of the water and mud samples, and also of the analytical methods employed, are preserved at the Director's Office and in the Kew Library.

An account of the Kew water system is given in the *Kew Bulletin*, 1897, p. 334. Briefly it may be stated that water is allowed to enter the Lake, as required, from the river immediately opposite, at certain high tides. From the Lake it passes to filter beds in the Gardens, and is then pumped up to a reservoir in Richmond Park, from whence it comes back to the Gardens under considerable pressure.

Preliminary experiments showed that the water in use at Kew during August and September contained considerable quantities of chloride, mostly in the form of sodium chloride. On this basis it was decided to analyse samples taken from the Lake and from the River Thames at different states of the tide. The results were calculated both in terms of chlorine and of chlorides, considered as sodium chloride. For the purposes of this note we may quote the results throughout as grams of sodium chloride per 1000 cc. of water. Altogether over 20 distinct samples have been analysed in the course of the investigations.

Six samples of water were collected on September 15 and 16, and their analysis brought to light the fact that the lake water, at this time, was 10 times as salt as the river water, collected immediately opposite the inlet to the Lake at high tide. It was obvious that the immediate source of salt water at Kew was the Lake. The river water contained between 0·15 and 0·18 grams of NaCl per thousand, varying slightly at different levels, and the Lake water 1·5. It was suggested that the concentration of salt in the Lake might be due to one or both of two causes:—(1) Considerable, and abnormal, evaporation during the hot summer. (2) Tidal or river conditions other than those occurring when these samples were taken. Finally it has been shown that during 1921 both causes operated and in the same direction, but evidence of extra-salt tides was not immediately forthcoming. Following the results obtained by the first set of analyses the Lake was emptied of water and refilled several times from the river. Analysis then showed that the salt content had been reduced to 0·424 grams per 1000 cc. of water.

The first tidal barrier in the Thames is at Richmond, where the lock and weir are usually manipulated as a half-tidal barrier, the first full lock being at Teddington. Samples of water were obtained from above Richmond Lock at high and low tides and contained respectively 0·2 (3.10.21). and 0·1 (16.9.21.) grams of salt per 1000 cc. of the samples. There was thus only a slight difference in salt-content between the surface river water at high-tide at Kew and at Richmond. Indeed the Richmond water, as analysed, contained slightly the more salt, but that is explained by small variations noted for different tides throughout the course of the work. A sample collected from the Thames at Hampton Court (3.10.21.) contained 0·117 grams of sodium chloride per 1000 cc., that is, practically the same as the water at low tide at Richmond.

In order to determine if the mud of the Lake held any considerable quantity of salt, known weights of wet mud were stirred with known volumes of cold and hot distilled water respectively. With cold water 0·585 grams of salt were extracted from 1000 grams of mud, and with hot (boiling) water 0·83 grams. The amount of water held in the mud (" mud-water ") was then found by experiment, and by calculation 1·38 grams of salt was shown to be associated with 1000 grams of mud-water. This calculation on the " mud-water " basis shows, of course, a richer salt content than the calculation on the basis mud plus water (" wet-mud "). There seems every probability that during the latter part of the summer the mud and water left behind when the lake was drained as far as possible, contained enough salt to affect temporarily the next supply of water, but insufficient to be considered a permanent cause of salinity.

It was not till the week ending November 5th that definite evidence of extra-salt tides was obtained. During the week very high tides were experienced in the Thames estuary. Two samples taken at Kew contained 1·14 grams of sodium chloride and 1·2 grams per 1000 respectively, as compared with 0·15 grams per 1000 which appears to be about the average salinity of the Thames water at Kew. During these very high and extra-salt tides fresh water fish (barbel) came to the surface and sides of the river in shoals. They showed obvious signs of being affected by the incoming tide and many were caught with the hands or in hand-nets.

The conditions which cause the increased salinity of the Kew water have thus been shown to be due directly to the drought of the past summer, but the action has been a double one. In the first place a very much reduced quantity of fresh water has been drained from the Thames basin down the river. The river throughout its entire course has been relatively sluggish and this would tend to greater evaporation for any given mass of water and consequent increase in salt-content. The salinity of Thames water, however, is due mainly to carbonates and these have not been considered in the work summarised above. The small quantity of fresh-water coming down has meant that at Kew the salt tidal water has come up higher and in greater quantity than is normally the case. Whether mixed with fresh water, or pushing it back and flowing with it in more or less separate layers, the salt sea-water coming up the Thames estuary at high tide, and most especially at spring tides, is the ultimate source of the salt in the Kew water supply. In this connection it is interesting to note that during the last summer seaweed came up as far as Kew Bridge. Thus at extra-salt tides, just now and again during the summer, decidedly salt water was let into the Kew Lake. This is a shallow basin giving the contained water a relatively large superficial area for evaporation compared with its bulk. This helps to account for a marked concentration of salt in the Lake itself during last summers' heat. It is probable that the water as supplied for watering purposes in Kew Gardens is often more salt, especially in summer, than fresh river-water, which in the case of the Thames normally contains very little sodium chloride. The conditions of drought and heat aggravated this state during the past year by reducing the quantity of fresh water coming down, and therefore increasing both the relative and actual amount of salt sea water coming up, and also by increasing the concentration of salt through evaporation of the water in the Lake, which for the time being was tending to become a miniature Dead Sea.

IV.—FURTHER NOTES ON THE AUSTRALIAN SPECIES OF STIPA.*

D. K. Hughes.

In response to the communication of a copy of Miss Hughes' paper " A Revision of the Australian Species of Stipa," published in the *Kew Bulletin* of last year, pp. 1–30, Mrs. A. Chase, on the behalf of the United States National Herbarium, asked for the revision of their Australian Stipas by Miss Hughes. The proposition was all the more welcome as the Washington collections

* See *Kew Bulletin*, 1921, 1.

contained much additional material, among it species which Miss Hughes had been obliged to place among the "dubiae." The present "Notes" are the result of her examination of these collections. It is very satisfactory that her conclusions, tested on a considerable number of new specimens, were found to hold good in nearly all cases. As to the "dubiae," one of Reader's species, *S. acrociliata,* was recognised as an accession to her list of Australian species, whilst another, *S. eremophila,* was found to cover the bulk of *S. rudis,* as understood by Miss Hughes, but not the original *S. rudis* of Sprengel, which, on the examination of a better co-type, has turned out to be *S. pubescens.* A third species, *S. Luehmannii,* proved to be the *S. Drummondii* of Steudel, and a fourth, not accounted for in her original paper and missed in the *Index Kewensis,* takes now the place of her *S. lachnocolea.* The other "dubiae" are all species, the elucidation of which will require the consultation of continental herbaria. Two further additions to the list of Australian species resulted from her examination of specimens collected in New South Wales by R. T. Baker and F. v. Mueller respectively. Interesting is the discovery that *S. aristiglumis* of F. v. Mueller was based on a really non-existent character which by the rules of nomenclature will yet remain evident in the name of the species.

The number of species of Stipa in Australia is brought up to 42 by the "Notes," whilst 6 are left among the "dubiae."

O. S.

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1. **S. elegantissima,** *Labill.*, Pl. Nov. Holl. i. 24, t. 29.
W. Australia. Killerberrim, *Vachell.*
S. Australia. Roseworthy, 11.xi.1889, *Tepper.*
New South Wales. Murray River, *Mueller.*
Victoria. Near Bacchus Marsh, *Tovey* and *French.*

3. **S. Muelleri,** *Tate,* Trans. Roy. Soc. S. Austral. vii. (1885) 70.
Victoria. Emerald, *P. St. John.*

5. **S. teretifolia,** *Steud.*, Syn. Glum. i. 128.
Victoria. Brighton, *Mueller.*

12. **S. falcata,** *Hughes* in *Kew Bull.* (1921) 14.
N. S. Wales. Hunter's River, Capt. Wilkes' Expedition; Belltrus via Scone, *White* 17; Liverpool Plains (*coll. ?*).

14. **S. variabilis,** *Hughes* in *Kew Bull.* (1921) 15.
N. S. Wales. Sydney, *Maiden.*

Further material of the group *Falcatae* shows forms intermediate between *S. falcata* and *S. variabilis.*

S. falcata, as understood at present, comprises shorter plants with dense tufts of fine very scabrid basal leaves and extremely short basal sheaths. *S. variabilis,* although of very varying habit, possesses leaves which are generally longer, coarser and more loosely convolute than in *S. falcata,* their lower epidermis being smooth or slightly pubescent but not scabrid, whilst the tufts are less dense and the basal sheaths are longer. Continued study will be necessary to determine the value of those differences. Comparison of this material with *S. Drummondii* has proved its distinctiveness from that species.

The specimens enumerated under *S. variabilis,* collected at Kauring by Stoward (nos. 361, 459, 466), might rather be included in *S. falcata* on account of the slightly scabrid leaves, but they represent a coarser plant than the type and do not conform well with either species.

15. **S. Drummondii,** *Steud.,* Syn. Glum. i. 128. *S. Luehmannii,* Reader in Vict. Nat. xvi. 158.

N. S. Wales. Liverpool Plains, (*coll.* ?).

Victoria. Little Desert, Lowan, 19.xi.1899, *Reader.*

Reader's plant quoted above is no doubt an authentic specimen of *S. Luehmannii* though collected a year later than the type (" Sandy Desert, Lowan, 1898 "). On the sheet examined there are two plants, both densely tufted with softly pubescent leaves and sheaths. The smaller of the two has convolute leaves about 7 cm. long and about 3 mm. wide when flattened out, and agrees with the type of *S. Drummondii* (Drummond 378). The larger plant has convolute lower leaves, while the upper are mostly unrolled, about 17 cm. long and 5 mm. wide. The flowering culms are very stout, loosely enclosed by sheaths up to 1·4 cm. wide. This is a far more luxuriant form than the typical *S. Drummondii,* but intermediates are seen in the specimens collected by J. M. Black in S. Australia.

The chief distinguishing character emphasised by Reader in his description of *S. Luehmannii,*—the toothed unequal empty glumes,—is also found in *S. Drummondii,* Steud.

17. **S. platychaeta,** *Hughes* in *Kew Bull.* (1921) 16.

N. S. Wales. Murrumbidgee River, 1886, *Bennett.*

18. **S. scabra,** *Lindl.* in Mitch., Trop. Austral. 31.

N. S. Wales. Gilgunnia, *Baker*; Nyngan, *Baker*; " N. Western area," 1912, *Boorman.*

Comparison of further material shows that the length of the ligule varies from 1–3 mm. and cannot therefore be relied upon as a character for diagnosis if not accompanied by other distinguishing features. Otherwise the specimens quoted above are fairly uniform and in keeping with Mitchell's type.

20. **S. densiflora,** *Hughes* in *Kew Bull.* (1921) 18.

N. S. Wales. Lake Andgellica, *Boorman.*

Boorman's plant differs from the type (Etheridge) in having larger spikelets with unequal glumes, the lower being 1·8 cm. long and the upper 1·4 cm. long. The valve is 7 mm. long with a tuft of hairs about 2 mm. long at the apex and the awn 4·8 cm. The hairs on the valve are longer than in typical *S. densiflora*, while those on the awn are slightly shorter.

21. **S. hemipogon,** *Benth.* Fl. Austral. vii. 569.

W. Australia. Parker's Range, 1890, *Merrell.*

22. **S. nobilis,** *Pilg.* in Diels and Pritz., Fragm. Phytog. Austral. Occ. 70. in Engl. Jahrb. xxxv. e descr.

Victoria. Near Dandenong Ranges, 1891, *Dixon.*

The three species *S. mollis, S. nobilis* and *S. semibarbata* are very closely allied. The following differences will supplement or amplify those already given in the Key.

In *S. mollis* the hairs of the long flexuous awn are present all along the bristle except at the extreme tip, and are about 2 mm. long. The bristle is very long, usually about 6–7 cm.

In *S. nobilis* the hairs are usually denser and longer (2–3 mm.) than in *S. mollis* or in *S. semibarbata*, and are not continued beyond a few mm. of the base of the bristle, which varies in length between 4 and 6 cm. and turns black at maturity. In this, as in the preceding species, the column of the awn does not exceed 2·5 cm. in length.

In *S. semibarbata* the column measures 3·5–4·5 cm. The hairs are generally scanty, 1·5–2 mm. long and not continued beyond the column. The bristle rarely exceeds 4·5 cm. but in a few cases has been found to be as long as 6 cm.; it also usually turns black at maturity.

27. **S. pubescens,** *R. Br.* Prod. 174.

N. S. Wales. Morisett, *Boorman*; Awaba, *Boorman*; Sydney, *C. Wright*; Capt. Wilkes Expedition 1838–42; Port Jackson District, *Camfield.*

See note under *S. eremophila*, Reader.

28. **S. eremophila,** *Reader* in Vict. Nat. xvii. 154. *S. rudis.* Hughes in *Kew Bull.* (1921) 21, non Spreng.

Victoria. Borung, 28. x. 1904, *Reader.*

After careful comparison this plant was found to agree, not with the type of *S. rudis* (*Sieber Agrost.* 66), but with the other specimens quoted for that species in Kew Bull. (1921) 21.

Since writing that enumeration a more complete specimen of *Sieber Agrost.* 66 was lent by the British Museum for examination. The fully matured floret and awn show a marked difference from the other specimens formerly believed to be identical. The hairs of the valve are whitish and the stout column of the awn pale. Thus although the lower glume is only 1·4–1·5 cm. long there seems no character to keep it distinct from *S. pubescens,* R. Br. The type of the latter species (*Brown* 6203) has the lower glume

2 cm. long. In *Gunn* 588 the length is 1·8 cm., in *Stuart's* from New England and *Cunningham's* from the Brisbane River it is 1·7 cm. In others a length of 2·2–2·3 cm. is attained. The column of the awn, though constant in texture, colour and indumentum, varies in length from 3·2 cm. (*Cunningham*) to 5 cm. (*Stephenson* 261 and *Llotsky*). In the present state of our knowledge it would seem that *Sieber* 66 should be placed with *S. pubescens* while *S. eremophila* might include all the other plants formerly referred by me to *S. rudis*, Spreng.

FIG. 1.—Spikelet of *S. acrociliata*. x3. *a.* valve. x3. *b.* valve and awn to show the length of the bristle, natural size.

30a. **S. acrociliata,** *Reader* in Vict. Nat. xiii, 167.

VICTORIA. Little Desert, Lowan, 18.xi.1896, *Reader*.

This species is allied to *S. tenuiglumis* and *S. elatior*. From the former it differs in having smaller spikelets (lower glume 9 mm. long, upper glume 7 mm. long, valve 6 mm. long) and larger panicles about 30 cm. long, and from both in its several-noded culms and branching habit, the non-convolute leaves 6–8 cm. long and 3–4 mm. wide, and the glabrous ligule about 5 mm. long.

31. **S. compacta,** *Hughes* in *Kew Bull.* (1921) 24.

S. AUSTRALIA. Largs near Adelaide, 6. xii. 1882, *Tepper*.

The lobes of the valves in this species were described as being 1 mm. long. I have examined them again and find that they do not as a rule exceed 0·5 mm. in length, and are sometimes shorter or often only one is developed. *Tepper's* plant is identical in every respect except that the lobes are entirely absent and that the overmature panicle is still partly enclosed in its sheath.

33. **S. aristiglumis,** *F. Muell.* in Trans. Vict. Nat. Inst. (1855) 43.

S. fusiformis, Hughes in *Kew Bull.* (1921) 25.

N. S. WALES. Hunter's River, Capt. Wilke's Expedition, 1838–42; Sindleton, *Boorman*.

VICTORIA. Shire of Dimboola, *Reader*.

Further microscopic examination of the glumes of Mueller's plant shows that the appearance of three teeth or aristulae at their tips is due to the breaking down of the extremely delicate tissue between the very strong nerves. The tips of the glumes are therefore really entire and the total length of the latter must be taken to include the teeth. Taken thus it comes up to at least 1·1 cm. There is then nothing left to distinguish *S. fusiformis* from *S. aristiglumis*, which latter name will have to stand, although it is misleading. At the same time my description of *S. fusiformis* may be accepted as an emended description of *S. aristiglumis*.

FIG. 2.—Spikelet of *S. bigeniculata*. x3. *a*. valve. x3.

33a. **S. bigeniculata,** *Hughes*; sp. nov. *S. aristiglumis*, Muell., affinis sed basi densiore caespitoso, foliis tenuibus brevioribus scabridis, floribus majoribus, aristis longioribus, differt.

Perennis, dense caespitosa, usque 50 cm. alta. *Culmi* erecti, teretes, glabri, 2-nodi, nodis breviter pubescentibus. *Foliorum* vaginae pallidae, apertiusculae, striatae, subpubescentes, basales breves, 1·5–3 cm. longae, persistentes; *ligulae* breves, ciliatae; laminae setaceo-convolutae, in acumen pungens attenuatae, interdum recurvae, usque ad 10 cm. longae, scabridulae. *Panicula* laxa, angusta, 25 cm. longa, et 2–3 cm. lata; axis primarius leviter scaberulus; rami fasciculati, erecti vel leviter patentes, pauciflori; pedicelli gracillimi, 1 cm. longi. *Spiculae* subherbaceae. *Glumae* longe acuminatae, valvam amplectantes, inaequales; inferior 3-nervis, 1·6 cm. longa; superior 5-nervis, 1·3 cm. longa. *Valva* cylindrica, 7 mm. longa, 0·5 mm. lata, integra, breviter et dense sericeo-pubescens, pilis luteis apice productis 1–2 mm. longis; callus acutus, 0·8 mm. longus; arista 4·5 cm. longa; columna apice mediaque angulo recto geniculata, seta recta 2·5–3 cm. longa, valvula valvam aequans.

N. S. WALES. Cooma, Jan. 1887, *R. T. Baker*.

FIG. 3.–Spikelet of *S. effusa*. x3. *a*. valve x3. *b*. valve and awn to show the length of the bristle, natural size.

36a. **S. effusa,** *Hughes*; sp. nov. *S. setaceae*, R. Br., affinis, sed ligula breviore usque 1 mm. longa, foliis planis vel laxissime convolutis, glumis minoribus, differt.

Basis incognita. *Culmi* floriferi erecti vel geniculati, minime 5-nodi, glabri, infra nodis scaberulis. *Foliorum* vaginae apertae, striatae, glabrae; ligulae usque 1 mm. longae, ciliatae; laminae planae vel laxissime convolutae, usque 30 cm. longae et 3–4 mm. latae, striatae, glabrae, interdum scabriusculae. *Panicula* effusa, 22 cm. longa et 3–4 cm. lata; axis primarius teres, praeter nodos ciliatos glaber; rami filiformes, patentes, 1·5–3 cm. longi; pedicelli ad 3 mm. longi. *Spiculae* hiantes, nitidae. *Glumae* acuminatae, integrae, glabrae, dorso scaberulae; inferior 8·5 mm. longa, 1– sub 3-nervis; superior 7·5 mm. longa, 3-nervis. *Valva* pallide brunnescens, tenuis, cum callo 5 mm. longa, sparse hirsuta pilis albis; callus acutus, 1 mm. longus; arista tenuis, 4·5 cm. longa; columna brevissime pilosula vel scabrida, 1·2 cm. longa; seta leviter curvula; valvula valvam aequans.

N. S. Wales. Lachlan River, Sept. 1878, *Mueller*, (received at Washington under the name *S. scabra*, Lindl.).

38. **S. crinita,** *Gaud.* in Freyc. Voy. Bot. 407. Subsequent examination of the specimen of *S. crinita*, Gaud. sent by the author to the British Museum in 1825 revealed the fact that it consists of two similar but not identical plants.

Fig. 4.—Spikelet of *S. crinita*. *a*. valve. x3.

A. This has a narrow compact panicle exserted from its sheath. The glumes are hyaline with obscure or very short lateral nerves. There are no awns now remaining. Belonging to this is part of a densely tufted base of narrowly convolute leaves. The plant is too incomplete for precise recognition, but probably belongs to *S. falcata*, Hughes, or a very closely allied species.

B. This consists of a panicle only, which is very lax and still partly enclosed in its sheath. The lateral nerves of the glumes are prominent and extending almost to the tip. The awns are fine, not falcate, and about 4 cm. long.

Enquiries and drawings of both plants were addressed to the Museum d'Histoire Naturelle, Paris, when M. Gagnepain kindly made the following observations. " Nous n'avons pas de *Stipa crinita*, Gaudichaud de la main de ce botaniste; mais seulement un *S. flavescens Nouv. Holl. Port Jackson, C. Gaudichaud* de son écriture même. Je soupçonne que c'est l'échantillon sur lequel il a basé son *Stipa crinita.* Ce specimen n'a pas de souche, ni les feuilles inférieures; mais une feuille moyenne, une feuille supérieure et une inflorescence de 20 cm., abondamment pourvue d'épillets. La feuille la plus grande mesure 22 cm. et 2–3 mm. de large; elle est roulée. En examinant soigneusement les épillets nombreux de ce *Stipa* (*flavescens ?*) je reconnais très facilement le dessin B: glumes vertes scabres sur la nervure médiane, les 2 nervures latérales assez fortes atteignant presque le sommet; caryopse à appendice tordu, scabérule, présentant de place en place une zone verte formée de 2 nervures vertes longitudinales, contiguës, qui par la torsion se sont diposées en spirale, à spires équidistantes. Quand les glumes sont sèches, elles prennent l'apparence hyaline, scarieuse, mais les 2 nervures latérales sont toujours évidentes jusqu'au sommet.

"Il n'y a rien de A, dont les glumes paraissent appartenir à une autre espèce comme *flavescens,* Labill par exemple.

"Il ne serait pas extraordinaire que Gaudichaud ait cru avoir affaire au *Stipa flavescens,* Labill. puisque'il a écrit cette détermination dans notre herbier."

If this, then, is the true *Stipa crinita,* Gaud., the species should be placed, not in § *Aphanoneurae* as indicated in the Key to the Species but in § *Striatae* near *S. tenuiglumis.*

40. **S. McAlpinei,** *Reader* in Vict. Nat. xv, (1899) 143. *S. lachnocolea,* Hughes in *Kew Bull.* (1921) 26.

S. Australia. Clarendon, *Tepper* 274.
Victoria. Little Desert, Lowan, *Reader.*

When raising *S. compressa* var. *lachnocolea,* Benth., to specific rank I was not aware that Mr. Reader had already described it under the name of *S. McAlpinei.*

V.—NEW ORCHIDS: DECAS XLIX.

This Decade of New Orchids was left completed by the late Mr. R. A. Rolfe, A.L.S., at the time of his death.

They have been collected together for publication and represent his last contribution to the study of the *Orchidaceae,* the family on which he was the recognised authority.*

481. **Agrostophyllum seychellarum,** *Rolfe*; species *A. zeylanico,* Hook. f. (cujus flores ignoti) maxime affinis.

Caules erecti, subcompressi, 1·5–3 dm. alti. *Folia* lineari-oblonga, obtusa vel minute bidentata, 7·5–12·5 cm. longa, 1–1·6 cm. lata; vaginae conduplicatae, imbricatae, striatae, nigro-marginatae, 5–7·5 cm. longae. *Capitula* terminalia, sessilia, densiflora, 2·5–3·1 cm. lata. *Bracteae* oblongae, obtusae vel apiculatae, striatae, imbricatae, 4–6 mm. longae. *Pedicelli* 5 mm. longi. *Sepala* late ovato-oblonga, apiculata, 3 mm. longa, lateralia subconcava. *Petala* ovato-oblonga, subacuta, 3 mm. longa. *Labellum* ovato-oblongum, subacutum, planum, subpetaloideum, 3 mm. longum. *Columna* crassa, 2 mm. longa. *Capsula* ovoideo-oblonga, 6 mm. longa.

Seychelles Islands: Cascade Estate, Mahé, *Thomasset* 156 bis; *Neville*; *Barkly*; *Horne.*

An interesting outlying species which has long been known from fruiting specimens, and the flowers now enable it to be described. It seems most allied to the Ceylon *A. zeylanicum,* Hook, f., of which fruiting examples only are known, but the

* In *Kew Bulletin,* 1921, p. 52 the ten New Orchids there described were inadvertently entitled "Decades XLVIII—XLIX" instead of Decas XLVIII.

different locality and slight differences in the vegetative organs warrant the belief that it is distinct. The petal-like character of the lip was remarkable, but was found in five flowers successively examined.

482. **Catasetum Rothschildii,** *Rolfe*; affinis *C. puro*, Nees, et *C. uncato*, Rolfe, sed rostello dentibus duobus tenuibus divergentibus instructo distinguitur.

Pseudobulbi ovoideo-oblongi, circa 10 cm. longi. *Folia* oblongo-lanceolata, acuta, 3·8 dm. longa, 7·5 cm. lata. *Scapus* arcuatus; racemus 1·55 dm. longus, multiflorus; bracteae lanceolato-oblongae, acutae, 1–1·25 dm. longae; pedicelli 1·6–2 cm. longi. *Sepala et petala* subconniventia, elliptico-oblonga, subobtusa, concava, 2–2·4 cm. longa. *Labellum* superum, galeatum, late oblongum, obtusum, carnosum, 2 cm. longum, 1·4 cm. latum, apice incurvum, obtusum, integrum; os oblongum lateribus parallelis subincurvis minute crenulatis. *Columna* rostrata, 1·4 cm. longa; antennae parallelae, incurvae; rostellum cum dentibus 2 gracilibus divergentibus instructum.

Flowered in the collection of Sir Trevor Lawrence, Bart., Burford, Dorking, in February, 1899, having originally been obtained from the Hon. Walter Rothschild. It is allied to *C. purum*, Nees, and *C. uncatum*, Rolfe, but, among other characters, is readily distinguished by the rostellum possessing a pair of slender diverging teeth, in addition to the normal antennae. The flowers are light green, with the inside of the lip buff-yellow.

483. **Microstylis Whitmeei,** *Rolfe*; affinis *M. Reineckeanae*, Kränzl., sed floribus majoribus differt.

Caulis erectus, polyphyllus. *Folia* circa 9, breviter petiolata, ovato-elliptica, breviter acuminata, tri-quinquenervia, 5–7·5 cm. longa, 1·85–3·1 cm. lata; petiolus 2·5 cm. longus, basi vaginatus. *Scapus* 3 dm. longus, basi nudus; racemus multiflorus. *Bracteae* triangulari-lineares, acuminatissimae, 4–6 mm. longi. *Pedicelli* 3·75–5 cm. longi. *Sepala* oblonga, obtusa vel apiculata, 2–3 mm. longa. *Petala* lineari-oblonga, obtusa vel apiculata, 2–3 mm. longa. *Labellum* reniformi-orbiculare, 4·35 mm. latum, apice minute 4–5-dentatum; auriculae late rotundatae; callus subobsoletus. *Columna* brevissima; stelidia linearia.

SAMOA. Rev. S. J. Whitmee.

Allied to *M. Reineckeana*, Kränzl., but having much larger flowers, those of the latter being described by Dr. Kränzlin as scarcely 1·5 mm. in diameter.

484. **Bulbophyllum scandens,** *Rolfe*; species insignis, a caeteris speciebus Africanis caule valido scandente tetragono epseudobulboso differt.

Caules scandentes, validi, tetragoni, radicantes circa 0·8–1 cm. lati, vaginis ovatis striatis imbricatis tecti, internodiis circa 1·5–2 cm. longis. *Pseudobulbi* obsoleti, diphylli. *Folia* elliptico-oblonga, subobtusa, subcoriacea, 15–17 cm. longa, 5–6 cm. lata. *Scapi* arcuati, circa 10 cm. longi; racemi multiflori. *Bracteae* ovatae, apiculatae, circa 2 mm. longae. *Pedicelli* 5–6 mm. longi. *Sepala* oblonga, obtusa, circa 1 cm. longa. *Petala* laeviter arcuata, caeteris sepalis similia. *Labellum* recurvum, oblongum, obtusum vel emarginatum, circa 8 mm. longum; lobi laterales angusti, erecti. *Columna* clavata, 4 mm. longa.

SEYCHELLES ISLANDS. Common in forests of Mahé and the Silhouette, *Horne* 603; Cascade Estate, in mountain forests, 430 m. *Thomasset* 32; Casse les dents, *R. Dupont.*

Remarkable for its stout climbing 4-angled stems, and the absence of pseudobulbs. Thomasset remarks that it is found climbing rocks and trees, and that the flowers are cream-coloured or purple.

485. **Microstylis Thomassetii,** *Rolfe*; affinis *M. Rheedii*, Lindl., differt foliis angustioribus, labelli dentibus duplo brevioribus.

Pseudobulbi anguste oblongi, 7–8 cm. longi, 2–3-phylli. *Folia* elliptico-ovata vel oblonga, acuta vel breviter acuminata, paullo undulata, basi attenuata, 12–15 cm. longa, 3-4 cm. lata. *Scapi* 20–30 cm. longi; racemi multiflori. *Bracteae* lineari-lanceolatae, acuminatae, 4–8 mm. longæ. *Pedicelli* 4 mm. longi. *Sepalum* ovatum vel ovato-oblongum, obtusum 2 mm. longum; lateralia lineari-oblonga, obtusa, subfalcata, 3 mm. longa. *Petala* linearia, obtusa, 3 mm. longa. *Labellum* flabellatum vel transverse oblongum, 3 mm. latum, apice breviter 8–9-dentatum, basi callo erecto bidentato instructum. *Columna* 1 mm. longa, alis minutis. *Capsula* obovoidea, breviter pedicellata, 8–10 mm. longa.

SEYCHELLES ISLANDS. Mahé; Cascade Estate, *H. P. Thomasset* 99. Endemic.

486. **Anoectochilus burmannicus,** *Rolfe*; affinis *A. sikkimensi*, King & Pantl., sed labelli lobis angustioribus et multo longioribus differt.

Herba terrestris, circiter 20 cm. alti. *Rhizoma* repens. *Folia* 3–4, breviter petiolata, ovata, acuta, 4–5 cm. longa, 2·5–3 cm. lata; petiolus 1–1·5 cm. longus, basi ample vaginatus. *Scapus* erectus, circiter 12 cm. longus, omnino sparse pubescens, vaginis ovato-lanceolatis vestitus; racemus laxus, pauciflorus. *Bracteae* ovato-lanceolatae, acuminatae, circiter 1 cm. longae. *Pedicelli* patentes, 1·5 cm. longi. *Flores* mediocres. *Sepalum* posticum ovatum, subobtusum, 5 mm. longum; sepala lateralia oblique oblonga, subacuta, 7 mm. longa. *Petala* membranacea, late semiovata, subobtusa, membranacea, 5 mm. longa. *Labellum* 1·5 cm. longum, basi hastatum, apice divergente bilobum; lobi lineari-oblongi, subobtusi, 6 mm. longi; unguis 5 mm. longus, subinteger; calcar conicum, obtusum, 3·5 mm. longum. *Columna* lata, 3 mm. longa, facie bilamellata.

BURMA. Pegri: Kadat Reserve; 300 m., in evergreen forest, *C. G. Rogers.*

Readily separated from *A. sikkimensis*, King & Pantl., by the much elongated lobes of the lip. A plant in the Calcutta

Herbarium collected in Burma by *S. Toppin*, n. 4412, is very similar and may represent the same species, though there are a few differences in the floral structure. More complete material is desired.

487. **Maxillaria insignis,** *Rolfe*; affinis *M. grandi*, Reichb. f., sed colore sepalorum petalorumque differt.

Pseudobulbi oblongi, compressi, circiter 9 cm. longi. *Folia* petiolata, elliptico-oblonga, subobtusa, circiter 30 cm. longa, 9 cm. lata; petiolus conduplicatus, circiter 12 cm. longus. *Pedunculi* 35 cm. longi, multivaginati; vaginae conduplicatae, oblongo-lanceolatae, acutae, subimbricatae, 3–6 cm. longae. *Bracteae* conduplicatae, oblongo-lanceolatae, acutae, 5·5 cm. longae. *Pedicellus* 6 cm. longus. *Sepalum* posticum elliptico-ovatum, acutum, concavum, 4·5 cm. longum; sepala lateralia oblique triangulari-ovata, acuta, 3 cm. lata, basi in mentum oblongum 3·5 cm. longum extensa. *Petala* anguste ovata, acuta, 3·5 cm. longa, 1·4 cm. lata. *Labellum* obovatum, 4 cm. longum, obscure trilobum; lobi laterales obtusi; lobus intermedius semiorbicularis, 1·7 cm. latus, crispo-undulatus et crenulatus; discus callo oblongo 1·4 cm. lato instructus *Columna* crassa, 1·5 cm. longa.

PERU. *Forget.*

A very large and distinct species, which was introduced by Messrs. Sander & Sons, St. Albans, and flowered at the Royal Botanic Garden, Glasnevin, in May 1912. It is apparently allied to the Ecuadorean *M. grandis*, Reichb. f., which is known only from description, and of which no dimensions whatever are given, but as that is described as having the front-lobe of the lip oblong and the petals spotted the two are believed to be distinct. The sepals and petals of *M. insignis* are ivory white, the former slightly and the latter strongly striped with red-purple, while the lip is dull yellow, with some brown markings on the front lobe, a red brown suffusion and darker lines on the side lobes, and a deep yellow crest.

488. **Camaridium vinosum,** *Rolfe*; a *C. Lawrenceano*, Rolfe, foliis duplo brevioribus et latioribus et floribus vinosis valde distincta.

Herba epiphytica, 15–30 cm. alta. *Caules* parce ramosi sub-compressi, 4–12 cm. longi, remote pseudobulbiferi. *Pseudobulbi* oblongi, compressi, 2–2·5 cm. longi, apice diphylli. *Folia* disticha, patentia, sessilia, oblonga, brevissima biloba, 1·5–2·3 cm. longa, 4–8 mm. lata, vaginis conduplicatis striatis imbricatis caule adpressis. *Flores* axillares, solitarii, pedunculati, vinosi. *Pedunculi* circiter 2 cm. longi, vaginis lanceolatis paucis vestiti. *Sepala* subconniventia, oblonga, subobtusa, vel apiculata, 0·8–1 cm. longa, lateralia in mentum breve extensa. *Petala* oblonga, obtusa, vel apiculata, 7–9 mm. longa. *Labellum* late oblongum, obtusum, integrum vel obscure trilobum, 7–9 mm. longum; discus callo oblongo nitido ornatus. *Columna* 6–7 mm. longa.

Habitat. Not recorded.

This species flowered in the collection of the late Sir Trevor Lawrence, Bart., Burford, Dorking, in July, 1899.

489. **Cryptophoranthus Lehmannii,** *Rolfe*; a *C. Dayano*, Rolfe, floribus multo minoribus, sepalis lateralibus subtus minus concavis intus favoso-areolatis et maculatis differt.

Caules 5–6·3 cm. longi, vaginis amplis tubulosis obtecti. *Folia* petiolata, late elliptica vel suborbicularia, subobtusa, 6·3–7·5 cm. longa, 3·7–5·6 cm. lata; petiolus 1·6–1·8 cm. longus. *Flores* fasciculati, breviter pedunculati, 3·1 cm. longi. *Bracteae* spathaceo-ellipticae, apiculatae, 6–8 mm. longae. *Ovarium* hexapterum, alis undulatis. *Sepalum* posticum ellipticum, apiculatum, valde concavum, quinquecarinatum, carinis prope apicem pauce serrulatis; sepala lateralia connata, elliptica, apiculata, subtus subconcava, intus favoso-areolata. *Fenestra* 1·6–1·8 cm. longa. *Petala* obliqua, late oblonga, apiculata, 3·5 mm. longa. *Labellum* sagittatum, 3·5 mm. longum; lobi laterales erecti, apice angusti reflexi; lobus intermedius oblongus, subobtusus, denticulatus; callus dentiformis, prope basim insertus. *Columna* oblonga, 2 mm. longa.

COLOMBIA. Popayan, *Lehmann*.

Flowered at the Glasnevin Botanic Garden in November 1899, and subsequently at the Zurich Botanic Garden, and in the collection of the Hon. Walter Rothschild. The sepals are heavily blotched with dull purple on a whitish ground, which becomes yellow towards the base of the lateral pair; and the petals and lip yellow, the former being more or less spotted with dull purple.

490. **Megaclinium angustum,** *Rolfe*; affinis *M. Millenii*, Rolfe, sed rhachi 2·5–4 mm. diametro, floribus purpureis fere concoloribus differt.

Pseudobulbi caespitosi, ovoideo-oblongi, obscure tetragoni, 1·25–2·5 cm. longi, diphylli. *Folia* lineari-oblonga, subobtusa, 3·75–4·4 cm. longa, 0·6–1·2 cm. lata. *Scapi* 3·75–5 cm. longi. Rhachis linearis, tenuis, minute lepidota, 2·5–4 mm. diametro, margine crenulato; bracteae late triangulares, subobtusae, 1·5 mm. longae, 1·5 mm. latae, demum recurvae; flores 2·5 mm. distantes; pedicelli 2 mm. longi, sparse pubescentes. *Sepalum* posticum lineari-oblongum, subacutum, 3·5 mm. longum; lateralia ovata, concava, 2 mm. longa, supra medium reflexa, apice subfalcata, acuta. *Petala* subulata, falcata, 2 mm. longa. *Labellum* ovatum, obtusum, integrum, recurvum, vix 1 mm. longum. *Columna* brevis, alis brevissimis obtusis.

W. TROPICAL AFRICA. Old Calabar, *Holland*.

Sent to Kew in 1898 by Mr. J. H. Holland, Curator of the Botanic Garden, Old Calabar, and flowered in the Kew Collection in June 1900. The flowers are almost uniformly lurid purple in colour, a little paler on the dorsal sepal and petals.

VI.—DIAGNOSES AFRICANAE: LXXV.

1661. **Crotalaria Hislopii,** *Corbishley* [Papilionaceae-Genisteae]; affinis *C. anisophyllae*, Welw., sed foliis angustioribus longioribusque, sepalis latioribus differt.

Herba erecta, circiter 25 cm. alta, e basi ramosa. *Folia* simplicia, linearia, subtus strigoso-pubescentia, petiolo 5 mm. longo; stipulae subulato-lineares, 3–5 mm. longae, apice recurvatae. *Flores* pauci, rachibus strigoso-pubescentibus foliis longioribus. *Bracteae* lineares, recurvatae, 3–4 mm. longae; pedicelli circiter 5 mm. longi. *Calyx* ad 1·3 cm. longus, lobis acuminatis circiter 1 cm. longis utrinque minute strigillosis. *Corolla* glabra, calyce paullo longior; vexillum erectum, violaceum; carina et alae luteae. *Legumen* juvenile cinereo-oblongum, stipitatum, 2·5 cm. longum, 8 mm. latum, stylo persistente apice petala emarcida gerente.

TROPICAL AFRICA. Southern Rhodesia, probably Rusapi, *A. Hislop* 155.

1662. **Crotalaria Breyeri,** *N. E. Brown* [Papilionaceae-Genisteae]; affinis *C. eldomae*, Baker f., sed ramis gracilioribus et floribus multo minoribus conspicue differt.

Frutex glaber, ramis gracilibus. *Folia* trifoliolata; petioli 0·6–1·5 cm. longi, 0·5 mm. crassi; foliola 0·5–1·5 cm. longa, 1–4 mm. lata, linearia vel cuneato-oblanceolata, acuta vel obtusa. *Racemi* laterales, graciles, 3–7 cm. longi, laxe 2–4-flori; bracteae ad 2 mm. longae, subulatae; pedicelli 5–7 mm. longi. *Calyx* 6–7 mm. longus, campanulatus, ad medium subaequaliter 5-dentatus, dentibus deltoideis acutis. *Corolla* circa 2 cm. longa; vexillum suborbiculare; alae carina duplo breviores, obtusae, rugosae; carina acute rostrata.

SOUTH AFRICA. Transvaal: Griffin Mine in Pietersburg District, *Breyer* in Herb. *F. A. Rogers* 23998.

This shrub appears to be quite glabrous to the naked eye, but with a strong lens some very minute sparsely scattered and very closely adpressed hairs may be detected upon the young branchlets and leaves.

1663. **Erythrophleum lasianthum,** *Corbishley* [Caesalpiniaceae-Dimorphandreae]; affinis *E. Couminga*, Baill., et *E. pubistamineo*, Hennings, sed ab illo foliorum costa glabra, inflorescentia laxiore, pedicellis longioribus, filamentis dense lanato-pilosis, ab hoc foliis glabris nitidis oblique ovatis apice angustatis, staminum pilis multo longioribus et densioribus differt.

Folia bipinnata, pinnis oppositis 12–15 cm. longis, rachibus teretibus glabris; foliola utrinsecus 5 vel 6, alterna, oblique ovata, apice emarginata, basi inaequalia rotundata, usque ad 4·5 cm. longa, 1·5–2 cm. lata, chartacea, marginibus leviter undulatis, utrinque glabra et nitida, subtus costa media conspicua, nervis lateralibus utrinsecus circiter 15; petioluli 4 mm.

longi, glabri, supra canaliculati. *Inflorescentia* paniculata, pedunculis lanato-pubescentibus demum glabrescentibus, pedicellis hirsutis usque ad 3 mm. longis. *Receptaculum* turbinatum, extra tomentosum, intra glabrum, circiter 2 mm. longum. *Sepala* oblonga, obtusa, circiter 2·5 mm. longa, extra tomentosa, marginibus dense pilosa. *Petala* oblanceolato-spathulata, apice rotundata, 4 mm. longa, 1 mm. lata, extra lanato-tomentosa. *Stamina* 10, cum petalis inserta; filamenta inaequalia, dense lanato-pilosa, circiter 5 mm. petalis longiora; antherae parvae, ovatae, dorso affixae. *Ovarium* stipitatum, circiter 7 mm. longum et 1 mm. latum, fusiforme, dense lanatum, in stylum brevissimum glabrum contractum. *Fructus* non visus.

South Africa. Natal: Ingwavuma, Nov. 1919, Magistrate of District, *National Herb. Pretoria* 1228.

1664. **Pteronia Foleyi,** *Hutchinson et Phillips* (Compositae-Asteroideae), affinis *P. sordidae*, N.E.Br., sed foliis majoribus bracteis inferioribus minoribus numerosis minus membranaceis differt.

Frutex circiter 30 cm. altus. *Rami* glabri, brevissimi. *Folia* opposita, 5–6 mm. longa, 1·5 mm. lata, linearia, apice rotundata et frequenter recurva, minute papillosa. *Capitula* terminalia, solitaria, subsessilia, 2·5 cm. longa, obconica. *Involucri bracteae* circiter 10 seriatae, minute ciliatae; extimae elliptico-lanceolatae, marginibus vix membranaceis; intimae oblanceolatae, apice obtusae. *Corollae tubus* 9 mm. longus, cylindricus, glaber; lobi 3 mm. longi, 1 mm. lati, oblongi, apice obtusi. *Filamenta* 2·5 mm. longa, linearia; antherae 5·5 mm. longae, lineares. *Pappus* 1 cm. longus, setis basi connatis, *Achaenia* 5·5 mm. longa, obovata, villosa; stylus 7 mm. longus, teres, glaber; lobi 4 mm. longi, lineares, apice angustati, obtusi.

South Africa. Wittebergen; Matjesfontein, *Rehmann* 2923; common on flats and stony Kopjes at Matjesfontein, October 1921, *W. J. Foley in S. Afr. National Herbarium* 1516.

Near *P. sordida*, N.E.Br. but differs by its larger leaves which are usually recurved, bracts much narrower and with less membranous margins, and usually less densely villous achenes.

1665. **Acocanthera longiflora,** *Stapf* [Apocynaceae-Carisseae]; affinis *A. venenatae*, G. Don, sed floribus fructibusque omnibus partibus majoribus.

Arbuscula, 5–6 m. alta, glaberrima inflorescentiis exceptis; ramuli novelli magis minusve compressi, laeves. *Folia* elliptica vel elliptico-oblonga, apice mucronato-acuta, basi acuta vel subcuneata, plerumque 6–9 cm. longa, 3·5–4 cm. lata, rarius ampliora (ad 11 cm. longa, 6·5 cm. lata), coriacea, exsiccando olivaceo-viridia, subtus pallidiora, nitida, nervis secondariis utrinque 7–9, tertiariis similibus saepe interjectis, obliquis parallelis utrinque prominentibus, venis distinctis prominulis; petiolus crassiusculus, 2–3 mm. longus. *Inflorescentiae* subglomeruliformes, plerumque ubique puberulae, multiflorae, sessiles vel subsessiles, axi demum ad 5 (raro 8) mm. longo; bracteae ovatae, acutae, minutae. *Calyx* puberulus, raro glaber, 3·5–4 mm. longus; sepala ovato-lanceolata vel lanceolata, subacuminata. *Corolla* alba, suaveolens; tubus circiter 15–16 cm. longus, magis minusve puberulus, intus laxe pilosus; lobi rotundato-ovati, breviter apiculati, 2–2·5 mm. longi. *Antherae* 1·5 mm. longae. *Stigma* breve, obtusum. *Bacca* oblongo-ellipsoidea, 2·3–2·5 cm. longa, medio 1·5–1·7 cm. diametro, demum atro-purpurea vel exsiccando nigra, edulis. *Semina* ambitu late elliptica, circiter 1·4 cm. longa, 1·1 cm. lata, albida. *A. venenata*, Vatke ex Schweinf. in Engl. Jahrb. xvii. Beibl. 41, 46 (footnote), Holmes in Pharm. Journ. ser. 3, xxiv, 42; Stapf in Dyer, Fl. Trop. Afr. iv. 94 (partly). *A. Schimperi*, Schweinf. in Boll. Soc. Afr. Italia x. (1891) xi–xii, 13 (the Taita plant); and in Engl. Jahrb. xvii. l.c., Pax in Engl. Pfl. Ost. Afr. B. 519 (the Taita plant). *A. abyssinica*, K. Schum. in Engl. Pfl. Ost. Afr. A. 48 (partly ?).

East Africa. Kenya Colony; Taita, Ndara Mountains, 1270–1525 m., *Hildebrandt; Holmwood.* Nairobi, common on the edges and in open places of the forests, 1780 m., *C. F. Elliott* 266; *Battiscombe*; Kikuyu, *Whyte.* Usambara; Kwa Mshuza, 1300 m., *Holst* 8968. "Deutsch-Ostafrika" without precise locality, *Busse*, 382.

A. venenata, G. Don, appears to be confined to South Africa and Matabeleland (by streams near Buluwayo, *Rand*, 572; Hope Fountain, south of Buluwayo, *Baines*).

According to Mr. Battiscombe the fruits are edible having a sweet taste and are readily devoured by birds. Mr. Battiscombe writes :—"Both *Acocanthera Schimperi* and *A. longiflora* are used indiscriminately for arrow-poison, but that derived from *A. Schimperi* is said to be more potent than *A. longiflora;* to the Wakamba natives who are chief users of the arrow poison both trees are known under the name of 'Ki bai' but *A. longiflora* is qualified as 'Ki bai chi ao' *e.g.* black Ki bai. Just now the former is in full blossom and is a beautiful sight."

I have adopted Endlicher's spelling of *Acocanthera* in the place of the absurd and barbarous form *Acokanthera*, found in G. Don's Generum Systema, which is evidently due to a printer's error. Don himself gives the derivation of the name as "from ακωκη, acoce (two ce's) a mucrone......" Another printer's error of a similar nature has crept into the same paragraph lower down where the anglisized names of the species of *Acocanthera* are rendered as "Poisonous Aconanthera," "Lamark's Aconanthera," etc. and there are further misprints on the same page, a clear proof of bad reading. Pfeifer, Nomenclator Botanicus, has also *Acocanthera.*

1666. **Brachystelma brevipedicellatum,** *Turrill* [Asclepiadaceae-Ceropegieae]; affinis *B. Arnotii*, Baker, sed pedicellis brevioribus floribus majoribus corolla haud reflexa coronae lobis truncatis in parte superiore atropurpureis praecipue differt.

Tuber napiforme, 5 cm. diametro, pallide brunneum. *Caules* 2–4, erecti, a basi saepe ramosi, minute puberuli pilis plus minusve reflexis. *Folia* elliptica vel lanceolato-elliptica, apice obtusa vel subacuta, basi in petiolum circiter 5 mm. longum angustata, 2 cm. longa (petiolo excluso), marginibus leviter undulata, in pagina superiore margines versus hispidula, in pagina inferiore omnino hispidula pilis uncinatis instructa, nervis subtus prominentibus, supra impressis, nervis lateralibus utrinque 5–6 vix anastomosantibus. *Flores* in foliorum axillis 3–5; pedicelli 2 mm. longi. *Sepala* lanceolata, acuta, 3 mm. longa, 1 mm. lata, puberula. *Corolla* extus fere glabra, viridis, tubo breviter campanulato, lobis patulis supra atropurpureis leviter corrugatis subcarnosis pilis brevibus nitentibus instructis. *Corona exterior* nulla. *Corona interior* lobis 5 staminis oppositis truncatis vix 2 mm. latis ex ore corollae tubi eminentibus parte superiore atropurpureis intus pulvinis carnosis viridibus staminis adnatis prædita. *Stamina* flava, brevia, inflexa. *Styli apex* truncatus.

South Africa. Described from a plant cultivated at Kew and received originally from Pretoria.

1667. **Huernia Hislopii,** *Turrill* [Asclepiadaceae-Stapelieae]; affinis *H. barbatae,* Haw., sed corollae lobis reflexis, tubo haud intus pilis longis instructo, coronae exterioris lobis angustioribus praecipue distinguitur.

Planta a basi ramosa, circiter 5 cm. alta, ramis 5-angulatis inferne viridibus superne purpurascentibus glaucis glabris 1 cm. diametro ad angulos dentibus 3 mm. longis instructis. *Flores* solitarii; pedicellus 6 mm. longus, glaber. *Sepala* lanceolato-subulata, apice acuminata, 6 mm. longa, glabra. *Corolla* campanulata; tubus 1.6 cm. longus, inferne leviter ampliatus, superne contractus, extra albus, intra lineis atro-sanguineis instructus, fauce 1.1 cm. diametro, papillis subclavatis albis apice fusco-sanguineis praeditus; limbus 5-lobatus, cremeus, maculis fusco-sanguineis numerosis instructus, lobis deltoideis acuminatis 1.4 cm. longis papillosis valde reflexis, dentibus intermediis 3 mm. longis basi 2 mm. latis reflexis. *Corona exterior* lobis 5 oblongis 4 mm. longis 3 mm. latis atro-sanguineis et fere nigris apice truncatis breviter 3–4-dentatis praedita. *Corona interior* lobis 5 subulatis 4 mm. longis ad medium conniventibus superne divergentibus albis apice atro-sanguineis instructa.

Tropical Africa: Rhodesia, *Hislop.* Described from a living specimen grown in the Royal Botanic Gardens, Kew.

1668. **Bowkeria citrina,** *Thode* [Scrophulariaceae-Cheloneae], affinis *B. velutinae,* Harv. ex Hiern, sed foliis aureo-glandulosis parce puberulis minime vero velutinis, pedunculis brevioribus, calycis segmentis angustioribus lanceolatis-oblongis acutis vel acuminatis, corolla citrina distincta.

Frutex ramosissimus, 6–8-pedalis, fragrans. *Ramuli* subteretes, pubescentes glandulosique, internodiis foliis multo brevioribus. *Folia* terna, breviter petiolata, lanceolata, 5–7.5 cm. longa, medio 0.6–1 cm. lata, acuta, basi et apice angustata, marginibus integris vel sub apice denticulatis subrevolutis, utrinque aureo-glandulosa glandulis subtus multo magis conspicuis, superne densius subtus parce puberula vel praeter nervos subglabra, hic pallidiora et tenuiter reticulata. *Petioli* 2–3 mm. longi, puberuli. *Pedunculi* axillares, oppositi, uniflori, puberuli, 1–1.2 cm. longi, sub apicem bibracteolati. *Bracteolae* lanceolatae, puberulae, 4–5 mm. longae. *Calyx* alte 5-partitus, segmentis oblongo-lanceolatis acuminatis ciliolatis. *Corolla* bilabiata, obliqua, ventricosa, inflata, puberula, flava, interne purpureo-punctata, ad 1.6 c.m. longa, labio superiore bidentato, inferiore tridentato lobis brevibus obtusis ciliolatis. *Stamina* filamentis arcuatis glabris, antheris didymis glabris reniformibus. *Ovarium* pubescens. *Stylus* filiformis, puberulus, longe persistens. *Capsula* septicidalis, bivalvis, aureo-glandulosa, ad 1 cm. longa. *Semina* ignota.

South Africa. Natal: Utrecht Division; by the tributary streamlets of the Pongola River, near Rooipoort, 1270 m., *J. Thode.*

An agreeably scented large shrub growing by the banks of streamlets under the Drakensberg in the Utrecht division and flowering from January to June.

1669. **Acrocephalus erectifolius,** *N. E. Brown* [Labiatae-Ocimoideae]; persimilis *A. venoso*, Baker, sed foliis brevissime petiolatis bracteisque subduplo majoribus et late membranaceo-marginatis facile distinguitur.

Herba perennis, erecta, ad 80 cm. alta. *Caules* 2–4 mm. crassi, patule pilosi. *Folia* erecta, utrinque pilosa; petioli 2–3 mm. longi; laminae 5–9 cm. longae, 0.5–1.2 cm. latae, lineari-lanceolatae, acutae, sub-integrae vel minute denticulatae. *Capitula* globosa, circa 1 cm. diametro, corymboso-paniculata, foliis reductis coloratis praedita; bracteae 4–5 mm. longae, 5–8 mm. latae, late rhomboideae, subacutae, late colorato-marginatae, ciliatae et infra marginem dorso pubescentes. *Calyx* 2 mm. longus, obtuse bilabiatus. *Corolla* 5 mm. longa, lobis parvis obtusis.

Tropical Africa. North-west Rhodesia; Broken Hill, on clay soil, 1220 m. June 1909, *F. A. Rogers* 8157.

1670. **Englerastrum rhodesianum,** *N. E. Brown* [Labiatae-Ocimoideae]; affinis *E. Schweinfurthii*, Briq., sed racemis duplo longioribus et ramosis conspicue differt.

Herba annua, 1.5–40 c.m alta, erecta. *Caulis* 1.5–4 mm. crassus, simplex vel opposite ramosus, pubescens vel puberulus, fere ad basin florifer, internodiis 2–5 cm. longis. *Folia* opposita, deflexa, subsessilia, 1.5–2.5 cm. longa, 1–1.5 cm. lata, ovata, obtuse acuta, basi rotundata vel subcuneata, subintegra vel obscure crenata, utrinque parce pubescentia. *Racemi* patuli, 5–15 cm. longi, laxe ramosi, graciles, minute puberuli vel fere glabri;

ramuli distantes, ad 3 cm. longi, apice subcapitato–3–6-flori; pedicelli 1–2 mm. longi. *Calyx* 1.5 (fructu 2.5) mm. longus, subaequaliter 5-dentatus, pubescens, dentibus deltoideis acutis. *Corolla* 4 mm. longa, caerulea; labium superum 1 mm. longum, inaequaliter 4-lobum; labium inferum 2 mm. longum, concavum.

TROPICAL AFRICA. Northern Rhodesia: Mumbwai, *Mrs. Macaulay* 637; Livingstone, *F. A. Rogers* 7205.

VII.—MISCELLANEOUS NOTES.

MR. H. GREEN, Assistant Superintendent of the Botanical and Forestry Department, Hong Kong (*K.B.*, 1911, 118) has been appointed by the Secretary of State for the Colonies Superintendent of the Department in succession to the late Mr. W. J. Tutcher (*K. B.*, 1920, 136).

MR. L. G. RICHARDS, a member of the gardening staff of the Royal Botanic Gardens, Kew, has been appointed by the Secretary of State for India, on the recommendation of Kew, a Probationer Gardener in India.

Visitors during 1921.—The number of visitors to the Gardens in 1921 was 1,236,308.

Additions to Gardens, 1921.—The number of separate consignments of living plants, seeds, etc., to the Gardens was 338. The most important were the following:—

Edinburgh, Royal Botanic Garden.—147 packets of seeds; *Bursera pinnata* and *B. Delpechiana*, *Rhododendron acuminatum*; various other plants and seeds.

Glasnevin, Royal Botanic Garden.—39 packets of seeds; *Lilium Lowii*, *Protea abyssinica*, *Primula Fortunei*, *Bulbophyllum erythrostachyum*.

Cambridge Botanic Garden.—Various herbaceous plants and seeds.

R.H.S. Gardens, Wisley.—*Lilium giganteum*, Chinese shrubs and herbaceous plants.

Regents Park (T. Hay, Superintendent).—14 large Agaves, *Musa Ensete*. *Restio subverticillatus*.

Dominica Botanic Garden.—Seeds *Phytelephas macrocarpa*.

St. Kitts-Nevis Agri. Dept.—*Melocactus communis*.

Nigeria Agri, Dept.—Seeds of economic plants, bulbs, *Crinum purpurascens*, *Lissochilus Heudelotii*.

Rotterdam Botanic Garden.—*Macodes petola*.

Batoum Botanic Garden.—Seeds of herbaceous plants and Palms.

Gold Coast Agri. Dept.—Seeds *Digitarum exilis.*

Soudan Forestry Dept.—Orchids, Ferns, etc.

Ceylon, Royal Botanic Garden.—*Dendrobium aureum.*

U.S. Dept. of Agriculture.—Seeds *Prunus Davidiana*, etc., *Casimiroa edulis*, *Pinus Bungeana.*

Tokyo Botanic Garden.—106 packets of seeds.

Kirstenbosch Botanic Garden.—S. African bulbs, seeds of Proteas, etc.

S. African Dept. of Agriculture, Pretoria.—*Aloe sessiliflora*, seeds *Osyris abyssinica.*

Seychelles Botanic Station.—Seeds of *Lodoicea sechellarum.*

Mauritius Forest Dept.—Wardian case of Orchids and other plants. Seeds *Typhonodorum Lindleyanum*, various Palms and Pandanads.

Penang Botanic Garden.—Seeds *Pholidocarpus macrocarpa* and *Borassus machadonis.*

Arnold Arboretum.—Many packets of seeds, including *Quercus rhombica*; collection of seeds from Mr. Hers, Peking.

Uganda, Dept of Agriculture.—Seeds *Encephalartos Laurentianus.*

Singapore Botanic Garden.—Four Wardian cases of plants. Seeds *Hosea Lobbii.*

Sydney Botanic Garden.—Seeds *Telopea speciosissima.*

Darwin Botanic Garden.—Seeds *Callitris intratropica.*

Egyptian Ministry of Agriculture.—Various seeds.

Kumaon Botanic Garden.—Seeds and roots of native plants including *Habenaria Suzannae.*

Angola Botanic Garden.—Various seeds.

Ottawa Experimental Farm.—Seeds *Zizania aquatica.*

Uganda Botanic Garden.—Orchids.

Kenya Colony, Forest Dept.—Various seeds.

Messrs. Sanders, St. Albans.—*Vanda luzonica.*

Messrs. Charlesworth & Co., Haywards Heath.—*Eulophiella Rolfei* and other Orchids.

Mr C. Engelmann, Saffron Walden.—Collection of Carnations.

Messrs Wallace & Co., Tonbridge.—Liliums and *Clematis koreana.*

Messrs Vilmorin Andrieux & Co., Verrières.—Seeds of Chinese trees and shrubs.

Mr T. Richardson, Victoria, Australia.—Collection of Australian seeds.

Mr J. C. Watt, Aberdeen.—*Lonicera splendida.*

Mr J. S. Gamble, Liss.—*Arundinaria Pantlingii* and *A. Maling.*

Mr H. J. Elwes, Colesborne.—Various seeds and plants. *Hedychium Elwesii*, *Cymbidium Devonianum*, *Campanula mirabilis*, etc.

Mr A. Pride, Lincoln.—*Stevia Rebaudiana*, Hippeastrums, etc.

Mr R. Fox, Penjerrick.—Rhododendrons.

Mrs King, Hendon.—Collection of Indian seeds.

Mr W. R. Price, Chepstow.—Orchids from Formosa.

Mr C. B. Kloss, Richmond.—*Amorphophallus Rex*, bulbs, seeds of *Hodgsonia heteroclita*.

Mr A. E. Bowles, Waltham Cross.—Various spp. of Crocus.

Booth Steamship Co., Liverpool.—Seeds *Attalea funifera*.

Mr R. B. Stamford, Loughborough.—Large plant of *Epiphyllum truncatum*.

Mr A. M. Mitford, Upton Park.—Various tropical plants and seeds.

Mount Everest Committee of R. Geog. Soc. and Alpine Club.—Collection of seeds (Everest Expedition).

Mr J. C. Williams, Caerhays.—*Populus Wilsoni, Daphne retusa*, Chinese Rhododendrons.

Mr R. S. Hall, Blackpool.—Dwarf Musa from West Africa.

Mr J. Kay, Prestwick.—Seeds of conifers.

Marquis of Headfort, Meath.—Hardy trees and shrubs.

Mr A. K. Bulley, Neston.—Seeds *Eriogonium Wrightii, Codonopsis Bulleyana*.

Mr H. Spence, Knutsford.—Seeds *Quercus cornea*.

Mr M. Yorke, Iver Heath.—*Rhododendron Edgarianum*.

Mr P. D. Williams, St Keverne.—Hardy trees and shrubs, *Rhododendron Boothii:* seeds *Quercus marylandica*.

Mr R. Cory, Duffryn.—Chinese seeds, trees and shrubs.

The Hon. Vicary Gibbs, Aldenham.—*Cotoneaster Vicarii, Syringa palibiniana*.

Major A. A. Dorrien Smith, Tresco—Various seeds and plants.

Major L. de Rothschild, Gunnersbury.—Chinese seeds, hardy Nymphaeas, *Arundinaria rubicunda, Magnolia Wilsoni*.

Major A. Pam, Broxbourne.—*Hymenocallis Amancaes*.

Mr C. Turner, Slough.—*Syringa Swezingowii*.

Mr S. T. Dunn, Kew.—Seeds *Cinnamomum inunctum*.

Mr J. Cadman, R. Colonial Institute.—Seeds *Hodgsonia, Theobroma* and *Acrocomia*.

Dr H. Durham, Hereford.—*Polymnia edulis, Iris atrofusca*.

Mr A. Grove, Henley.—*Lilium auratum macranthum*.

Mr C. W. James, Welbeck Street, W.—Seeds *Quercus alnifolia*.

Mr T. H. Lowinsky, Sunningdale.—Rhododendrons.

Mr H. G. Elisha, Canonbury.—Collection of Mesembryanthemums and other succulents.

Mr G. Fraser, Ucluclet.—Hybrid Rubi, Erythroniums.

Mr D. Tannock, Dunedin.—Seeds of Celmisias, etc. Wardian case of plants.

Lt. Col. Lee, S. Shan States.—Seeds *Aristolochia Hookeriana*.

Mr C. Hanbury, La Mortola.—Collection of seeds.

Mr W. Purdom (the late), Peking.—Seeds of Chinese plants.

Mr F. Griffith, Bloemfontein.—Seeds, *Cupressus arizonica* and of S. African Heaths.

Miss Wilman, Kimberley.—Various bulbs and seeds.

Mr G. Coomber, Zomba.—Seeds *Widdringtonia Whytei, Khaya senegalensis*.

Mr M. T. Dawe.—Various seeds from the Gambia. Tubers of Yams, *Arracacha esculenta, Solanum sp.*, fruit edible. Orchids, bulbs and seeds from the Congo. Seeds *Befaria sp.*

Miss M. Mason, Cape Town.—Seeds, bulbs and tubers of S. African plants.

Mr T. B. McLelland, Porto Rico.—*Dioscorea esculenta.*

Mr E. C. Villiers, Ceylon.—Wardian case of plants.

Mr A. W. Maynard, Queenstown, S. Africa.—*Encephalartos horridus, E. Frederici-Guilielmi* and *E. sp.*

Mr G. W. Grabham, Khartoum.—Orchids, Ferns, bulbs and seeds.

Mr J. G. Watson, Johore.—Orchids.

Mr F. Kingdon Ward.—Many packets of seeds, collected in China.

Mr G. M. Michell, Para.—Collection of Passifloras.

Mr J. M. Hunter, Queensland.—*Nymphaea sp.* (native).

Mr W. Campbell, Johannesburg.—Seeds *Bolusanthus speciosus.*

Dr L. Cockayne, New Zealand.—Collection of seeds and native plants.

Mr C. H. Lankester, Uganda.—Orchids; seeds from Mount Elgon.

Mr M. Koch, W. Australia.—Collection of seeds.

Rev. H. H. Mathias, Christchurch, N.Z.—Seeds of New Zealand plants.

Mr P. M. Bayne, Chang-Tu, China.—Collection of Chinese seeds.

Mr A. F. Baker, Bloemfontein.—S. African bulbs and seeds.

Dr Y. S. Sanitwongse, Bangkok.—*Jasminum Rex.*

Mr T. D. A. Cockerell, Colorado.—Seeds *Primula Parryi.*

Mr T. P. Stokoe, Cape Town.—Seeds *Orothamnus Zeyheri, Erica*, etc.

Prof. Trabut, Algiers.—*Urginea maritima.*

Dr J. Borg, Malta.—*Urginea maritima.*

Mr L. H. Wah, Burma.—Dendrobiums.

Dr H. Takeda, Tokyo.—*Ranzania japonica.*

Mr C. Hummel, British Honduras.—*Ananas macrodontes.*

Surplus plants from the various collections were distributed as usual, either in exchange with botanic gardens, nurserymen, etc., or as gifts to teaching institutions. The total number of packets of seeds distributed was 2,888 of hardy trees and shrubs, and 3,090 of hardy herbaceous plants. The most important of the seeds obtained for special distribution were *Typhonodorum Lindleyanum, Pinus canariensis* and Nigerian Oil Palm. Two trees which have been freely distributed are the hybrid *Populus generosa* (cuttings) and *Aesculus indica*, the latter having seeded freely at Kew.

Wardian cases of plants were sent to the Botanic Gardens of Sierra Leone, Kumaon, Ceylon and the Emir of Katsina.

The recipients of plants, etc., from Kew, included the following:—

Richmond Park.—Trees and shrubs.

Armstrong College, Newcastle-on-Tyne.—Collection of Willows.

Mr A. Anesworth, Otford.—Shrubs and herbaceous plants.

Oxford Botanic Garden.—Collection Bamboos and collection of Selaginellas.

Mr C. Eley, East Bergholt.—Rhododendrons and other shrubs.

Mr A. Ashridge, Pinner.—Collection of hardy herbaceous plants.

Mr H. A. Hesse, Weener, Hanover.—Collection of seeds of trees and shrubs.

Ministry of Agriculture and Fisheries, Pathological Laboratory, Harpenden.—Hardy trees and shrubs.

Miss Willmott, Warley.—Hardy trees, shrubs and herbaceous plants.

Dr F. Boergesen, Copenhagen.— Rhododendrons and other shrubs.

Glasnevin, Royal Botanic Garden.—Collection of Mesembryanthemums, various greenhouse plants, trees and shrubs.

Mr H. J. Elwes, Colesborne.—Cacti, Mesembryanthemums and other plants.

Mr C. Hanbury, La Mortola.—Shrubs and herbaceous plants (tender).

Royal Botanic Society, Regents Park.—250 greenhouse plants.

Mr J. C. Williams, Caerhays.—Hardy trees and shrubs.

Emir of Katsina.—Plants and seeds.

Imperial War Graves Commission, St Omer.—Plants and cuttings of shrubs, various seeds.

Rachel Macmillan Training Centre, Deptford.—171 trees and shrubs.

Hyde Park.—50 *Aesculus indica*, 12 *A. californica*.

Regents Park.—80 trees and shrubs.

Ministry of Agriculture and Fisheries, Veterinary Laboratory, Weybridge.—50 shrubs.

Forestry Commission.—1,300 cuttings of *Populus generosa*, etc.

John Innes Horticultural Institute, Merton.—Shrubs and herbaceous plants.

National Physical Laboratory, Bushey Park.—384 trees and shrubs.

Jardin des Plantes, Paris.—50 trees and shrubs, collection of cuttings.

Mr. T. H. Lowinsky, Sunningdale.—Rhododendrons.

Included in the painting of the plant houses, etc., were the interiors of the central portion of the Palm House and the octagons of the Temperate House. The roof of the Victoria House and adjoining porch, owing to the decay of some of the principal rafters, underwent considerable repair. Improved accommodation for the smaller succulent plants was provided by converting a large span frame into a low house, and this has given satisfactory results. Such a house was necessary owing to the purchase of a valuable collection of Mesembryanthemums formed by the late Mr H. G. Elisha, Canonbury. Other purchases of importance were a collection of Australian seeds from Mr T. Richardson, Elmhurst, Victoria, and greenhouse plants from Messrs Haage and Schmidt, Erfurt.

A new Lecture room for the use of the Student Gardeners has been fitted up and is now in use, so that it is possible for two courses of lectures to be given simultaneously.

Arboretum.—The most laborious undertaking in this Department has been the removal of mud from the Lake bottom. The last time it was done was during the winter of 1906–1907 (*see K.B.* 1907, p. 101), so that there has been a fifteen years' accumulation; this varied in depth in different parts of the Lake from four to eighteen inches. Sixteen of the regular labour staff were set to work in November, their places in the ordinary gang being taken by the same number of unemployed men in the neighbourhood. Owing to fine open weather, the work has proceeded very satisfactorily and will probably be finished early in February.

The Natural Order *Hamamelidaceae* or witch-hazel family, although small, is a very interesting one and the species in cultivation have been considerably increased by recent exploration in China. Two new genera have been made, *Sinowilsonia* and *Fortunearia*, both commemorating famous plant collectors in China. To provide adequate accommodation for these new introductions a miscellaneous shrubbery immediately north-east of King William's Temple was cleared away last February and the site devoted to the witch-hazels and their allies, of which the following is a complete list now in cultivation in the open air at Kew :—

Corylopsis Gotoana, Mak.
,, *Griffithii*, Hemsley.
,, *pauciflora*, Sieb. & Zucc.
,, *platypetala*, Rehd. & Wils.
,, *sinensis*, Hemsley.
,, *spicata*, Sieb. & Zucc.
,, ,, var. *foliis variegatis*, Hort.
,, *Veitchiana*, Bean.
Corylopsis Willmottiae, Rehd. & Wils.
,, sp. Forrest, 13516.
Disanthus cercidifolia, Maxim.
Distylium racemosum, Sieb. & Zucc.
Fortunearia sinensis, Rehd. & Wils.
Fothergilla Gardenii, Murray.
,, *major*, Lodd.
,, *monticola*, Ashe.
Hamamelis arborea, Masters.

Hamamelis japonica, Sieb. & Zucc.
,, ,, var. *rubra*, Hort.
,, ,, var. *Zuccariniana*, Nichols.
,, *mollis*, Oliver.
,, *vernalis*, Sargent.
,, *virginiana*, L.

Liquidambar formosana, Hance.
,, ,, var. *monticola*, Rehd. & Wils.
,, *orientalis*, Mill.
,, *styraciflua*, L.
Parrotia Jacquemontiana, Decne.
,, *persica*, C. A. Meyer.
Sinowilsonia Henryi, Hemsley.
Sycopsis sinensis, Oliver.

Loropetalum chinense, Oliver, has several times been tried in the open air, but is not hardy and is now grown in the Temperate House. *Eucommia ulmoides*, Oliver, and *Cercidiphyllum japonicum*, Sieb. & Zucc. are sometimes placed in *Hamamelidaceae*. Both are hardy.

The Rose Garden near the Pagoda, which is largely planted with the free-growing hybrids of the polyantha and Wichuraiana groups of roses, was formed out of a disused gravel pit in 1895–1896. The steep banks were held up by tree stumps. Many of these having decayed the whole garden was given a thorough overhauling during the early part of the winter, the decayed stumps being replaced by fresh ones. The opportunity was taken also to plant a large number of young roses in place of old worn-out ones.

The large breadths of spring flowering heaths which make such a charming feature at Kew suffered very badly from last year's drought; many were killed outright and many more so debilitated as to be unfit to remain. Fortunately there was a large quantity of healthy young plants in the nursery to take their place. The occasion of replanting was taken to make a winding informal grass walk through the heath bed close to the Unicorn Gate (H and I 9 on Key Plan) in which some interesting Magnolias and other rare shrubs are planted and will thereby be made available for closer inspection by visitors.

A considerable number of men have been employed since October in renewing the turf at the edges of the walks. Owing to public traffic this is an annual task, but the drought of 1921 has made it a much more arduous one than usual. The work nevertheless is essential, for worn and battered verges to the walks detract much from the appearance of any garden, however well kept in other respects.

The remainder of the Palace Lawn on which potatoes had been grown in 1920 was sown with grass seed last spring; and the western corner of Kew Green in front of the Herbarium which had been cut up into vegetable allotments during the war was also laid down to grass again.

Museums.—During the year the Staff has been fully occupied in dealing with a large number of products received for determination, and report and in furnishing information to commercial firms planters and others upon various plants of economic interest. The remainder of the timbers received in the rough from the Empire Timber Exhibition have been prepared for exhibit and placed in position and a large and miscellaneous collection of products obtained from the Rubber and other Tropical Products Exhibition have likewise been dealt with. Duplicates have been distributed to the Agent-General for Queensland, the National Museum Cardiff, School of Forestry at Yale University etc. As in past years a collection chiefly of duplicate material was prepared for the Bath and West and Southern Counties Show at Bristol also for the Shropshire and West Midland Agricultural Society at Shrewsbury and for the Royal Agricultural Society of England at Derby. The checking and relabelling of the contents of Museum No. I. has been completed and other necessary work on the permanent collections taken in hand. Individual students and parties from schools have made good use of the Museums during the year.

J. M. H.

Research in Jodrell Laboratory in 1921.—Mr. W. N. C. Belgrave studied the laticiferous tissue of certain rubber-plants, and investigated one or two cases of incipient "brown-bast" disease.

Mr. L. A. Boodle examined the structure of specimens from Lime-trees showing swellings due to Mistletoe, and compared the anatomy of camphor-yielding and oil-producing examples of *Cinnamomum Camphora*.

Dr. J. W. Munro and Mr. R. N. Chrystal carried out experiments on the fumigation of plants with hydrocyanic acid gas with a view to controlling insect pests.

Mr. W. B. Turrill made determinations of the chloride content of a number of samples of Thames water and of the water-supply of Kew Gardens, in connection with injuries to plants by salt.

Prof. F. E. Weiss made some further observations on graft-hybrids.

Presentations to the Library during 1921.—A presentation of great value and interest has been made to the library by Sir William T. Thiselton-Dyer. It consists of a collection of 201 original letters written to him by Sir J. D. Hooker, the first in April, 1870, and the last in December, 1909, thus covering a period of forty years. They will be prized because, as Sir William has remarked in a letter accompanying his gift, of the intimate picture they give of Sir Joseph himself; "his straight and unflinching fervour in the interests of science, and his extreme modesty." Sir Joseph's last letter in this collection is perhaps the most interesting of all, for in it he records his personal recollections of Robert Brown. We are familiar with the estimate of Brown as a botanist, "botanicorum facile princeps," as expressed by Humboldt. Sir Joseph reveals some of his remarkable characteristics as a man. "Of all the friends I ever had," he wrote, "he was the most persistently reticent, whether in conversation or correspondence." Asa Gray (*Letters*, vol. i. p. 128) seems to have held the same opinion of Brown: "He is, as old Menzies told us, the driest pump imaginable." Though Brown showed him kindness during his preparations for the voyage to the Antarctic Sir Joseph makes the startling confession: "On my return he never asked me a single question about the Erebus, its captain or officers, or the places we had visited." This appears the more extraordinary in view of the fact that, as naturalist to Flinders' Expedition, Brown, about forty years before, had explored and collected in Tasmania, the scene of many important investigations by Hooker. Their impressions of the island and its people, and their common interest in its vegetation, might be supposed to have prompted many a question and remark when the two men met on Hooker's return, but Brown maintained a sphinx-like silence with regard to his own experiences and manifested no desire to learn anything of Hooker's. We should imagine from the singular treatment that Hooker received from Brown that the latter, in spite of so much that was really great and amiable in his character, was small enough to regard the enthusiastic younger botanist with some jealousy. Darwin (*Letters*, i. p. 73) observed that Brown was "strangely jealous on some points."

The late Lady Hooker has presented a large collection of typed matter comprising copies of Sir Joseph's letters, journals and lectures, etc.; also 37 original notebooks of his Indian and other travels.

Among manuscripts received from Dr. W. Botting Hemsley are his notes for a *Flora Seychellensis* and for a supplement to the *Biologia Centrali-Americana*, and numerous letters written to him by Sir J. D. Hooker; Dr. Hemsley has also presented some publications containing plates for the collection of drawings.

Mr. J. F. Duthie has presented 122 letters, also by Sir J. D. Hooker, written during the period 1875 to 1910. Three copies of Mr. Duthie's *Flora of the Upper Gangetic Plain*, etc., vol. iii. pt. 2, have reached the library from the Director of the Botanical Survey of India. This part includes the families Coniferae to Juncaceae.

In addition to the current issues of several serials and periodicals, received in exchange for *Hooker's Icones Plantarum*, the Bentham Trustees have presented a rare little volume by Baptista Fiera, which is sometimes quoted under the title: *Coena: de cibariorum virtutibus;* it is undated, but it is believed that it was published in Rome about 1489. It is an octavo volume containing 29 leaves of text, which consists of Latin verses dealing with the properties of various foods, many of which are of vegetable origin. The work is dedicated to Cardinal Rearius, and the recto of the first printed leaf bears 16 lines by Pomponius Laetus (1425–1498), the Italian humanist, celebrated in his day as a teacher, and regarded as the first head of a philological school.

Dr. N. L. Britton has sent the four parts issued during the year of the *North American Flora;* and an interesting collection of 26 photographic postcards of views in the New York Botanical Garden has been received from Mrs. Britton.

Mr. J. H. Maiden has continued to present the parts as issued of his great work: *A critical revision of the genus Eucalyptus;* no less than 6 parts (44–49) were received from him in 1921, in addition to pamphlets. Parts 65–68 of Mr. Maiden's *Forest Flora of New South Wales* have been presented by the Honourable the Secretary of Agriculture, Sydney.

Prof. Hans Schinz has sent 3 more dissertations. They are; *Pflanzengeographische Beobachtungen auf einigen schweizerischen Hochmooren,* etc., by G. Josephy; *Pflanzengeographische Studien im Obertoggenburg,* by M. Vogt; and *De l'existence de variétés hétéroploïdes de l'Hyacinthus orientalis L. dans les cultures hollandaises,* by W. E. De Mol.

From the Secretary of State for India have been received *The Silviculture of Indian Trees,* by R. S. Troup, a fine work in 3 volumes, *The English Factories in India,* 1655–1660, by W. Foster, *Report of the Indian Cotton Committee,* 1919, *The Botany of Bihar and Orissa,* by H. H. Haines, part 2, and *The Flora of the Presidency of Madras,* by J. S. Gamble, part 4. A second copy of the last named has been presented by Mr. Gamble.

The Delegates of the Press, Oxford, have presented 11 bound copies of the fifth supplement to the *Index Kewensis,* published in August last, and a copy of supplements 1–5, bound together, forming vol. iii. of the work.

Lieut.-Col. Sir David Prain's presentations include *Travaux du Laboratoire de Matière médicale de la Faculté de Pharmacie de Paris,* tome xii., and the continuation of the *Berichte der Deutschen Botanischen Gesellschaft* and of the *Bulletin de la Société de Botanique de France.* Mr. W. J. Bean has presented gardening books by S. Mottet, W. Robinson and J. Weathers. A copy of Mr. Robinson's *Home landscapes,* ed. 2, was presented by the author.

Prof. A. Engler has sent *Beiträge zur Flora von Afrika,* xxxvii–xlviii., reprinted from his *Botanische Jahrbücher,* and Prof. F. Fedde vols. iii–xiii. of his *Repertorium Specierum novarum.*

The library has received as in other years numerous publications from botanical, agricultural and other public institutions in the British Colonies and Dominions, in India, and in foreign countries, not already mentioned in this note. The Department of Agriculture, Buitenzorg, the Agricultural and Forestry Departments, and the Bureau of Science in the Philippine Islands, the Agricultural Research Institute, Pusa, the Division of Botany, Department of Agriculture, Union of South Africa, the United States Department of Agriculture and the Smithsonian Institution have very liberally contributed. The Director of the Arnold Arboretum has presented a copy of *A monograph of Azaleas*, by E. H. Wilson and A. Rehder, and from the Director of the New York Agricultural Experiment Station *Sturtevant's Notes on edible plants*, edited by Prof. U. P. Hedrick, has been received.

The Controller of H.M. Stationery Office has supplied the library with a set of the Handbooks and Vocabularies compiled by the Geographical Section of the Naval Intelligence Division of the Admiralty, comprising 24 volumes; and Miss A. Lorrain Smith's *Handbook of the British Lichens* has been presented by the Trustees of the British Museum.

Under the direction of Dr. A. Chevalier 3 numbers, presented by him to the library, of a new *Revue de Botanique appliquée et d'Agriculture coloniale* appeared during the year. The library is also indebted to Dr. Chevalier for a copy of his *Exploration botanique de l'Afrique française*, tome i.

A considerable number of original drawings of plants, mostly coloured, have been received. Lieut.-Colonel W. G. King has presented 10 albums containing 842 paintings of Madras and Burmese plants, the work of the late Mrs. King. This collection includes representations of many species of Cucurbitaceae, showing fruits. Colonel King has also sent to Kew vols. 2 to 6 of Wight's *Icones Plantarum Indiae orientalis* and *The Ferns of Southern India*, by R. H. Beddome. A collection of 72 paintings and 8 pencil sketches of South African plants, by the late Mrs. F. G. Crossman, mounted in 3 albums, has been received from Captain Crossman. Messrs. F. Sander & Sons have presented an album of original drawings, chiefly dissections of the flowers of orchids, by H. G. Reichenbach, and with MS. lists of plants in cultivation at Kew, 1816–50, and other MS. and printed matter, Mr. R. J. A. Jackson has presented some original drawings of Banka plants by Dr. T. Horsfield. Mr. Jackson's presentations were formerly the property of his father, the late Mr. J. R. Jackson, for many years Curator of the Museums, Kew.

The Executors of the late Mr. R. B. Chapman have presented a manuscript index, compiled by Mr. Chapman, to Solereder's *Systematic anatomy of the Dicotyledons*, translated by L. A. Boodle and F. E. Fritsch.

The following have been received as presentations: *Arbejder fra den botaniske Have i Köbenhavn*, nos. 94–97, from the Botanical Library of the University of Copenhagen; O. Beccari, and J. F. Rock, *A monographic study of the genus Pritchardia*, from the Director of the Bernice Pauahi Bishop Museum, Honolulu; *Botanical Survey of South Africa*, Memoir no. 2, from the authors, Mr. R. D. Aitken and Mr. G. W. Gale, also from the Director of the Survey, Dr. I. B. Pole Evans; M. T. Cook, *College Botany*, from the publishers, Messrs. Lippincott; E. B. Copeland, *The Coconut*, ed. 2, from the publishers, Messrs. Macmillan; E. De Wildeman, *Contribution à l'étude de la flore du Katanga*, from the Comité Spécial du Katanga; *The Flowering Plants of South Africa*, edited by I. B. Pole Evans, vol. i. pts. 1–4, from Miss M. Smith; R. Kanehira, *Anatomical characters and identification of Formosan woods*, and supplement, from the Bureau of Productive Industries, Government of Formosa; *Malayan Science Bulletin*, no. 1, from Mr. F. W. Foxworthy; K. Miyabe and Y. Kudo, *Icones of the essential forest trees of Hokkaido*, fasc. 1–4, from His Excellency the Governor of Hokkaido; *The Orchid Review*, vol. xxix., from the Editor, Mr. Gurney Wilson; K. Rangachari, *A handbook of some South Indian grasses*, from the Director of Agriculture, Madras; *Recherches sur la répartition des plantes ligneuses croissant spontanément en Suisse*, pts. 1–4, from the Secrétariat de l'Inspection fédérale des Forêts, Chasse et Pêche, Berne; F. J. Smiley, *A report upon the boreal flora of the Sierra Nevada of California* (University of California Publications in Botany, vol. ix.), from the Manager of the University Press; F. Watts, *An introductory manual for sugar growers*, from Mr. J. H. Holland; T. S. Woolsey, jr., *Studies in French forestry*, from the publishers, Messrs. Chapman & Hall; and J. H. Veitch, *A traveller's notes*, from Mrs. R. A. Rolfe.

Among others who have made presentations to the Library the following should be mentioned as the donors of books or papers by themselves or in a few cases of other publications:— Mr. R. D. Aitken, Dr. G. E. Anastasia, Dr. G. Antonelli (*Calendario forestale italiano*, 1921), Dr. L. H. Bailey (*The principles of vegetable-gardening*, ed. 18), Mr. S. N. Bal, Prof. J. W. Bews, Prof. P. A. van der Bijl (6 mycological papers), Dr. G. Bitter (5 papers), Miss C. G. Bitting (*The effect of certain agents on the development of some moulds*), Prof. S. R. Bose, Mr. F. Bucholtz, Dr. W. Burns & Mr. S. H. Prayag (*The book of the Mango*), Prof. L. Buscalioni & Prof. G. Muscatello (*Studio anatomo-biologico sul gen. Saurauia*), Dr. E. Chiovenda (*La culla del cocco*), Messrs. W. G. Clarke & R. Gurney (*Notes on the genus Utricularia*, etc.), Dr. J. C. Costerus, Prof. A. X. Pereira Coutinho, Prof. W. G. Craib (13 papers), Miss K. M. Curtis, Mr. C. Davis (*A discourse concerning the irritability of some flowers*, by Dal Colvolo, 1767), Mr. J. Burtt Davy (Map of Rhodesia), Mr. M. T. Dawe, Mr. M. Denis, Mr. Paul Descombes (9 papers on afforestation), Prof. G. B. De Toni, Dr. E. De Wildeman, Mr. K. Dinter (*Die vegetabilische Veldkost Deutsch-Südwest-Afrikas*), Mr. J. Doyle, Mrs. Elisabeth Ekman, Prof. A. J. Ewart (several papers by himself and his assistants), Prof. C. E. Fairman, Prof. P. F. Fyson (*The flora of the Nilgiri and Pulney hill tops*, vol. iii.), Mr. R. Gestro, Mr. W. B. Grove (*Monograph of the Pilobolidae*), Dr. H. Hallier (*Beiträge zur Kenntnis der Linaceae*), Prof. A. Henry, Dr. A. W. Hill (*Tropisches Gartenbau*, 1912, by H. Deistel, and a few publications relating to the Cameroons), Dr. B. P. G. Hochreutiner (34 papers), Mr. R. S. Hole, Dr. C. C. Hosseus, Dr. J. B. Hurry (*Vicious circles in disease*, ed. 3), Dr. J. Jeswiet (*Beschrijving der soorten van het suikerriet*, 8 parts), Col. H. H. Johnston, Mr. W. Jungman, Dr. Karl von Keissler, Mrs. Koorders (*Botanisch overzicht der Rafflesiaceae*, by the late Dr. S. H. Koorders), Mr. Lester-Garland, Mr. L. Lewin, Mr. C. G. Lloyd (several of his mycological writings), Mr. R. B. Loder (*Some notes on a few of the old and remarkable oaks in England*, typed), Capt. J. McDonald, Dr. C. Massalongo, Mr. W. R. Maxon, Mr. T. Nakai (*Flora sylvatica koreana*, pts. 9 & 10), Prof. I. V. Novopokrovsky, Dr. C. H. Ostenfeld (*Contributions to West Australian Botany*, part 3), Dr. B. Peyronel (several papers on plant pathology), Dr. H. Pfeiffer (*Revision der Gattung Ficinia*), Dr. E. P. Phillips, Mr. C. V. Piper (17 papers), Prof. S. J. Record (papers on timbers), Mrs. Clement Reid, Prof. J. F. Rock (*The Leguminous Plants of Hawaii*), Mr. S. Savage, Prof. J. H. Schaffner (14 papers), Dr. R. Schlechter, Dr. T. R. Sim (*Native Timbers of South Africa*, etc.), Dr. J. J. Smith, Dr. Otto Stapf (3 papers by Dr. Handel-Mazetti, and *Précis de Botanique pharmaceutique*, by L. Beille, vol. ii., 1909), Prof. D. Thoday, Dr. G. B. Traverso, Prof. W. Trelease, Right Rev. M. N. Trollope, Bishop in Corea (*Transactions of the Korea Branch of the Royal Asiatic Society*, containing his *Arboretum coreense*), Dr. H. W. T. Wager, Mr. C. T. White (31 papers, mainly on Queensland Botany, by himself and others), Prof. R. H. Japp (several papers from the Botanical Department of the University of Birmingham), and Dr. T. G. Yuncker (*Revision of the North American and West Indian species of Cuscuta*).

Additions to the Herbarium during 1921.—During the year about 19,400 specimens were received as donations or exchanges and 8,002 purchased, while 4,032 were received on loan.

The principal collections are enumerated below :—

Europe.—*Presented :* Britain; Cornwall, by Mr. Edgar Thurston; Orkneys, by Col. H. H. Johnston; Rubi collected by the late Rev. W. Moyle Rogers, by Archdeacon F. A. Rogers; Finland, by the Helsingfors University Botanical Museum; Spain, by Prince Roland Bonaparte; Flora Rumaniae Exsiccata, cent. 1, by Prof. A. Borzi.

Purchased : Adr. Fiori & A. Béguinot, Flora Italica Exsiccata cent. 25–26; G. Briosi & F. Cavara, Funghi Parasiti, fasc. 181 Dr. F. Petrak, Fungi Polonici, fasc. 1–18, Mycotheca Carpathica, fasc. 1–8, Fungi Albani, fasc. 1–8, and Cirsiotheca Universa, fasc. 15–18.

Orient.—*Presented :* Syria (coll. B. T. Lowne) and Orient (coll. Balansa), by Mr. C. E. Salmon.

North Africa.—*Presented :* Egypt, by Mr. G. W. Grabham.

China.—*Presented:* Kansu and North-Eastern Tibet, by the Rev. Frank D. Learner.

Purchased: Prof. C. S. Sargent, O. Schoch's collection; Dr. H. Winkler, Dr. W. Limpricht's collection.

India.—*Presented:* Bengal, by Mr. H. H. Haines; Assam, by Mr. R. S. Hole; Chamba State by Mr. R. N. Parker; Tibet, by Lt.-Col. R. S. Kennedy; Himalaya and Lahore, by Mr. B. Sahni.

Malay Peninsula. — *Presented:* Various localities, by Mr. I. H. Burkill; Tahan and Kwala Lumpur (Coll. Seimund), by Mr. H. N. Ridley.

Malaya.—*Presented:* Siam, by Dr. A. F. G. Kerr, Mr. A. Marcan and Mr. I. H. Burkill. Philippine Islands, mosses by Mr. E. D. Merrill, and orchids by Prof. Oakes Ames.

Purchased: Mrs. J. Clemens, Borneo, Mt. Kinabalu.

Australia.—*Purchased:* W. A. Weymouth, Tasmanian mosses; Max Koch, Western Australia.

New Zealand.—*Presented:* Dr. L. Cockayne, seeds.

Polynesia.—*Presented:* Fiji, by Mr. W. Greenwood.

Tropical Africa.—*Presented:* Gambia, by Mr. M. T. Dawe; Nigeria, by Mr. H. V. Lely and Mr. T. Laycock; Angola and the Congo region, by Mr. J. Gossweiler; Belgian Congo, by Dr. E. De Wildeman and Mr. J. Burtt-Davy; Portuguese Congo, by Mr. M. T. Dawe; Abyssinia, by Mr. G. W. Grabham; Mombasa, by Mr. T. D. Maitland; Uganda, by Mr. C. H. Lankester; Tanganyika Territory, by Mr. A. Leechman; Portuguese East Africa, by Mr. G. Coombes; Rhodesia, by Dr. I. B Pole-Evans, Archdeacon F. A. Rogers, Mr. J. Burtt-Davy, Mr. A. Hislop, and Mr. H. G. Munday. Plants from Dr. H. L. Shantz's expedition, by the U.S. Department of Agriculture.

Purchased: R. A. Dummer, Uganda and British East Africa; Dr. J. Mildbraed, Cameroons.

Mascarene Islands.—*Presented:* Mauritius, by Mr. H. A. Tempany.

South Africa.—*Presented:* Transvaal, by Dr. I. B. Pole-Evans and Mr. J. Burtt-Davy; Griqualand West, by Miss M. Wilman; various localities, by Archdeacon F. A. Rogers.

North America.—*Presented:* Trees and shrubs, by Prof. C. S. Sargent; Washington State, by Mr J. M. Grant.

Purchased: W. N. Clute, Arizona; B. F. Bush, Arizona.

Central America.—*Presented:* Mexico, by Mr. J. Gonzalez Ortega; British Honduras, by Mr. C. Hummel; Panama, by Mr. W. R. Maxon.

West Indies.—*Presented:* Various islands, Dr. N. L. and Mrs. E. G. Britton, and Mr. W. Fishlock; Danish West Indies, by Dr. F. Börgeson.

Mr. Edgar Thurston, C.I.E., has continued his investigation of the Cornish flora, and has presented the specimens collected in 1920. A collection of Rubi made by the late Rev. W. Moyle Rogers, has been presented by his son, Archdeacon F. A. Rogers. The European herbarium formed by Miss E. A. Willmott, F.L.S. has been presented by her. Specimens collected in Syria by B. T. Lowne about 60 years ago have been presented by Mr. C. E. Salmon and supplement those already at Kew from the same collector.

The plants of the Mount Everest Expedition have been deposited at Kew for identification. A collection from Kansu and Tibet by the Rev. Frank D. Learner contained the rare *Gentiana striata*, Maxim. Various plants collected by Mohamed Haniff, Mohamed Nur, Seimund and others in the Malay Peninsula have been received and are being used by Mr. N. N. Ridley for working out at Kew his Flora of the Malay Peninsula. Dr. A. F. G. Kerr and Mr. A. Marcan have continued to send Siamese plants, and additional material has been also furnished through the exertions of Mr. I. B. Burkill's collectors. Philippine Island mosses have been presented by Mr. E. D. Merrill, and orchids from the same region by Prof. Oakes Ames. Mr. W. Greenwood has continued his work in Fiji and sent his specimens to Kew.

Tropical Africa, as usual, has furnished a large proportion of the material received during the year. From the western side interesting collections from the Gambia, Naraguta, and Yorubaland have been received from Mr. M. T. Dawe, Mr. H. V. Lely and Mr. T. Laycock. The Congo region has been explored by various collectors.

Various consignments from Rhodesia have been received through Dr. I. B. Pole-Evans, C.M.G., from the Department of Agriculture, Pretoria, as well as from the collectors enumerated above. Dr. I. B. Pole-Evans has also supplied other collections from Africa south of the tropic. Mr. Burtt-Davy, who is working at Kew on the Transvaal flora, has presented specimens from that country as well as from other parts of Africa. Miss M. Wilman has continued to send plants from Griqualand West. Prof. C. S. Sargent, LL.D., has presented a valuable collection of specimens of North American trees and shrubs. Mr. J. Gonzalez Ortega has communicated from the Sinaloa region of Mexico an interesting collection which has furnished several novelties, including a new species of *Amoreuxia*. Dr. N. L. Britton has sent further instalments of specimens collected by himself and others in the West Indies.

Nearly 2,000 specimens of Marine Algae from the Danish West Indies have been presented by Dr. F. Börgesen.

The Genera Plantarum.—Bentham & Hooker's 'Genera Plantarum' is, in detail, a series of monographs of the orders of Flowering Plants. While the whole work is indispensable in

Herbaria and Libraries, individual parts are sufficient for the needs of botanists working at groups or orders contained in those parts.

Complete copies of the whole work are no longer available.

This is also the case with vol. i but part 2 can be supplied. It contains all *Calyciflorae* except *Connaraceae*.

Complete copies of vol. ii are all but exhausted but part 2 can be supplied. It contains the bulk of *Gamopetalae* except *Compositae*.

Vol. iii is especially important, complete copies are available; part 1 comprises all the genera of *Monochlamydeae* and Gymnosperms; part 2 the whole of Monocotyledons. The monographs of *Orchideae*, *Liliaceae*, and *Gramineae* are of outstanding interest. The disposal of the whole of the remaining stock affords the opportunity of purchasing separate portions.

W. T. T.-D.

Plant Collection from the Azores.—An interesting and valuable collection of Azores plants has recently been presented to Kew by Capt. G. A. Carew Hunt. This consists of about 600 specimens mostly collected in the island of St. Michael or San Miguel, Azores, by Capt. Carew Hunt's grandfather, Thomas Carew Hunt, who was from 1844–48 H.B.M. Consul for the Azores. The specimens are in good condition, unmounted and laid between sheets of brown paper. The present set was stored, apparently for many years, in the warehouse of Messrs. Joseph Barber & Co., Ltd., and it is largely due to the interest and good offices of this firm's Director, Mr. H. G. Pole, that the presentation was ultimately made to Kew. The package was addressed to the Botanical Society of London which became defunct in 1858 (*see* Druce in Rep. Bot. Soc. & Exch. Club, 1920, pp. 93–95).

Carew Hunt's Azores plants were worked out by H. C. Watson, who included them in papers published in Hooker's London Journal of Botany, vol. III., 1844, p. 582, and vol. VI., 1847, p. 380, and in Godaman, "The Azores," 1870. Mr. Carew Hunt himself published accounts of the islands of St. Mary and St. Michael in the Journ. of the Roy. Geogr. Soc. XV., 1845, p. 258, and included lists of plants.

Among the new plants collected by Carew Hunt and described by Watson there may be mentioned: *Vicia Dennesiana*, *Petroselinum Seubertianum*, *Ammi Huntii*, *Seubertia azorica*, and *Campanula Vidalii*. *Ammi Huntii* is figured in Trelease, "Botanical Observations on the Azores," in Ann. Rep. Missouri Bot. Gard, 1897, Plate 23.

According to Watson (in Godaman, "The Azores," p. 262) Carew Hunt collected 375 species in the Azores, adding 67 species previously unrecorded from the islands, out of a then known total of 478 species of Phanerogams and Vascular Cryptogams.

W. B. T.

Emmenopterys Henryi, *Oliver.*—This interesting tree was first discovered by Prof. A. Henry in China and was originally described by Oliver in Hooker's *Icones Plantarum*, t. 1823. It was introduced to cultivation by E. H. Wilson in 1907 when collecting for the Arnold Arboretum. It is deciduous and is described by Wilson as attaining a height of 50 to 80 feet, with a trunk up to 9 or 10 feet in girth. The leaves are opposite, oval or ovate, tapered towards both ends, the larger ones 8 in. long by 4 in. wide, dark dull green above, pale beneath, with a pubescent midrib and veins; petiole reddish, ½ to 1½ in. long. The inflorescence is a terminal flattish corymbose panicle, as much as 10 in. wide and 6 to 8 in. high. Corolla white, 1 in. wide, the base funnel-shaped, dividing at the top into five rounded spreading lobes. The calyx ordinarily is small, only ¼ in. long with five roundish lobes; but on a certain proportion of the flowers one lobe of the calyx becomes remarkably enlarged and develops into a large white-stalked oval "bract," the largest as much as 2 in. long by 1½ in. wide. According to Wilson these bracts persist and change to pink as the fruits ripen.

A plant was obtained for Kew from the Coombe Wood Nursery in 1913 which has been grown out-of-doors without protection ever since and has not yet been injured by cold. Mr. Wilson, who found it near Ichang at from 2000 to 4000 feet altitude, was rather surprised when last at Kew by its hardiness. He describes it as "one of the most strikingly beautiful trees of the Chinese forests," and it is evidently a tree well worth a trial in the milder parts of our islands. The extraordinary development of one of the calyx lobes very much resembles the large showy bracts seen in *Schizophragma*, and the large trusses of these combined with the *Luculia*-like flowers must be remarkably handsome. The largest plant at Kew is a bush about 7 feet high and it may be some time before we see its blossoms. The genus, which belongs to the Natural family *Rubiaceae*, is monotypic and is most closely allied to *Luculia*. The family to which it belongs is but sparsely represented among hardy trees and shrubs.

W. J. B.

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ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 2] [1922

VIII.—SIR JOHN KIRK.

By the lamented death of Sir John Kirk, G.C.M.G., K.C.B., F.R.S., M.D., LL.D., D.Sc., D.C.L., &c. on January 15th, 1922, in his 90th year, Kew has lost a most valued friend, keenly interested in many branches of botanical science. For some sixty four years Sir John Kirk was in correspondence with Kew and he was a frequent visitor to the Gardens and the Herbarium whenever he was in England. By his presentations of large collections of Herbarium specimens of the Flora of East and Central Africa, Zanzibar and the Somali Coast, by many gifts of living plants of great interest to the Gardens and by valuable collections of economic products to the Museums from East Africa, &c., he enriched the National Collections at Kew to an extent that was almost unprecedented. The large and varied collection of economic products contributed between the years 1858 and 1891 included a valuable and complete series of specimens illustrating the Zanzibar Copal Industry (1868–70); specimens of 'Buaze' (*Securidaca longepedunculata*)—fibre and fish-nets made from same from the Zambesi (1860), Baobab (*Adansonia digitata*)—fibre with net used for catching large game, East Africa (1860); wheat from Tette (1860) and a series of Flax (*Linum usitatissimum*) specimens from Scotland (1858). Some further particulars of some of the East African contributions are given below, together with a list of the plants contributed to the Gardens.

Sir John was the second son of the Rev. John Kirk of Arbirlot, and was born at Barry near Arbroath on December 19th, 1832. His earliest study was Botany, but he chose Medicine as his profession and, entering the University of Edinburgh before he was 15, graduated as M.D. and L.R.C.S. in 1854. This year saw the outbreak of the Crimean War and Kirk with other young Edinburgh graduates joined the Civil Medical Staff and served in

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Turkey and the Dardanelles. When there he found time to keep up his botanical work and made some excursions into the interior of Anatolia. The numerous plants he was able to collect are preserved in the Herbarium of the Royal Botanic Garden, Edinburgh. On his return to England at the end of the War, in 1857, his long and valuable correspondence with Kew commenced.

His earliest letters preserved at Kew are dated Oct. 17th and Nov. 12th 1857 from Arbroath. It is clear that he must have been in correspondence with Sir William Hooker before that date but unfortunately any earlier correspondence there may have been does not exist.

17th Oct. 1857.

Dear Sir,

I have been for some time residing in the centre of the Flax Manufactures. If your Museum is not already supplied with specimens of the various qualities of the manufactured and prepared article I shall have much pleasure in supplying them.

The *Muscari* concerning which we took the liberty of consulting you when in London has turned out to be quite a new species to which Dr. Playne Armitage and I have given the name of *M. latifolium.*

I have been busy with my Syrian collection but it is little I can do in the country without books and Herbarium. Dr. Parkes has inserted a list of the plants collected at Renkiri [Renkioi] in his Hospital Report.

Believe me,
sincerely yours,
(signed) John Kirk.

12th Nov. 1857.

Dear Sir,

I beg to acknowledge receipt of your letter relative to the specimens of Flax. I have now obtained the different qualities and shall soon have the material showing the various stages of manufacture.

Dr. Balfour has advised me to apply for a situation in one of the Canadian Schools as teacher of Natural Science.

Should you consider me fitted for such an office I trust you will not think me too bold in requesting you to grant me a few lines to that effect.

Believe me,
Dear Sir,
Your most obedt. Servant,
(signed) John Kirk, M.D.

P.S.—I send a few Photographs which I took in the East.

I. Valonea oak (*Quercus Aegilops*) Renkiri, Dardanelles, 1856.
II. Group of Valonea. *Q. Aegilops*, Dardanelles.

III. *Pinus Pinaster*, Renkiri.

This is the same as covers the whole of the Ida range and furnishes fine timber.

IV. *Cupressus horizontalis*, Kuzhiri, Dardanelles.

These letters show that he was keenly interested in matters of Economic Botany and also the extent to which he had been able to devote his leisure moments to the study of the Syrian flora during his Service in the Crimean campaign. He was appointed assistant physician at the hospital at Renkioi in the Dardanelles and found time for excursions into the interior of Anatolia. Writing to Sir William Thiselton-Dyer on October 14, 1915, it is of interest to quote the final paragraph of his letter with reference to the Dardanelles campaign. "What a muddle we are making—I was over a year on the Dardanelles some 60 years ago and knew we could do nothing there but lose men."

It was on his return from the Crimea that the chance came to him to accompany Livingstone on his Zambesi Expedition and led to his becoming one of the most famous and distinguished Colonial servants that the British Empire has known. The story is—and we believe it to be true—that on the day after his return from the Crimea he met Prof. John Hutton Balfour in Queen Street, Edinburgh, who offered him the appointment of Naturalist to Livingstone's second Expedition. Kirk with that eagerness and impetuosity which was so characteristic of him replied 'start to-morrow'! Whether Prof. Balfour's invitation was due to the instance of Sir William Hooker or more probably to Dr. Risden Bennet—a close personal friend both of Prof. Balfour and Dr. Livingstone—is not known, but Kirk was evidently in close touch with Kew at the time and we find in the *Kew Report* for the year 1857 (p. 4) that "Dr. Kirk, about to start with Dr. Livingstone as Naturalist, studied in the Botanical Library and Herbarium for a length of time in preparation for foreign travel." The Expedition left England in March 1858 and for five eventful years Kirk was Chief Officer—the second in command having resigned at the outset—and the "tried and valued associate" of Livingstone. The Expedition went by way of Sierra Leone and the Cape and the following letter from Kirk was written to Sir Joseph Hooker on April 30th, 1858 in Simon's Bay on board the S.S. "Pearl."

My dear Dr. Hooker,

You will be glad to hear of the safe arrival of Dr. Livingstone and party at this port. We have made a good passage but in a small ship such as this we have of course had a good shaking.

At Sierra Leone we remained for six days and I made a small collection of plants and of other specimens, such of these as I have been able to preserve under the disadvantageous circumstances I send off from here. The only Zoological specimens worth anything are the two bottles of jumping fish, I caught them a good way up the river, running about out of the water on the mud.

They go along at a good rate and can make a jump of 1½ feet or more. They retreat, when disturbed, to holes. It was not very easy to capture them as they kept to the wet mud left beyond the Mangroves at low water.

I examined the islands up the creeks to the north of Sierra Leone during an excursion of three days. As all this time was spent among Mangroves and mudbanks and the heat very great, never under 85°, I found considerable difficulty in preserving specimens, and I looked on it as of more importance for me to examine and dissect than to preserve, most of the plants of the district being already in England. I send you two cases. Such vegetable products as I obtained I have tried to connect with the plants yielding them, but I found that extreme caution was requisite before receiving native testimony. May 1st. I shall send you full details from Tete by the "Pearl" on her return. We are off sooner than I expected. I have been engaged in the Cape with Dr. Pappe.

I have sent you the two boxes of specimens by the "Castor." I hope they reach safely.

In great haste. Remember me kindly to your Brother.

Yours very sincerely,

(signed) John Kirk.

While in East Africa with Livingstone, Kirk sent long and very interesting letters to Kew dealing not only with the Botany of Tropical Africa, but with the Geology, Mineral Resources and Geography of the country. They cannot unfortunately be reproduced in extenso here, but the following extracts relating more especially to his Botanical activities show his keen interest as a Naturalist and his activity as an observer. On the Zambesi he enjoyed very good health, and it is remarkable, despite the time that had to be given to medical work on behalf of members of the Expedition, the amount of time he was able to devote to scientific studies.

In those early days transport was difficult and very uncertain, We learn from one of his letters that he once had five cases of specimens packed for a year before they could be despatched. The vessel they used to explore the Zambesi, the "Pioneer," was most unsatisfactory. Writing to J. D. Hooker in December, 1860, from the Zambesi between Tette and Senna, he says :—"The plants I have sent will give a very good idea of the Flora of the Zambesi and the Manganja highlands, but the latter being explored on foot, the collections were limited, as people are not easily got to carry things and on journeys of geographical discovery the preservation of specimens is a hard task. The miserable state of the vessel, overrun with all sorts of vermin, has kept me from consulting my plants once they have been dried. She is in a bad state, with more holes than sound iron in the bottom. We keep the fires in by constant pumping with the aid of a few buckets, but once a day we commonly have to stop to fill up some big hole."

Describing a journey in canoes down a narrow gorge with a swift current, he wrote :—" My canoe, having the best boatmen, passed safely, and we were ready to save Dr. Livingstone whom no one thought could escape, as his canoe got into a strong whirlpool; while we looked at him for a moment, forgetting ourselves, our canoe was dashed with great force against the perpendicular rocks and instantly upset. In such a place it was not easy to save ourselves and the others could give little assistance."

" Fortunately Dr. Livingstone's canoe escaped . . . and by good luck one of my men got hold of a small rock and kept my canoe from going down the stream, in which case we should have had no chance. I was sucked under her by the current, but got up on a small corner of rock where I could just stand. One of the other canoes then came up to us and we got to a place where it was possible to climb up. In this unlucky accident my plants, notes drawings etc. all went with the exception of a few plants which I seized as they were about to sink. On getting out I found myself possessed of the shirt on my back, a rifle and Lindley's 'Vegetable Kingdom,' with a long weary march before us to Tette, all clothes bedding etc. gone. However the plants I have saved are those from the Victoria Falls, so we have something new even out of this wreck. I am in a very unfit state for a journey now, without barometer, thermometer, lenses and surgical instruments, all of which went down the rapids, along with the chronometer, which will keep Greenwich time in some quiet pool fifteen fathoms deep."

Describing the climate of the Zambesi, Kirk writes :—" When we come to the ascent of the Batoka hills it is very different. The river valley there is 1000 feet above the sea-level while the hills are from 3000 to 4000 feet. After making the ascent of 1000 feet above the valley, we find an entirely new Flora, the climate becomes quite changed and one feels quite invigorated. In the valley there is a constant sleepiness which acts very injuriously on Europeans but of which they become insensible after some time, and the change is only perceived on going to some healthy country such as this when the marked difference is at once felt."

" The whole of the southern slope of these highlands is well wooded and reminded me much of the Manganja hills, but being much less humid there was a want of the many rich-coloured herbs which adorn the latter country."

" We had some very cold nights on these slopes and the thermometer was observed on one stream bed at 25° and ice formed near the edge, at a short distance up the hills the temperature was above freezing. On the table lands the air was not so cold at night while even during the day the sun never felt oppressively hot. This was the cold season, but during the heat of September and October, previous to the rains, the air becomes much hotter than at the coast, and during our return in crossing these highlands we had the mercury in the shade at 102° with a difference of 40° between the dry and wet bulbs."

Exploring the Rovuma River for a route to Lake Nyassa he speaks of the dangers from the natives :—" On the lower part no trade exists; the people are robbers who sport men's heads on poles when they can get them. They would have done the same with us but found that we could give them more than they cared for. Some of their arrows went near us, and four musket balls passed through one of the boat's sails, but when two of their number fell to our first shots they made off and never troubled us more, nor had we a chance of giving them a better lesson. We stood a great deal of nonsense from them in the first place, even allowing them to fire at us without returning it, but when it came to 20 yards practice it was rather too dangerous. Confined to our boats among such people, I have made almost no collection."

His descriptions of the vegetation on the banks of the Zambesi are graphic and instructive. Writing to Sir William Hooker in February 1860, he says —" I hope you will receive the entire collection made on the bank of the Zambesi between the sea and Tette, and also that on the river Shire and among the Manganja hills to the north extending as far as S. Lat. 14° 25′. This country offers considerable diversity of climate and position. That of the sea coast is damp, abounding in trees of the Mangrove and *Avicennia* and others inhabiting the soft mud of tropical coasts, at the distance of a few miles up the mouths of the river, these become replaced by a more varied forest of *Pandanus* and *Barringtonia* while there are many open spots covered with a dwarf variety of the *Hyphaene* and the Date Palm, with a large bush, a species of *Strychnos*, whose fruit is acid, the pulp in which the seeds are imbedded being quite wholesome although the seeds themselves are apt to cause pain and vomiting. There is another fruit tree of the order *Clusiaceae* (*Guttiferae*) called ' Motsami ' which grows both at the sea coast and inland."

" The coast vegetation extends only about 10 miles up the river; there the mud banks disappear, their place being taken by sand, and instead of the forest we find extensive grass lands. The Delta may be said to reach as far as Mazaro where the river, which flows to the town of Quilimane, is given off, it is not a branch of the Zambesi, as it is only when in high flood that the water of the Zambesi passes through it; during the greater part of the year it is quite dry. The Portuguese say that in former times they could pass by it at all seasons, if so there has been a great change taking place."

" These delta lands are low and feverish, but we have not observed fevers such as are described on the rivers of the West Coast of Africa, and when seized and taken early they have been easily removed. Quinine seems to us to be of no service in preventing, although it is most useful in curing these fevers."

" This large extent of land from Quilimane to the Kongone on the coast and islands as far as Mazaro is well suited for cotton, sugar-cane and rice; wheat is grown, but of inferior quality. Cotton once introduced propagates itself and when not burned down with the grass becomes a perennial bush. There are two species of it in the country, one named '*Tonje Kaja*' or native cotton, seems to have been the plant first known, but there is no evidence of it but as cultivated or as having escaped from former plantations; the fibre of this adheres strongly to the seed and cannot be removed completely; it resembles wool, being coarse and stiff; the staple is short, and the plant yields much less than the other species the '*Tonje Manga*' [*Gossypium hirsutum*, Linn.] or Foreign Cotton. The name indicates that it is from abroad, probably having come with the Arabs. Some of the varieties of this are of excellent quality and would at once draw a high price in England. I have seen some of it an inch in length; it grows readily and near where we are now, it is to be found growing uncared for and of fine quality nevertheless. It is to be found on the Zambesi as far as we have been (that is 60 miles beyond Tette). It is grown on the Shire and in the lands to the north as far as Lat. 16° S.; beyond this it is replaced by the '*Tonje Kaja*' which is found in the other parts also. We do not meet with it again until we reach Lat. 15° S. when it becomes more frequent as we approach the southern end of the Lake Nyassa, which is the line of trade between the coast to the north of Mozambique and the interior of Londa."

"Sugar-cane was cultivated in the Delta by the Portuguese in former times, and a little is grown by the natives and refugees who now inhabit these parts. No doubt the soil is well suited for it. At present the rich lands of the Delta are almost uninhabited, having been destroyed by war and the slave trade."

"In many parts there is evidence of former settlements, the Mango trees and Cocoa-nuts still remaining. The white Guava [*Psidium Guayava*, Linn. var.] has become wild throughout the forest beyond the Mangroves, and the fruit is gathered yearly and sent to the Portuguese towns."

"From Mazaro to Lupata, where for the first time the Zambesi is narrowed by rocks, the hills come down near to the river in the upper part beyond Senna, while below this the country is like that of the Delta, covered with gigantic grasses which exclude other vegetation. From there the forests which cover the interior come down near to the banks. This intermediate district is very rich and yields a considerable proportion of the food used by the settlements in the neighbourhood."

"The estate of Shupanga possesses the great forests from which the large canoes are obtained, some of these cut out from a single trunk, 36 feet long and 5 feet beam, cost £70 each; the forests are at some distance off and I have not been able to reach them."

"In the same locality the India-rubber plant [*Landolphia Kirkii*] is abundant; it is a climber with rough bark and woody stem. The fruit is eatable. The gum [rubber] is collected by the people and employed in a few domestic articles such as drums and mixed with oil as a cement; with a little care in gathering it might become an important article of commerce; the plant is abundant and the trouble of collecting very small. The surface of the bark is cut off until the inner is reached, when, after a few punctures have been made, the milky juice runs out and being removed by the finger and applied to the skin of the body dries instantly; by a repetition of this process a thin cake is formed and rolled up in a ball to which the fresh layers are successively applied. At the season when I saw it gathered there was no troublesome drying required."

"Between Senna and Shupanga on the north left hand bank of the river a few hills of quartz and trap come down to the water edge. They are the southern extremity of hilly country extending north and a little west of which Moramballa is the only mountain of considerable size; to the west of these hills and at the western slope of Moramballa the River Shire flows to join the Zambesi,—near Shamwara hill. Among these hills the 'Buaze' plant [*Securidaca longepedunculata,* Fres.] is abundant; it is a bush with erect stem sometimes 4 inches in diameter and 12 feet high but oftener of smaller size. It gives off above a number of slender twigs, which may be cut annually for the sake of the fibrous bark; by this process the plant is not injured. I have sent dissections of the flower of this plant home among the collection of drawings. It seems to be a new genus of the *Polygalaceae*. The seed contains a drying oil which might be used for the same purpose as linseed oil. Among the woods you will find the stem of the 'Buaze'; it is remarkable from including layers of fibrous bark at intervals imbedded between the woody zones. For the growth of the 'Buaze,' little care is required; it germinates easily and grows in rocky grounds which would serve for little else. It is nowhere cultivated, but the people make fishing nets of it such as I sent you by the Lynx gunboat in December."

"Between Lupata and Tette and as far as Kelrabassa, the banks of the Zambesi are high and rocky, the climate is more healthy, but the cultivable lands not so extensive."

"Here the wheat is grown which supplies the province; it is sown in holes during the cold season. It can only be grown in places which have been under the influence of the river when in flood as there is no rain then to supply moisture."

"In damp places sugar-cane is cultivated, and sugar extracted from it by a rude mill, the crushing of the cane is effected in such an imperfect manner that the sugar always possesses a disagreeable flavour which depends entirely on faulty manufacture."

"The cultivation and produce of sugar might be made a highly profitable business in these parts, as also throughout the whole country from the sea upwards. In the rich valleys among the mountains of Kelrabassa, cotton is grown for native use; it is of both sorts, but the '*Tonje Manga*' is the more common; it is grown on perennial bushes, which are pruned yearly and shoot up even after being burned down. This region from Shupanga to Kelrabassa is well stocked with fine woods."

"In waste ground near the settlements of Shupanga, Senna and Tette, the Indigo plant [*Indigofera tinctoria*, Linn.] grows wild, but the people are quite unacquainted with its value; at Shupanga it is often 5 feet high and I have made indigo from the leaves which seemed to be good, considering the small scale on which it was made."

"The *Borassus* palm [*Borassus flabellifer*, Linn.] with stem 80 feet high bears a long cluster of fruits, the yellow fulvous pulp surrounding the three seeds is agreeable when ripe and much eaten by the elephants. The *Hyphaene* palm has a fruit resembling that of the Doum of Egypt, from which I do not feel quite satisfied that it differs materially; at the coast this palm is a small bush or with only a short stem which is frequently divided dichotomously; in the upper parts it is much higher, being 30 feet, and I have not observed this variety branching. I can find no specific distinction however between these two forms [probably the same—*Hyphaene thebaica*, Mart.]."

On his return from the Zambesi in 1863, Kirk spent some time at Kew working on his collections and in January, 1866, he was appointed Acting Surgeon to the Political Agency at Zanzibar. His administrative abilities led to his being made Vice-Consul in 1867, and in the following year Assistant Political Officer. In April 1873 he became Agent and Consul-General and held that Office until his retirement in 1887.

During his twenty-one years of service in Zanzibar, Kirk was in constant correspondence with Kew and his letters to Sir William, and Sir Joseph Hooker and later to Sir William Thiselton-Dyer contain much information about the vegetation and products of East Tropical Africa. He investigated the source of the different grades of the valuable East African Copal, *Trachylobium Hornemannianum*, Hayne, of which, as already mentioned, he sent excellent specimens of the gum and tree. Great quantities of the Copal were at that time dug by the natives of the mainland, being the remains of ancient forests of this tree.

The following is an extract from one of his letters to J. D. Hooker on this subject dated Zanzibar, 20 March, 1868:— "While enjoying a little relaxation and breathing the fresh air for a few days on the African mainland. . . . . I met with one or two things worthy of note which will prove of interest to you, being supplemented by specimens. . . . . The spot we selected for our holiday was opposite the southern end of Zanzibar island, where we could remain at anchor in a large spacious creek which there furnished a natural harbour. The immediate sea-edge is lined with Mangrove vegetation composed of *Avicennia, Sonneratia, Rhizophora, Bruguiera*, etc., the last yielding the well known Zanzibar 'Benti' or rafters on which the flat roofs of the houses are supported. A few paces from the water edge the ground rises suddenly to a height of 30 feet, whence a flat plain extends inland to the foot of the coast ridge, distant perhaps 20 miles. The section of this flat maritime plain consists of sand, gravel, vegetable mould and clay, sometimes with beds of water-worn pebbles, and such is the surface of the soil too, unless where hollows have accumulated dark soil, the produce of many seasons and rotting marsh vegetation."

"This coast fringe of Eastern Africa is obviously a sea beach left by the receding waters as this point of the continent was slowly upheaved. The first coast range is the landward limit of this sand formation, which varies in width from 20 to 100 miles, the latter width being only met with in what are now river valleys, as on the Rovuma, where the sandy gravel extends far inland having on either side older strata."

"The vegetation along the creek of Dar-es-Salam, where we were, consisted of many curious and to me unknown bushes, with heavy timber scattered here and there. Among the latter was the *Trachylobium mossambicense*,* Klotzsch, distinguished by its rounded head of glossy leaves with white groups of flowers projecting from the points of the branches. This is the 'M'Sandarusi' (Tree of Copal) of the natives, and from it one variety of Copal is obtained. On examining the tree more closely, the trunk and main limbs were seen to be covered with the clear resinous exudation, now brittle and hard; from the upper branches it dropped down on the ground below, but not in a fluid state. To judge by the appearance it presented I should say that the resin dries and hardens after being exuded but must be easily broken off by violence. Pieces of various tint and form were collected, some with insects imbedded, but all presented a smooth polished exterior quite free of any pitting or 'goose-skin' known in all kinds dug up from the ground. This sort is known in trade as 'Sandarusi-ya-su'ti,' or 'Copal from the tree.' It is exported in considerable quantity to India but not to Europe."

"Having thus established the source of one sort of Copal to be the *Trachylobium* and transmitted the resin with full herbarium specimens of flower and fruit, which if I mistake not are to this day *desiderata* in all our collections, let me briefly state my reasons for thinking that in this we have the source of the oldest Zanzibar copal, the semi-fossil or bituminized resin known in the English market as 'Animi,' and which is the most valuable of all resins for the manufacture of varnish, exceeding anything produced on the west coast for hardness, elasticity and polish. There are three distinct kinds of Copal in the Zanzibar trade, subdivided by merchants into many classes according to colour, form, surface, and the other peculiarities known to those in the trade and affecting the value variously in different markets. First we have 'Sandarusi-ya-su'ti,' Tree Copal; secondly 'Chakazi,' or copal dug from the soil but modern (seemingly) in

* *Trachylobium Hornemannianum*, Hayne (Leguminoseae).

origin and obtaining a price like that of the former quality; the third is the true 'Sandarusi,' like the second dug up from the soil but hard, less soluble, and more than twice the value. This last forms by far the greatest part of Zanzibar Copal, the export of which has sometimes reached 800,000 lbs., or a value of £60,000." . . . .

"*Trachylobium mossambicense* is found along the coast between 3° and 15° South latitude, but it is not common between Cape Delgado and Mombasa.* It occurs along the creeks and on the maritime plain or old sea beach, but becomes very rare at a little distance inland, and quite unknown long before the change in geological structure offers an explanation for its absence. It requires the near presence of the sea for its growth and dies when far removed from its influence."

Dr. Kirk goes on further to describe in considerable detail the varieties of copal, and states that the most valuable, the 'Animi' of the English markets, is undoubtedly the produce of former forests of *Trachylobium mossambicense*, present in a fossil state all along the ancient sea-beach, some places being richer than others, and certain soils indicating good 'diggings.' Dr. Kirk searched for portions of leaves or flowers of the *Trachylobium* amongst the fossil copal, but never succeeded in obtaining any specimens.

The *Kew Reports* from 1857 to 1882 contain in almost every year references to specimens and plants sent to Kew by Sir John Kirk, at first from East Africa, and later from the Seychelles, Comoro Islands, Zanzibar and the Somali Coast.

In the *Report* for the year 1861 it is recorded that large additions were made to the Herbarium from "Eastern Tropical Africa, by Dr. Kirk, the energetic and accomplished companion of Dr. Livingstone." During the year 1862 "Plants and drawings" were received from him from the Livingstone Expedition and in the next years live plants were sent by Dr. Kirk "collected during Dr. Livingstone's expedition, and others in the Seychelle and Comoro Islands, etc. including Fruit of the Double Cocoa-nut." In the same report Dr. Kirk's return to England in October 1863 is recorded and he came at once to Kew and was "engaged in the investigation of his large and valuable collections, both in the Museum and Herbarium."

In 1864 cases of living plants he had collected in East Africa and the Seychelles reached Kew as well as valuable additions to the collections in the Herbarium, and in 1865 Nyasa Plants.

Most of Kirk's herbarium specimens are accompanied by valuable notes and excellent pencil and coloured sketches showing habit and floral details. A large number, besides those lost in the rapids, went astray. They were sent home in a Man-of-War, and though conspicuously addressed to Kew, the cases were not discovered until 1883 in a Dockyard Store. They were then

* From what Kirk says here it is unlikely that the tree is now entirely extinct as stated in the Encycl. Brit. ed. 11. vii. 94 (1910).

delivered intact and the contents were found to be in an excellent state of preservation.

In 1867 the first consignment of Herbarium specimens from Dr. Kirk from Zanzibar was received and in the *Kew Report* for the year 1868 the receipt of " a very valuable Zanzibar Herbarium" from Dr. Kirk is recorded.

The next record of interest is in the *Report* for the year 1872 :— " Kirk, J., H.B.M.V. Consul, Zanzibar; various new and most interesting plants."

In 1873 Dr. Kirk contributed Herbarium specimens from Zanzibar and the Somali Coast and in 1877 we find his attention again directed to *Landolphia* as a source of India rubber :—

" The district called Mungao extends from lat. 9° 25′ to Delgado in lat. 10° 41′. This last year yielded £90,000 worth of india-rubber—an industry that has been created in the last two years by my representations. This year the yield will be more, and other places are now collecting it. Thus Kilwa and Mombasa will this year probably double the supply, which I anticipate will reach in value not less than £180,000 worth of india-rubber, East Africa to the south, that is from Delgado Bay to the Zambesi, is producing it as well. I must try to get the plant introduced into India, for the quality is excellent, and if grown in the coast jungles would be an addition to the sources of wealth."

Kirk's attention to a native East African Rubber tree was drawn by his seeing a native boy playing with an elastic ball, which he found was made of caoutchouc. He traced the plant from which it was obtained and so started the East African Rubber Trade (*K.B.* 1896, p. 81; *Kew Report* 1880) and incidentally that of the West Coast. In 1882 he showed specimens of *Landolphia* and balls of rubber from East Central Africa at the Linnean Society.

During the year 1879 Dr. Kirk sent to Kew three Wardian Cases from Zanzibar containing " *Euphorbia* sp., *Hypoxis villosa*, seedling and other Landolphias, *Meyenia* sp., *Keramanthus Kirkii*, *Musa Livingstoniana*, *Actiniopteris radiata*, *Pellaea Doniana* and other ferns, *Aroideae*, *Chlorophytum macrophyllum*, *Angraecum* sp., and other orchids; seeds of *Landolphia*."

In 1880 his activities and interests were again directed towards distributing the Copal tree, *Trachylobium Hornemannianum*, seed of which he had sent to Natal some five years earlier. He was also interested in the Mpafu Tree of Tropical Africa (*Canarium Schweinfurthii*, Engl.), and on p. 50 of the *Report* for 1880 some interesting particulars are given about this tree.

On a short trip up the Somali Coast he gathered some very peculiar and interesting types of plants. But for his energy, East Africa would have been poorly represented in the pages of the first three volumes of the Flora of Tropical Africa, a large number of new species having been described from his material, whilst over a hundred commemorate his name either as *Kirkii* or *Kirkiana*, including the genus *Kirkia*, Oliver

(*Simarubaceae*), and the important East African rubber vine, *Landolphia Kirkii*, Dyer.

A list of living plants introduced by Kirk from East Africa, some particulars of the garden he founded in Zanzibar, and his opinion on the advisability of establishing botanic stations in that region will be found in the *Kew Bulletin*, 1896, pp. 80–86, where also it is stated that almost every economic production of East Africa has at one time or another received attention from Sir John Kirk.

Besides his botanical work, he was an active member of the Royal Geographical Society and numerous notes and sketch-maps by him are to be found in the volumes of Proceedings and in the Journal of that Society.

Of Sir John Kirk's political achievements this is not the place to speak in detail, but it should not be forgotten that the practical suppression of the Slave Trade in East Africa was due almost entirely to his persistent efforts.

The first living contribution to Kew from Dr. Kirk was a parcel of seeds on March 3rd, 1860. After this regular consignments of plants and seeds of many kinds were received, the total number recorded being 75. Sir John was equally zealous with respect to the introduction of plants of economic interest to Zanzibar and to the mainland, and many Wardian cases and packages were despatched from Kew at his request. The following is a list of some of the plants received from him and it is of interest to record that no less than seventeen of his introductions were figured in the Botanical Magazine.

Aloe brachystachys (Bot. Mag. t. 7399).
„ Kirkii (Bot. Mag. t. 7386).
„ penduliflora.
Clerodendron cephalanthum (Bot. Mag. t. 7922).
Clerodendron macrosiphon (Bot. Mag. t. 6695).
Crinum Bainesii.
„ Hildebrandtii (Bot. Mag. t. 6709).
Crinum Kirkii (Bot. Mag. t. 6512).
Dioscorea spp.
Drimiopsis Kirkii (Bot. Mag. t. 6276).
Encephalartos Hildebrandtii (Bot. Mag. t. 8592–3).
Euphorbia spp.
Gladiolus Kirkii.
„ Quartinianus (Bot. Mag. t. 6739).
Gloriosa spp.
Haemanthus spp.
Hibiscus schizopetalus (Bot. Mag. t. 6524).
Huernia Kirkii.
Impatiens Oliveri (Bot. Mag. t.7960)
„ Sultani. (Bot. Mag. t. 6643).
Keramanthus Kirkii (Bot. Mag. t. 6271).
Kniphofia Kirkii.
Landolphia spp.
Monodora Myristica (Bot. Mag. t. 3059).
Musa Livingstonei.
„ proboscidea (Ic. Pl. t. 1777).
Neobenthamia gracilis (Bot. Mag. t. 7221).
Ochna Kirkii.
Orchids.
Palms.
Pandanus spp.
Polystachya Kirkii.
Sansevieria Kirkii (Bot. Mag. t. 7357).
Stapelia spp.
Strophanthus Kombe.
Tacca pinnatifida (Bot. Mag. t. 7299).
Vanilla Roscheri.
Virchowia africana.
Zamioculcas Boivinii (Bot. Mag. t. 6026).
„ Loddigesii (Bot. Mag. t. 5985).

He was always keenly alive to anything of exceptional interest. *Impatiens Sultani* was raised at Kew from a capsule of seed he put in his waistcoat pocket. The discovery of *Encephalartos Hildebrandtii* in 1868 (*see K.B.* 1918, p. 127), was one of his most valuable finds and he took much trouble to secure fine living specimens for Kew, which are still flourishing in the Palm House. The living plants were accompanied by his own photographs of the plant and drawings from his own hand. His last striking addition to the living collections was *Crinum natans* in 1895, when acting as special Commissioner to Nigeria whence he brought home several plants.

Sir John as might be expected was not only interested in the introduction of new and interesting plants to Kew, but was a keen gardener himself and he maintained at his own expense a fine experimental garden at Zanzibar (*K.B.* 1892, p. 87), which is fortunately still maintained by Miss C. D. M. Thackeray, the present owner. Many of the trees and shrubs planted by Sir John have reached large dimensions and Miss Thackeray in 1915 sent full particulars to Kew about some of the more interesting trees. Sir John, to whom a copy of the letter was sent, wrote, "Is it possible that the Mahogany seed I planted is now a tree 8 ft. in circumference . . . . . I wish I might again visit the place and see the result of my work. I have visited Zanzibar twice since I retired—the last time about ten years ago when I went to inspect the Uganda Railway, of the Commission for the Construction of which by the Foreign Office, I was Chairman."

It was when in Uganda on this occasion that he collected seed of *Impatiens Oliveri*, from which the stock now in cultivation was raised.

Sir John maintained his interest in gardens until the end of his life and his letters to Kew for the past 14 years were usually concerned with gardening matters despite the fact that for some years he was nearly blind and for the last few years almost completely blind. Despite this infirmity, however, he maintained his keen interest in botany and corresponded always in his own handwriting often adding at the end of his letter "Pray excuse my bad writing for you know I cannot read what I have written." Knowing Sir John, as the writer was privileged to know him for some thirty years, it was very pathetic to see him stricken with blindness and unable to appreciate fully the beauties of nature to which he was so devoted. His last letter written in October of last year has this concluding paragraph "I am ashamed to send you such an illegible letter but venture to do so in the hope you may be able to read some of it." It is remarkable how legible his later letters are though often not very easy to read. His kindliness and sympathetic interest in everything that concerned his fellows is well known and his keen sense of humour enlivened many a narrative of his experiences abroad and also we believe the experiences themselves. He will be remembered as a public servant of rare ability and by Kew as a keen botanist, an active and accurate observer and an ever ready friend.

A. W. H.

IX.—THE "SERRATO-CILIATA" GROUP OF TROPAEOLUM.

D. K. Hughes.

When an attempt was recently made to name the Tropaeolums of Lehmann's and André's Andine collections previous to their incorporation in the Herbarium, it became necessary to revise first the older material according to Buchenau's monograph of the genus in the Pflanzenreich. No serious difficulties arose in the course of the revision until the group comprising Buchenau's species 14–29 was approached. This group is characterised by the possession of five apically serrate-ciliate petals and almost confined to the Andes of Venezuela, Colombia and Ecuador, only a few species occurring further north as far as Guatemala, or south as far as Bolivia. The affinities of the species referred to it are obvious, and the group appears therefore perfectly natural. It stands out from the remainder of the genus and may conveniently be designated by a name of its own, such as "serrato-ciliata."

The characters in which the members of this group were so far known to differ from each other are, partly foliar, namely, in the shape, size and attachment of the leaf-blades and the presence or absence of hairs on them, the length of the petioles, the development of the stipules, and partly floral, affecting mainly the size and colour of the flowers and their parts, and to a less conspicuous degree, the shape of the petals. Working on this basis it soon became evident that a number of new species would have to be added from the material at Kew, but as is usually the case with the addition of new forms, new characters had to be taken into account and studied with regard to their incidence and correlation. The more important of them were in this instance, the presence or absence of minute papillæ on the underside of the leaf-blades which make them appear more or less greyish or glaucose-pruinose, and secondly of coloured dots or mottling, usually confined to the underside of the leaf-blades or extending also to their upper side. Mr. L. A. Boodle kindly examined the leaves of some of the species with respect to those markings, and found that they were due to the presence of a colouring matter—probably tannin-mucilage—in the isolated epidermal cells, or in rows or groups of these cells. In one case (*T. papillosum*), the secretion occurred in the mesophyll, but apparently not in the epidermis. A priori one would not attach much importance to those characters, but a careful scrutiny of the material at hand has shown that they are so connected with other characters that they appear to form an essential part of the specific constitution of the species. Unfortunately the number of pieces of most of the species under observation is very small, nor was there any living material available, for it seems that these pretty plants are difficult to cultivate.

The range within which the characters used for discrimination actually vary, and consequently their reliability and ultimately perhaps even the claim of some of the units recognised to the status of species remain therefore open questions. Observations in the field and cultivation both have to be called in aid to answer them. Meanwhile, an adequate description of the members of the group and a clear disposition of their distinctive characters will not only prepare a sound foundation for such field and experimental work, but also serve for the immediate practical need of a ready means for determining Tropaeolums of the serrato-ciliata group. With this end in view I asked Miss Hughes to prepare, under my supervision, the revision which forms the subject of the present paper.

O. Stapf.

Key to the Species.

*Blades pruinose papillose below, or if epapillose then without red dots or mottling :
  Stipules leafy, conspicuous, persistent, semiorbicular, 1 cm. in diameter - - - - - 1. *Matthewsii.*
  Stipules inconspicuous, deciduous or wanting :
    †Blades glaucous and pruinose papillose below :
      Blades hairy on both sides, rotundate ovate and bluntly 5-lobed to subentire :
        Flowers 2-2·5 cm. long, hairy 2. *pubescens.*
        Flowers 3·5–4·5 cm. long, glabrous :
          Petiole stout, shorter than the blades which are densely white-papillose below; flowers 3·5 cm. long - - 3. *papillosum.*
          Petiole filiform, stout at the base, longer than the blades which are greyish-pruinose below; flowers 4·5 cm. long - - 4. *hirtifolium.*

Blades like the petioles and flowers quite glabrous :
Blades shorter than broad :
Flowers 5 cm. long; blades only slightly shorter than broad (ratio 1 : 1·3), distinctly 5-lobed, or the lower sinuses indistinct or obsolete 5. *menispermifolium*.
Flowers 2–3 cm. long; blades much shorter than broad (ratio 1 : 3) :
Spur of flower very slender, about 2·5 mm. broad at the mouth, tapering to an extremely fine tip; sepals much spreading and exceeded by the long fimbrii of the petals :
Leaves subentire, ellipsoid, each primary nerve terminated at the margin by a fine mucro; flowers scarlet - - 6. *Fintelmannii*.
Leaves shallowly 5-lobed, lobes mucronate; flowers pale (yellow ?) - 7. *Warscewiczii*.
Spur of the flower cylindrical, 3–4 mm. broad at the mouth, hardly tapering to the blunt apex; sepals rarely exceeded by the very short fimbrii of the petals; leaves distinctly lobed, concave at the base - 8. *bimaculatum*.
Blades longer than or as long as broad; flowers 4·5–5·5 cm. long :
Blades distinctly peltate :
Blades triangular, lateral angles somewhat obtuse, terminal blunt or acute but not acuminate; base truncate or slightly concave; flowers slender, diameter of the base of the spur about 4 mm. :
Petioles shorter (2·5–3 cm.) than the blades;

pedicels 7–10 cm. long;
flowers 5–5·5 cm. long 9. *Kuntzeanum.*
Petioles longer (7–10 cm.) than the blades; pedicels 18–20 cm. long:
    Blades longer than broad (ratio 3·4 : 2·3); petiole inserted in the ratio of 4 : 1; flower 4·5 cm. long - 10. *cirrhipes.*
    Blades triangular, as long as broad; petiole inserted near the margin in the ratio 9 : 1; flowers up to 5·5 cm. long - 11. *Traceyae.*
Blades ovate-acuminate, rounded at the base; diameter of the base of spur about 7 mm. - - 12. *Lehmannii.*
Blades hardly peltate with the insertion of the petiole near the margin, or not peltate at all:
    Blades rather longer than broad, triangular-hastate, with obscurely and irregularly lobed or wavy sides; pedicels 7 cm. long - 13. *Wagenerianum.*
    Blades as long as broad or very slightly longer; pedicels 15 cm. to over 20 cm. long:
        Lateral angles and apex very blunt, the former broad and rounded; pedicels very slender - 14. *Karstenii.*
        Lateral angles and apex sharply acute, the latter cuspidate; pedicels rather stout - - 15. *cuspidatum.*

††Blades epapillose, smooth below, quite glabrous:
    Flowers hairy (at least the sepals), 4·5–5 cm. long; blades usually sub 3–5-lobed with the terminal lobe produced and ± acute; petioles 3–10 cm. long; pedicels 5–15 cm. long - - 16. *Deckerianum.*

Flowers glabrous :
Flowers 3·7–5 cm. long; blades entire or obscurely 3-lobed, ovate to rotundate-ovate, longer than broad, obtuse or subacute, usually dark green above and purplish below, pale along the nerves on both sides - - - 17. *Lindenii.*
Flowers 2–4 cm. long :
Flowers 3·5–4 cm. long; blades shallowly and equally 5-lobed - - - 18. *Daweii.*
Flowers 2–2·5 cm. long; blades 3-lobed or if obscurely 5-lobed then the lower sinuses obsolete - - 19. *crenatum.*

**Blades punctate or mottled with red, not papillose below :
Blades distinctly hairy :
Blades tomentose below, ovate-acuminate with a sharp point above the middle on either side (ratio 1 : 0·8) stem at first tomentose, soon glabrescent; petioles stout, tomentose; flowers 4·5 cm. long - 20. *tomentosum.*
Blades fulvously hairy but not tomentose, petioles slender :
Blades entire or the lobes reduced to small teeth :
Blades orbicular or depressed orbicular, 1 cm. long by 1–1·4 cm. wide; stem fulvously tomentose at the nodes, the rest glabrous or sub-pubescent; flowers 4·5–5 cm. long 21. *parvifolium.*
Blades ovate-obtuse, larger; stem spreadingly hairy; flowers 3 cm. long - - 22. *fulvum.*
Blades shallowly 3–5-lobed :
Blades depressedly rotundate-ovate, ratio 1 : 1–1·25, copiously red punctate below on a dark ground, 5-lobed, lobes subcrenulate, rounded, spur 4 times the length of the sepals - - - - 23. *pseudopubescens.*
Blades broadly ovate (ratio 1 : 0·8) very sparingly red punctate on a whitish ground

usually 3-lobed, lobes often subacute, the terminal triangular; spur 6 times the length of the sepals - - 24. *adpressum.*

Blades and petioles glabrous or almost so :

Stems spreadingly hairy especially at the nodes; blades entire or obscurely lobed; flowers glabrous :

Stipules inconspicuous, deciduous; flowers 4–5·5 cm. long; blades longer than broad, acute or acuminate, rounded at the base :

Blades ovate-acute, obscurely lobed with the terminal lobe triangular or entire; flowers up to 5·5 cm. long - - 25. *coccineum.*

Blades oblong-lanceolate, entire; flowers 4–4·5 cm. long - 26. *longifolium.*

Stipules conspicuous, leafy, orbicular, about 10 mm. in diameter; flowers 2·5 cm. long; blades shorter than broad (ratio about 4 : 4·5), obscurely but equally 5-lobed, base slightly concave - - - - 27. *stipulatum.*

Stems quite glabrous; leaves bluntly 3–5-lobed :

Flowers 3·5–4·5 cm. long; blades densely mottled or dotted with red on a dark ground :

Flowers hairy (at least the sepals), 4·5 cm. long; blades shallowly and very obtusely 5-lobed, ratio 1 : 11 - - 28. *maculifolium.*

Flowers glabrous; blades entire or almost so :

Flowers 4·5 cm. long; blades subentire (ratio 1 : 1–0·8) - - - 29. *integrifolium.*

Flowers 3·5 cm. long; blades shallowly 5-lobed (ratio 1 : 1·2) - - - 30. *kerneisinum.*

Flowers 2·5–3 cm. long; blades mottled on a pale ground :

Blades 5-lobed, pentagonal, base concave, primary lateral nerves straight, terminal lobe ovate - - - - 31. *pentagonum.*

Blades 3-lobed, base convex, margins subcrenulate, primary lateral nerves curved - - 32. *trilobum.*

ENUMERATION.

All the specimens quoted in this paper have been seen by me.

1. **T. Matthewsii,** *Hughes,* nov. sp. (Page 70, fig. A.)

Herba scandens, novellis araneoso-villosis citissime magis minusve puberulis. *Caulis* gracilis, inferne plus minusve teres, apicem versus compressus et contortus. *Folia* egregie stipulata; *stipulae* persistentes, semiorbiculares, usque ad 1 cm. diametro, integrae vel inconspicue crispae, supra vix papillosae, subtus pruinoso-papillosae; *petioli* graciles, subcirrhosi, fere 3 cm. longi; *laminae* late triangulari-ovatae, 2·5–3 cm. longae lataeque vel paulo latiores, supra vix papillosae, subtus pruinoso-papillosae, partibus suprapetiolari et infrapetiolari ratione 5 : 1, breviter lataeque quinquelobae, lobis emucronatis, integris vel inconspicue crispis. *Pedicelli* gracillimi, cirrhosi, vix petiolos superantes. *Flores* sparse pubescentes, usque ad 2·5 cm. longi; *calcar* rectum, conicum, usque ad 1·8 cm. longum, basi circiter 4 mm. diametro; *sepala* obtusa, ovato-oblonga; *petala* haud exserta, parva, superne dentato-ciliata, superiora late spathulato-oblonga, 6 mm. longa, inferiora obtriangularia in unguem attenuata, 4 mm. longa.

PERU: Chachapayos, *Matthews.*

2. **T. pubescens,** *H. B. & K.*, Nov. Gen. et Spec. v (1821) 251.

Herba scandens. *Caulis* gracilis, curvatus, plus minusve angulosus et sulcatus, pilis fulvis (praecipue prope nodos) usque ad 1 mm. longis hirsutus. *Folia* stipulata; stipulae minutae, angustatae, usque ad 1 mm. longae, apice dentatae vel crenulatae, deciduae, glabrae; petioli subrobusti, curvati, saepe cirrhosi, laminas subaequantes vel excedentes, usque ad 10 cm. longi, pilis fulvis dense hirsuti; *laminae* late triangulari-ovatae, 2–6 cm. longae lataeque vel paulo latiores, saepe pilis albis minutissimis pubescentes et pilis fulvis dispersis ad 1 mm. longis indutae, supra intense virides, subtus pallidiores, subglaucae, minute pruinoso-papillosae, partibus suprapetiolari et infrapetiolari ratione 5 : 1, breviter lataeque quinquelobae, lobis emucronatis, integris vel inconspicue crispis. *Pedicelli* gracillimi, cirrhosi, petiolos vix superantes. *Flores* fulve-hirsuti, 2–2·5 cm. longi; *calcar* rectum, conicum, circiter 1·6 cm. longum, basi 3–5 mm. diametro, rubrum, apice obtusum; *sepala* rotundato-ovata, viridia; *petala* haud exserta, 5 mm. longa, spathulato-oblonga, superne 4–5-dentato-ciliata, atro-caerulea.

COLOMBIA: New Grenada, *Linden* 923; *Holton* 885; *Triana* 3775; Pasto, *Jameson;* and without precise locality, *Lobb* 17; Cundinamarca, Facatativa, hacienda La Selva, 2440 m., *Mrs. Tracey.*

A. *T. Matthewsii.* **B.** *T. parvifolium.* a. petalum inferius. b. petalum superius. c. leaf of *T. parvifolium.*

Ecuador: Quito, *Jameson*; Miligalli, 1768 m., *André*; Banos, *Spruce* 4985; Tambo de Quinoa, *Seeman* 886.

Eastern Andes: *Veitch's Collector* 358.

3. **T. papillosum,** *Hughes,* nov. sp. (Page 72, fig. A.)

Herba scandens, glabra. *Caulis* gracilis, striatus, subcompressus et contortus. *Folia* estipulata; petioli robusti, inferne satis incrassati et cirrhosi, quam laminas breviores, usque ad 4 cm. longi; *laminae* subintegrae, late rotundato-ovatae, 6·5 cm. longae lataeque, partibus suprapetiolari et infrapetiolari ratione 3 : 1, supra virides, rubro-punctatae, papillosae et sparse pubescentes, infra glaucae, obscure marmoratae, dense pruinoso-papillosae. *Pedicelli* gracillimi, vix cirrhosi, petiolos superantes, usque ad 7 cm. longi. *Flores* glabri, fere 3·5 cm. longi; *calcar* rectum, cylindrico-conicum, apice abrupte attenuatum, 2·5 cm. longum, basi 4 mm. diametro; *sepala* ovata; *petala* dentata, haud exserta, 4·5 mm. longa, superiora spathulato-oblonga, longe ciliata, inferiora minora, breviter ciliata.

W. Tropical S. America. Ecuador ? Tambo grande, 24 Oct. 1876, *André.*

4. **T. hirtifolium,** *Hughes,* nov. sp. (Page 72, fig. B.)

Herba scandens. *Caulis* gracilis, striatus. *Folia* estipulata; *petioli* glabri, graciles, basin versus sensim modice incrassati, subcirrhosi, quam laminas longiores, usque ad 8 cm. longi; *laminae* hirsutae, breviter lateque subquinquelobae, lobis obsolete mucronatis, circiter 3·5–7·5 cm. longae, 4·5–10 cm. latae, partibus suprapetiolari et infrapetiolari ratione 8 : 1, nec marmoratae nec punctatae, supra viridis, infra cinereo-papillosae. *Pedicelli* glabri, gracillimi, cirrhosi, vix petiolos superantes. *Flores* penduli, pubescentes, ad minimum sepala, usque ad 4·5 cm. longi; *calcar* coccineum, angustum, subcurvatum, 3·5 cm. longum, basi 3 mm. diametro; sepala viridia ovato-oblonga; *petala* haud exserta, 4·5 mm. longa, superne dentato-ciliata fimbriis nigris.

Colombia: Prov. Antioquia, 5490 m., borders of forest, *Kalbreyer* 1455.

5. **T. menispermifolium,** *Buchenau* in Engl. Jahrb. xxxiv Beibl. lxxviii, 11.

Herba alte scandens. *Caulis* obtusangulus, sulcatus, diametro 2 mm., griseo-pubescens. *Folia* estipulata; *petioli* curvati, sed rarius cirrhosi, 5 usque 7 cm. longi, griseo-pubescentes; *laminae* latiores quam longiores, repando-quinquelobae, basi vadoso-repandae, sino laterale inferiore vadosissimo, superiore distinctiore sed etiam vadoso, obtusangulae, apice rotundatae, partibus suprapetiolari et infrapetiolari ratione 6 usque 7 : 1, supra intense virides, subtus griseo-virides, dense pruinoso-papillosae, glabrae. *Pedicelli* foliis longiores, filiformes, sub flore incrassati, curvati,

A. *T. papillosum.* B. *T. hirtifolium.* C. *T. Lehmannii.* D. *T. Daweii.* E. *T. Traceyae.* a. petalum inferius. b. petalum superius. The petals of B. C. D. and E. are similar to those figured for A. differing only slightly in size (*see* descriptions).

saepe cirrhosi, subpubescentes. *Flores* circiter 5 cm. longi; *calcar* conico-subulatum, puniceum (?), supra 4·5, infra 4·1 cm. longum, basi 8 mm. diametro, glabra; *sepala* circiter 5 mm. longa, oblonga, rotundata, virida (?); *petala* parva, usque ad 5 mm. longa, vix exserta, superne serrato-ciliatae, probabiliter rubro-violacea.

ECUADOR: Angamarca near Pangoa, *Sodiro* 227.

6. **T. Fintelmanni,** *Wagener* in Allg. Gartenz., xviii (1850) 105.

Herba scandens. *Caulis* gracilis, curvatus, plus minusve angulosus et sulcatus, glaber vel interdum sparse pubescens. *Folia* estipulata; *petioli* tenuissimi, curvati, basi cirrhosi et sparse pubescens, caeterum glabri, usque ad 6 cm. longi; *laminae* depresso-orbiculares, 2–3 cm. longae, 4–5 cm. latae, integrae vel vadissime et indistincte lobatae, lobis apicis mucronatis, partibus suprapetiolari et infrapetiolari ratione 8 : 1, supra virides, subtus glaucae et minute pruinoso-papillosae, glabrae. *Pedicelli* petiolos vix excedentes, tenuissimi, cirrhosi, glabri. *Flores* coccinei, 2·5–3 cm. longi; *calcar* rectum vel leviter curvatum, e basi cylindrica subulatum, apice leviter attenuatum, circiter 1·8 cm. longum, basi 3·5 mm. diametro; *sepala* rotundato-oblonga, obtusa, usque fere 8 mm. longa; *petala* non exserta, 6 mm. longa, atroviolacea, superne dentato-ciliata, superiora late spathulato-oblonga, inferiora late obtriangularia in unguem longum anguste contracta.

VENEZUELA: Caracas, Galipan, 1830 m., *Herb. Otto Kuntze* 1498.

COLOMBIA: Cauca, Las Pavas, Quindio, *André* 2363; Rio dos Brazos, *André* 2798.

7. **T. Warscewiczii,** *Buchenau* in Engl. Jahrb. xxvi (1899) 582.

Herba scandens, probabiliter etuberifera, glabra. *Caulis* angulosus, diametro usque 1 mm. *Folia* stipulata; *stipulae* tenerae, lineares; *petioli* graciles, laminae saepe longiores, 2 usque 3 cm. longi, plerumque curvati, rarius cirrhosi; *laminae* latiores quam longiores (circiter 1 : 1·3) basi fere truncatae, margine quinque-sinuato-lobatae, incisuris obtusangulis, apice mucronata, partibus suprapetiolari et infrapetiolari ratione 12 : 1, supra intense virides, subtus pallidiores, dense pruinoso-papillosae. *Pedicelli* gracillimi, curvati, interdum cirrhosi. *Flores* 3·7 usque 3·8 mm. longi; *calcar* rectum, cylindrico-subulatum, 2·1 usque 2·2 mm. longum, basi diametro 2 mm., flavum; *sepala* ovoidea, obtusiuscula, circiter 5 mm. longa, probabiliter flava; *petala* circiter 7 mm. longa, calycem vix superantia, albo-flavida, crenato-ciliata, superiora late stipitata, rotundato-ovalia, apice superne dentata, 5-ciliata, inferiora anguste stipitata, ovalia, marginibus pluri-(circiter 15) dentato-ciliata.

Central America: Costa Rica and Veragua, *Warscewicz.*

There seems to be very little difference between this species and *T. Fintelmannii*, Wagener, apart from the shape of the leaves which are here decidedly more deeply lobed, and the colour of the flowers. In absence of good material of *T. Warscewiczii* it is not possible to decide whether it is really a distinct species.

8. **T. bimaculatum,** *Klotzsch ex Buchenau* in Engl. Jahrb. xv (1892) 217.

Herba alte scandens, glabra, probabiliter non tuberifera. *Caulis* tenuis, diametro usque 1·25 mm. (et ultra). *Folia* stipulata; stipulae tenerrimae, parvae, subulatae (interdum bifidae), deciduae; *petioli* graciles, diametro 0·2 usque 0·35 mm., subcirrhosi; *laminae* subpeltatae, reniformi-semiorbiculares, usque 3 raro fere 4 cm. latae et 2 raro 2·4 cm. longae, partibus suprapetiolari et infrapetiolari ratione 8:1, basi truncatae vel levissime repandae, quinquelobae, incisuris plerumque obtusis, plus minusve repandis (usque $\frac{1}{4}$ insecantes), lobis rotundato-obtusis, distincte mucronatis, subtus dense pruinoso-papillosae. *Pedicelli* foliis longiores, gracillimi, subcirrhosi. *Flores* circiter 2·7 cm. longi; *calcar* rectum, cylindrico-attenuatum, 1·7–1·85 cm. longum; *sepala* late oblonga, obtusissima, interdum mucronata, circiter 8 mm. longa; *petala* sepalis aequilonga, circiter 8 mm. longa, obovato-cuneata, apice serrato-aristata (aristis 8 usque 10), superiora latiora, inferiora angustius unguiculata.

Central America: Chiriqui and Carthago-Vulkan, *Warscewicz.*

9. **T. Kuntzeanum,** *Buchenau* in Engl. Jahrb. xxii, 163.

Herba alte scandens (usque 3 m.), glabra. *Caulis* tenuis, 1–1·25 mm. diametro, debilis. *Folia* estipulata; *petioli* tenues, debiles, lamina breviores, 2·5–3 cm. longi; *laminae* triangulares, integerrimae, basi subrepando, angulis basilaribus rotundatis, lateribus curvatis, circiter 3·5–4 cm. longae et basi 2·5 cm. latae, apice acuto, subtus glaucae, papillis squamuliformibus indutis, distincte venosae. *Pedicelli* graciles, debiles, folio multo longiores, 7 usque 10 cm. longi. *Flores* 5 usque 5·5 cm. longi; *calcar* fere rectum, cylindrico-conicum, apice rotundatum et leviter inflatum, circiter 4·5 cm. longum, pallide rubrum (apice viride?); *sepala* ovato-triangularia, aequilonga, obtusiuscula, viridia; *petala* calyce breviora, subaequalia (superiora lateriora), rhomboideo-cuneiformia, apice 5–7-dentato-aristata, saturate indigotica.

Bolivia: Paulo Rosa and La Seja, *Otto Kuntze.*

10. **T. cirrhipes,** *Hook.*, Icon. Pl. v. (1842), t. 411.

Herba scandens, praeter nodos hirsutos glabra. *Caulis* gracilis, angulosus et sulcatus. *Folia* estipulata, vel stipulis minutissimis deciduis praedita; *petioli* curvati vel cirrhosi, usque ad 11 cm. longi; *laminae* elongato-triangulares, integrae, angulis basilaribus rotundatis, apice obtusa, basi subrepando, lateribus leviter curvatae, usque ad 9 cm. longae et basi 5–6 cm. latae, partibus suprapetiolari et infrapetiolari ratione 2·5 usque 3 : 1, supra virides vel prope nodos violaceae, subtus glaucae, obscure vel minutissime pruinoso-papillosae. *Pedicelli* gracillimi, valde cirrhosi, usque ad 20 cm. longi, sub flore leviter incrassati. *Flores* 4·5 cm. longi; *calcar* cylindricum, coccineum, 3·6 cm. longum, basi diametro 4 mm., apice obtusum; *sepala* rotundato-ovata, viridia; *petala* non exserta, 4–5 mm. longa, superne dentato-ciliata, luteo-viridia.

PERU: Chachapayos, *Matthews* 3177.

11. **T. Traceyae,** *Hughes,* nov. sp. (Page 72, fig. E.).

Herba scandens, glabra. *Caulis* gracilis, triquater, contortus. *Folia* estipulata; *petioli* subrobusti, inferne satis incrassati et cirrhosi, quam laminas longiores, usque ad 7 cm. longi; *laminae* aequilateraliter triangulares, integrae, angulis basilaribus rotundatis, apice abrupte acutae vel subobtusae, 3–4·5 cm. longae lataeque, supra laeves, virides, subtus glaucae, minutissime papillosae, partibus suprapetiolari et infrapetiolari ratione 9 : 1. *Pedicelli* gracillimi, valde cirrhosi, usque 18 cm. longi. *Flores* 4·5–5·5 cm. longi; *calcar* rubrum, rectum vel sub-rectum, cylindrico-conicum, basi diam. 4–6 mm.; *sepala* oblonga, obtusiuscula, viridia; *petala* vix exserta, 4·5 mm. longa, dentato-ciliata, ciliis ad 5 mm. longis, superiora obovato-oblonga, inferiora obtriangularia in unguem attenuata.

COLOMBIA: Gundinamarca, La Mesa, edge of forest El Colegio, 1220 m., *Mrs. Tracey,* 164.

12. **T. Lehmannii,** *Hughes,* nov. sp. (Page 72, fig. C.).

Herba scandens, glabra. *Caulis* gracilis. *Folia* estipulata; *petioli* graciles, vix cirrhosi, 2–2·5 cm. longi; *laminae* late ovatae, acuminatae, subintegrae vel insconspicue crispo-crenulatae, 3–3·5 cm. longae, 2·6–3 cm. latae, supra laeves, subtus pruinoso-papillosae, partibus suprapetiolari et infrapetiolari ratione 3 : 1, rubro-marmoratae. *Pedicelli* gracillimi, basi cirrhosi, 6–7 cm. longi. *Flores* 4–5 cm. longi; *calcar* subrectum, conicum, ad apicem attenuatum, 3·5–4 cm. longum, basi ad 7 mm. diametro; *sepala* elliptico-oblonga; *petala* vix exserta, superne dentato-ciliata, 5 mm. longa.

COLOMBIA: Cauca, Paramo de Ruiz. *Lehmann* 3103. A specimen in the Natural History Museum—*Triana* (1829–1890)—with no locality given, resembles this species closely, but differs in having larger leaves, (5–7 cm. long, 3·5–4·5 cm. wide) which are apparently not mottled and larger flowers (5·5 cm. long).

13. **T. Wagnerianum,** *Karst.* in All. Gartenz. xviii (1849) 305.

Herba scandens, etuberosa, glabra. *Caulis* gracilis, curvatus. *Folia* estipulata; *petioli* flexuosi vel cirrhosi, quam laminas longiores (?); *laminae* triangulari-hastatae, longiores quam latiores, usque ad 6 cm. longae, anguste peltato-affixae, partibus suprapetiolari et infrapetiolari ratione 27 : 1, acuminatae, acutae, lobis baseos saepe truncatis hinc rotundatis, illinc (extrorsum) angulo obtuso terminatis, margine leviter incrassato, plus minusve inaequaliter sinuata, supra intense virides, subtus pallidiorae, pruinoso-papillosae, glaucae. *Pedicelli* folia longe superantes, usque 7 cm. longi. *Flores* 4·5 cm. longi; calcar cylindrico-conicum, leviter incurvatum, supra 3·5 (infra 3·0) cm. longum, basi diametro 1 cm., coccineum, apice viride; *sepala* late-ovata, acuta, viridia; *petala* calycem paulo superantia, caeruleo-violacea, superne fimbriata. *T. Schlimmii*, Linden. ms.

VENEZUELA: Trujillo, 2133 m., *Linden* 1431 (Herb. Planch.).

COLOMBIA (?).

14. **T. Karstenii**, *Wagner* in Oesterr. Bot. Zeitschr. lviii (1908) 436.

Herba scandens, glabra. *Caulis* gracilis, plus minusve angulosus et sulcatus. *Folia* estipulata; *petioli* subrobusti, laminae longiores, usque 10–14 cm. longi; *laminae* fere semiorbiculari-triangulares angulis obtusis, vix longiores quam latiores, usque 9 cm. longae, anguste peltato-affixae, partibus suprapetiolari et infrapetiolari ratione 18 : 1, basi leviter curvato-excisae, supra sparse, subtus densissime, minute pruinoso-papillosae. *Pedicelli* tenuissimi, flexuosi et cirrhosi, foliis multo longiores, minime 20 cm. longi. *Flores* incogniti.

COLOMBIA: Bogota, *Karsten*.

This species, the flowers of which are unknown, was compared by Dr. Wagner with *T. cirrhipes*, Hook. From this it is clearly distinguished by having the insertion of the petiole very near the margin. Its nearest ally seems to be *T. Wagenerianum*, Karst., which has relatively narrower leaves and much shorter pedicels. But in the total absence of flowers it is not possible to place it with absolute certainty.

15. **T. cuspidatum**, *Buchenau* in Engl. Jahrb. xxvi (1899) 581.

Herba scandens, etuberosa, glabra. *Caulis* angularis, genuflexus, 1·5 usque 2 mm. diametro. *Folia* estipulata; *petioli* graciles, saepe curvati, rarius cirrhosi, 3·5 usque 6 (raro 7) cm. longi, diametro circiter 1 mm.; *laminae* indistinctissime peltatae, fere semiorbiculari-triangulares, vix longiores quam latiores, integerrimae, basi curvato-excisae, supra laeves, subtus minute pruinoso-papillosae, angulis basilaribus rectis, lateribus infra medium convexis, supra medium concavis et in acumen 6 usque 8 mm. longum productis. *Pedicelli* foliis multo longiores (16 usque 20 cm. longi), petiolis crassiores, curvati sed vix cirrhiformes. *Flores* 5·2 cm. longi; *calcar* cylindrico-conicum, obtusum, usque ad 4 cm. longum, basi circiter 7 mm. diametro; *sepala* erecta, latissime ovata (fere semiorbicularia), obtusa;

petala calycem vix superantia, ovalia, basi cuneata, apice serrato-ciliata, nigro-caerulea, 7–8 mm. longa. *T. infundibularum*, Rusby in Bull. N. Y. Bot. Gard. iv (1907) 336.

BOLIVIA: Uchimachi, Coroico, *Miguel Bang* 2354.

16. **T. Deckerianum,** *Moritz & Karst.* in Karst. Ausw. Neu. Gew. Venez. (1848) 38 t. 12.

Herba scandens, subpubescens. *Caulis* angulosus, sulcatus, ad nodos pilis albis ad 2 mm. longis pilosus, caeterum glabrescens. *Folia* estipulata, vel stipulis minutis deciduis instructa; *petioli* laminas plus minusve aequantes, basis pilosi, caeterum glabrescentes, curvati vel vix cirrhosi; *laminae* ovato-triangulares, 4–8 cm. longae vel longiores, 3–7 cm. latae, partibus suprapetiolari et infrapetiolari ratione 3·5 : 1, basi rotundatae, apice acutae, subquinquelobae, lobis lateralibus plerumque multo reductis, lobo terminale elongato-triangulare, supra luteo-virides, subtus vix pallidiores, epapillosae. *Pedicelli* tenerrimi, 5–15 cm. longi, valde cirrhosi, glabri. *Flores* albo-pilosi, 4·5–5 cm. longi; *calcar* rectum vel leviter curvatum, 3–4 cm. longi, basi diametro 3·5–8 mm., rubrum, apice acuto, viride; *sepala* late ovata, viridia, valde pilosa; *petala* dentata, superne longe fimbriato-ciliata, atro-caerulea, 6 mm. longa, superiora late spathulato-oblonga, inferiora angustiora. *T. trilobum*, Turcz. in Bull. Soc. Nat. Moscow xxi (1858) 424.

N. COLOMBIA: Tovar, *Fendler* 149; *Moritz* 1676; New Grenada, Ocana, *Schlim* 355; and without precise locality, *Burke*.

17. **T. Lindeni,** *G. Wallis* in Ill. Hort. sér. 6, i (1894) 267 t. 17.

Herba alte scandens. *Caulis* gracilis, angulosus, curvatus, saepe atroruber, pilis fulvis (praecipue prope nodos) ad 3 mm. longis indutis. *Folia* estipulata; petioli subrobusti, laminas aequantes vel excedentes, ad 14 cm. longi, glabri vel basis pilis albo-fulvis induti; *laminae* pentagoni-ovatae, vel interdum ovatae, longiores quam latiores, basi rotundatae, lobo terminale triangulare, obtuso vel subacuto, lobis lateralibus plerumque bosoletis, supra medium unisinuatae, partibus suprapetiolari et infrapetiolari ratione 2 usque 3 : 1, utrinque glabrae et epapillosae, purpureo-marmoratae, ad nervos pallidiores. *Pedicelli* longissimi, gracillimi, usque ad 22 cm. longi, cirrhosi, glabri. *Flores* 4·5–5 cm. longi, glabri; *calcar* rectum, conicum, 3·5–3·8 cm. longum, rubrum, basi 8–9 mm. diametro; *sepala* oblonga, 8–10 mm. longa, 4 mm. lata, viridia; *petala* rubro-violacea, usque 8 mm. longa, superne dentata, longe fimbriata, fimbrii ad 9 mm. longi, superiora oblonga, fere ligulata, basi vix attenuata, inferiora obtriangularia, in unguem longe attenuata.

COLOMBIA: Antioquia, above Robledo near Medellin, 1500–1700 m., *Lehmann* 5870; and without precise locality *Sanders* 1881; *Jervise*; New Grenada, Mariquita, Quindio, 1600 m., *Triana* 3778; Bogota, Fusugasuga, *Hartweg*.

18. **T. Daweii,** *Hughes*, nov. sp. (Page 72, fig. D).

Herba scandens. *Caulis* gracilis ad nodos pubescens, caeterum glaber vel glabrescens. *Folia* estipulata; *petioli* glabri, graciles, demum incrassati, subcirrhosi, circiter 5 cm. longi; *laminae* glabrae, rotundato-ovatae, late repando-quinquelobae, lobis emucronatis, 3·5–4 cm. longae lataeque vel paulo latiores, partibus suprapetiolari et infrapetiolari ratione 3 : 1, epapillosae. *Pedicelli* gracillimi, subcirrhosi, vix petiolos superantes. *Flores* glabri, 3–3·5 cm. longi; *calcar* rectum, conicum, usque ad 2·5 cm. longum, basi 5 mm. diametro; *sepala* late elliptica vel ovata; *petala* haud exserta, superne dentato-ciliata, atrocaerulea, superiora spathulato-oblonga, 5 mm. longa, inferiora obtriangularia in unguem attenuata, 4·5 mm. longa. *T. Deckerianum*, Triana and Planchon, Prod. Fl. Nov. Gran. in Ann. Sc. Nat. Sér. 5, p. 119. non Moritz.

Colombia: Eastern Cordillera, *Dawe* 855; Bogota, 2700 m. *Triana* 3776; Prov. Mariquita, forests of Quindio, 2500 m. *Triana* 3777, 6063/5, 6063/6.

19. **T. crenatum,** *Karst.*, Fl. Colomb. i (1858–61) 145 t. 72.

Herba scandens, glabra, radice fibrosa. *Caulis* angulosus, lignescens, leviter sulcatus. *Folia* stipulata; *stipulae* minutae, hyalinae, subovales, obliquae, basi lata sessiles, laciniatae; *petioli* curvati, interdum cirrhosi, ad 7 cm. longi; *laminae* subrotundato-ovatae, apice obtusae, in utroque latere repandae vel sinuato-trilobae, lobis lateribus brevibus, latis, obtusissimis, majores 5–7 cm. longae lataeque, supra saturate virides, subtus pallidae, epapillosae, partibus suprapetiolari et infrapetiolari ratione 4·5–5 : 1. *Pedicelli* petiolorum longitudine vel breviores, teretes, glabri, cirrhosi. *Flores* usque ad 2·6 cm. longi; *calcar* rectum vel leviter curvatum, conicum, usque ad 1·8 cm. longum, apice obtusum; *sepala* ovata, apice rotundata; *petala* lateobovato-cuneata, superne dentato-fimbriata, violacea, superiora usque ad 4 mm. longa, inferiora paulo longiora.

Venezuela: Caracas, *Linden* 347; *Funcke* and *Schlim* 1394 (e descr.).

Colombia: Merida 2000–2500 m., *Karsten* (fragm. typ.); New Grenada, near San Miguel, Nevada de Santa Marta, *Purdie* (e descr.).

20. **T. tomentosum,** *Hughes*, nov. sp. (Page 81, fig. A.).

Herba scandens. *Caulis* subrobustus, quadrangularis, contortus, ad nodos fulve-tomentosus, caeterum subpubescens. *Folia* estipulata; *petioli* cirrhosi, robusti, fulve-tomentosi, haud laminis longiores; *laminae* ovatae, acuminatae, latere utrinque infra medium late rotundato, supra repando 1-dentato, vel latissime brevissime 1-lobato, circiter 7 cm. longae, 5·5 cm. latae, partibus suprapetiolari et infrapetiolari ratione 4·5 : 1, obscure rubromarmoratae, subtus dense tomentosae, epapillosae, supra tote glabri. *Pedicelli* glabri, gracillimi, a basi spiraliter cirrhosi, valde petiolos superantes, usque 13 cm. longi. *Flores* glabri, 4·5–5 cm. longi; *calcar* rectum, conicum, apice attenuatum, 3·5 cm. longum, basi 7 mm. diametro; *sepala* obtusa, elliptico-oblonga; *petala* haud exserta, usque ad 6 mm. longa, superne dentato-ciliata, superiora late spathulato-oblonga, inferiora obtriangularia in unguem attenuata.

Colombia: without precise locality, *Lobb* 16.

21. **T. parvifolium,** *Hughes*, nov. sp. (Page 70, fig. B.).

Herba scandens. *Caulis* gracilis, subcurvatus, plus minusve compressus, ad nodos fulvo-tomentosus, caeterum glaber vel subpubescens. *Folia* estipulata; *petioli* graciles, basi vix incrassati, cirrhosi, usque ad 2 cm. longi, subpubescentes; *laminae* orbiculares vel plus minusve depressae, utrinque magis minusve 2-dentatae, peltatae, circiter 1 cm. longae, 1–1·4 cm. latae, partibus suprapetiolari et infrapetiolari ratione 4:1, fulvo-hirtellae, supra intense virides, subtus dense marmoratae (?), epapillosae. *Pedicelli* foliis conspicue longiores, usque 9 cm. longi, tenuiter filiformes, superne incrassati subcirrhosi, glabri. *Flores* 4·5–5 cm. longi, fulvo-hirtelli; *calcar* rectum, cylindricum, triangulari-ovatae, obtusa; *petala* non exserta, usque ad 6 mm. longa, spathulato-oblonga, breviter unguiculata, superne dentato-ciliata, dentibus 5.

Colombia: without precise locality, *Lobb* 18.

22. **T. fulvum,** *Buchenau & Sod.* in Engl. Jahrb. xxxiv Beibl. lxxviii, 11.

Herba alte scandens. *Caulis* obtusangulus, indistincte sulcatus, circiter 1·5 mm. diametro, breviter pubescens. *Folia* estipulata; *petioli* saepe curvati, raro cirrhosi, usque ad 3 cm. longi, laminis breviores, breviter pubescentes; *laminae* elongato-ovatae, basi rotundatae, apice acutae, marginibus indistincte crenulatis et supra medium unidentatis, strigosae, supra intense fulvo-virides, subtus pallidiores, epapillosae, partibus suprapetiolari et infrapetiolari ratione 5·2 usque 6 : 1, pilis longioribus (usque fere 2 mm. longis) fulvis obtectae. *Pedicelli* foliis conspicue (duplo vel triplo) longiores, filiformes, superne incrassati, saepe cirrhosi, pubescentes pilis brevibus apice longioribus. *Flores* 5 cm. longi, pilis fulvis ad 2 mm. longis induti; calcar elongato-conicum, fulvo-puniceum (?), supra 4·5, infra 4 cm. longum, basi diametro 7 usque 8 mm.; *sepala* fulvo-viridia (?), rectangula, rotundata, obtusa, circiter 5 mm. longa; *petala* non exserta, superne serrato-ciliata, probabiliter rubro-violacea. *Mericarpium* semiobiculare, lateribus rugosis, dorso rotundato, apice stilo coronato.

Ecuador: prope Tamboloma, crescit in silvis subtropicis ad viam Quito-Guayaquil, *Sodiro* 230; Rio Cristal, *André* 4009 (e descr.).

23. **T. pseudopubescens,** *Hughes*, nov. sp. (Page 84, fig. D.).

Herba alte scandens, ad 7·6 m. (ex Lehmann). *Caulis* gracilis, sparse pubescens. *Folia* estipulata; *petioli* subrobusti, subcirrhosi, usque ad 6 cm. longi, fulvo-hirti; *laminae* late rotundato-ovatae, magis minusve breviter lateque quinquelobae, rarius subintegrae, lobis subapicularis, 4 cm. longae lataeque vel paulo latiores, partibus suprapetiolari et infrapetiolari ratione 3·5 : 1, fulvo-hirtae, supra atrovirides, subtus rubro-punctatae infundo obscuro, epapillosae. *Pedicelli* gracillimi, cirrhosi, basi pubescentes, apicem versus glabri, petiolos superantes, circiter 13 cm. longi. *Flores* fulvo-hirti, 4–4·5 cm. longi; *calcar* rectum, conicum, apice luteo-viride, usque 3·5 cm. longum, basi 6 mm. diametro; *sepala* elliptica vel ovata, luteo-viridia; *petala* non exserta, superne dentato-ciliata, atra, 5–6 mm. longa, superiora obtriangularia in unguem attenuata, inferiora late spathulato-oblonga.

Colombia: Central Andes of Popayan, Paramo de Guauacas, 2800–3000 m., *Lehmann* 4709.

24. **T. adpressum,** *Hughes*, nov. sp. (Page 84, fig. C.)

Herba scandens. *Caulis* gracilis, pilis albidis imprimis ad nodos hirtus. *Folia* estipulata; *petioli* quam laminas breviores, usque ad 3 cm. longi, cirrhosi, hirti; *laminae* ovatae, acutae, 5 cm. longae, 4 cm. latae, supra medium trilobae, lobo terminali triangulari, lobis lateralibus acutis interdum obscuris, partibus suprapetiolari et infrapetiolari ratione 5 : 1, supra infraque pilis albidis adpressus maxime ad nodos indutae, subtus valde rubro-punctatae, epapillosae. *Pedicelli* gracillimi, subcirrhosi, petiolos valde superantes, circiter 7 cm. longi. *Flores* hirsuti, ad minimum sepala, 4·5–5 cm. longi; *calcar* rectum ultra medium cylindricum, denique conicum, 3·5 cm. longum, basi 5 mm. diametro; *sepala* ovata, viridia; *petala* haud exserta, superne dentato-ciliata, superiora lamina rotundato-ovata, in unguem attenuata, 6 mm. longa, inferiora minora, angustiora, 5 mm. longa.

Ecuador: Quito, *Jameson;* Western Andes, 1220 m., *Pearce* 397.

25. **T. coccineum,** *Hughes*, nov. sp. (Page 81, fig. C.)

Herba scandens. *Caulis* gracilis, pilis albidis apice obtusis imprimis ad nodos hirtus. *Folia* estipulata; *petioli* graciles vel robustiusculi, cirrhosi, glabrescentes, usque ad 5 cm. longi; *laminae* glabrae, ovatae, acutae, 5–6 cm. longi, 4 cm. latae, supra medium trilobae, lobo terminali triangulari, lobis lateralibus saepe multum reductis, plerumque obtusiusculis rarius nullis, margine interdum crispo-crenulato, partibus suprapetiolari et infrapetiolari ratione 3 : 1, supra subtusque rubro-marmoratae, epapillosae. *Pedicelli* gracillimi, cirrhosi, petiolos valde superantes, 14–16 cm. longi. *Flores* tote glabri, 5 cm. longi; *calcar* coccineum, rectum, conicum, 4 cm. longum, basi 5–7 mm. diametro; *sepala* ovata, obtusa, viridia; *petala* vix exserta,

A. *T. tomentosum.* B. *T. integrifolium.* C. *T. coccineum.* D. *T. maculifolium.* E. *T. kerneisinum.* a. petalum inferius. b. petalum superius. The petals of B. C. and D. are similar to those figured for E. differing only slightly in size (*see* descriptions).

7 mm. longa, superne dentato-ciliata, atro-caerulea, superiora late spathulato-oblonga, inferiora in unguem attenuata.

Colombia: Prov. New Grenada, Quindio, *Purdie*: La Ceja, *André* 2204; *Lobb* 15.

26. **T. longifolium,** *Turcz.* in Bull. Soc. Nat. Moscow xxxi (1858) 423.

Herba scandens. *Caulis* teres vel leviter angulosus, glaber vel pilis fulvis ad 1·5 mm. longis, manifeste ad nodos, indutus. *Folia* stipulata; *stipulae* minutissimae, inconspicuae, deciduae; *petioli* subrobusti, cirrhosi, usque ad 6–8 cm. longi, glabri vel basi fulvo-pilosi; laminae ovato- vel oblongo-lanceolatae; obtuse acuminatae, basi rotundatae, integerrimae, usque ad 10 cm. longae et basi ad 3 cm. latae, partibus suprapetiolari et infrapetiolari ratione 4 : 1, intense virides, supra subtusque dense rubro-punctatae, glabrae, epapillosae. *Pedicelli* tenerrimae, cirrhosi, circiter 10 cm. longi, glabri. *Flores* glabri, 4–5 cm. longi; *calcar* rectum, conicum, apice leviter attenuatum, obtusum, 4 cm. longum, basi 5 mm. diametro, purpureo-rubrum; *sepala* ovata, apice rotundata, viridia; *petala* late spathulato-oblonga, basi leviter attenuata, superne 5-dentato-fimbriata, superiora 6 mm. longa, inferiora 9 mm. longa (fimbria excluda), atro-caerulea.

Colombia: Antioquia, *Kalbreyer* 1548; New Grenada, Mariquita, *Triana* 3772.

27. **T. stipulatum,** *Buchenau & Sod.* in Engl. Jahrb. xxxiv Beibl. lxxviii, 12.

Herba alte scandens. *Caulis* erectus, saepe curvatus, plus minusve angulosus et sulcatus, usque fere 3 mm. diametro, pilis patentibus hirsutus. *Folia* egregie stipulata; *stipulae* frondosae, semiorbiculares, integrae vel indistincte crenulatae, usque 1 cm. diametro, glabrae; *petioli* saepe curvati, interdum breviter cirrhosi, 6 usque 12 cm. longi, pilis patentibus (praecipue prope nodos) obsiti; *laminae* peltatae, subreniformes, supra intense virides, subtus vix pallidiores, epapillosae, partibus suprapetiolari et infrapetiolari ratione 3·6 usque 4·3 : 1, vadissime quinquelobae, basi distincte repandae. *Pedicelli* gracillimi, cirrhosi, foliis breviores, sub flore incrassati, glabri. *Flores* 2·5 cm. longi, glabri; *calcar* conicum, puniceum (?), apice viride, supra 1·9, infra 1·8 cm. longum, basi usque 4·5 mm. diametro; *sepala* oblongo-rotundata, viridia, 4 usque 5 mm. longa; *petala* parva, non exserta, superne serrato-ciliata, nigro-violacea (?).

Ecuador: Corazon, 2400–3000 m., *Sodiro* 224.

In the original diagnosis of this species the stipules are described as measuring 20 (rarely 30) mm. in diameter. I have examined the type specimen (*Sodiro* 224) and find that they do not exceed 1 cm. in diameter.

28. **T. maculifolium,** *Hughes*, nov. sp. (Page 81, fig. D.)

Herba scandens. *Caulis* gracilis, glaber vel subglabrescens. *Folia* estipulata; *petioli* gracilis, subcirrhosi, basi haud crassiores, usque ad 4 cm. longi; *laminae* glabrae, late rotundato-ovatae 3 cm. longi, 3·6 cm. latae, breviter lataeque quinque-lobae, lobis obtusissimis, margine obscure crenulato-crispo, partibus suprapetiolari et infrapetiolari ratione 3·5 : 1, supra subtusque dense rubro-marmoratae, epapillosae. *Pedicelli* subpubescentes, graciles, cirrhosi, petiolos superantes. *Flores* pubescentes, ad minimum sepala, 4·5 cm. longi; *calcar* rectum, conicum, usque 3·7 cm. longum, basi 6–7 mm. diametro; *sepala* elliptico-oblonga, obtusa, hirsuta pilis albis curvatisque; *petala* haud exserta, usque ad 6·5 mm. longa, superne dentato-ciliata, atro-caerulea, superiora late spathulato-oblonga, inferiora plus minusve in unguem attenuata.

Colombia: Andes of Bogota, *Saunders* 390.

29. **T. integrifolium,** *Hughes*, nov. sp. (Page 81, fig. B.).

Herba scandens, etuberosa (Hartweg), glabra. *Folia* estipulata; *petioli* graciles, vix cirrhosi, 4–6 cm. longi; *laminae* integrae vel subintegrae, suborbiculares vel rotundato-ovatae, 4–5 cm. longae, partibus suprapetiolari et infrapetiolari ratione 1·5–2 : 1, rubro-punctatae vel marmoratae, epapillosae. *Pedicelli* gracillimi, cirrhosi, valde petiolos superantes, usque ad 12 cm. longi. *Flores* 4·5 cm. longi; *calcar* rectum, anguste conicum, 3 cm. longum, basi usque 5 mm. diametro; *sepala* elliptica, obtusa, viridia; *petala* majuscula, usque ad 7·5 mm. longa, haud exserta, superne dentato-ciliata, superiora late obovato-cuneata, anguste unguiculata, inferiora minora, subunguiculata. *T. cirrhipes*, Benth., Pl. Hartw. 166. non Hook.

Colombia: Andes of Popayan, *Hartweg:* without precise locality, *Lobb* 6.

30. **T. kerneisinum,** *Hughes*, nov. sp. (Page 81, fig. E.)

Herba scandens. *Caulis* gracilis, subanfractuosus, internodiis 1·5–2 cm. longis, glabrescens. *Folia* stipulata; *stipulae* minutae, deciduae; *petioli* graciles, subcirrhosi, 2–3 cm. longi, glabri vel glabrescentes; *laminae* glabrae, suborbiculares, interdum plus minusve depressae, integrae vel superiores latissime sublobatae, lobis 3–5, 2·5–3 cm. longae lataeque vel paulo latiores, supra subtusque rubro-marmoratae, epapillosae. *Pedicelli* graciles, glabri, subcirrhosi, circiter 4·5 cm. longi. *Flores* glabri, usque ad 3 cm. longi; *calcar* coccineum, subcurvatum, angustum, a basi sensim attenuatum, apice obtusum, fere 2·5 cm. longum, basi 3 mm. diametro; *sepala* viridia, obtusa, ovato- vel elliptico-oblonga; *petala* non exserta, usque ad 5 mm. longa, superne dentato-ciliata, atroviolacea, superiora late elliptico-oblonga, vix vel brevissime unguiculata, inferiora cuneata, basi anguste attenuata.

A. *T. trilobum*. B. *T. pentagonum*. C. *T. adpressum*. D. *T. pseudo-pubescens*. all natural size. a. petalum inferius. b. petalum superius.

COLOMBIA : Andes of Pasto, Chimbalan woods, *André* 2951.

31. **T. pentagonum,** *Hughes*, nov. sp. (Page 84, fig. B.)

Herba scandens. *Caulis* gracilis, teres, ad nodos pubescens caeterum glabrescens. *Folia* stipulata; *stipulae* minutae, deciduae; *petioli* graciles, subcirrhosi, 2–2·5 cm. longi; *laminae* glabrae, pentagonae, basi late vetusae, quinquelobae, lobis obtusis interdum minute apiculatis, lobo infimo cum intermedio fere confluente, terminale late ovato, nervis primariis rectis, circiter 2·5 cm. longae lataeque vel paulo latiores, partibus suprapetiolari et infrapetiolari ratione 3 : 1, supra subtusque rubro-marmoratae, epapillosae. *Pedicelli* graciles, vix cirrhosi, subpubescentes, ad 6 cm. longi. *Flores* sparse pubescentes, 3 cm. longi; *calcar* rectum, anguste conicum, ad 2·3 cm. longum, basi 5 mm. diametro; *sepala* elliptico-ovata, obtusa; *petala* parva, haud exserta, spathulato-cuneata, superiora 5 mm. longa, inferiora 4 mm. longa, superne tenuissime dentato-ciliata.

COLOMBIA : Boqueron de Bogota, 2800 m., *André* 770.

32. **T. trilobum,** *Hughes*, nov. sp. (Page 84, fig. A.)

Herba scandens. *Caulis* gracilis, ad nodos pubescens, caeterum glaber. *Folia* estipulata; *petioli* glabri, graciles, subcirrhosi, 3–4 cm. longi; *laminae* glabrae, ambitu rotundato-ovatae, basi late convexae vel subtruncatae, trilobae, lobis latis obtusis, 3 cm. longae lataeque vel paulo latiores, partibus suprapetiolari et infrapetiolari ratione 6·5 : 1, marginis integris vel subcrenulatis, subtus rubro-marmoratae, epapillosae. *Pedicelli* graciles, subcirrhosi, vix petiolos superantes. *Flores* glabri, extra coccinei, 2·5–3 cm. longi; *calcar* rectum, conicum, 2 cm. longum, basi 6 mm. diametro; *sepala* elliptica, obtusa; *petala* haud exserta, atro-caerulea, 5 mm. longa, superne dentato-ciliata, dentibus 3, superiora late obovata in unguem angustum contracta, inferiora obovato-spathulata.

COLOMBIA : Afradita near Fusagasuga, 2000 m., *André* 1386.

X.—PHYTOPATHOLOGY IN THE UNITED STATES.

E. J. BUTLER.

With the permission of the Committee of the Imperial Bureau of Mycology the Report by Dr. E. J. Butler, Director of the Bureau, on his visit to America during July and August 1921 is here reprinted with a few omissions and alterations. We are glad to have been allowed to bring the Bureau of Mycology and its value to the Empire to the notice of a wider public through the medium of the *Bulletin:*

The immediate purpose of my visit to the United States was to attend a Conference on the diseases of cereals held by the American Phytopathological Society at St. Paul (Minnesota) and

Fargo (North Dakota) from July 19th to 23rd. The more important objects were, however, to visit a number of the chief centres of agricultural and botanical research in the eastern, southern and middle western States, and to meet as many of those engaged in research and the organization of research in these subjects as was possible in the time at my disposal. The specific aims that I had in view were: (1) to bring the international aspects of the work of the Imperial Bureau of Mycology before our American colleagues; (2) to enlist their co-operation in certain branches of this work, and to ascertain what assistance we might expect to obtain in the United States; (3) to examine the organization and present development of the study of plant pathology and its application to the prevention and control of crop diseases in the United States; and (4) to visit some of the chief crop areas of the eastern half of the country and see the conditions under which the crops are grown and the measures taken to improve varieties and methods. The time at my disposal was insufficient to carry out this last adequately.

The Conference on cereal diseases was attended by some fifty members of the American Phytopathological Society (including several Canadians), a few American visitors, and representatives from England, Japan, Australia, and the Philippines. It met at St. Paul from the 19th to the 21st of July, moved to Fargo on the night of the 21st, and terminated there at 10 p.m. on the 22nd. The daylight hours were mostly given to field meetings at the experimental farms at St. Paul and Fargo and automobile trips through the wheat belt of Minnesota and North Dakota, while meetings to discuss specific subjects were held in the evenings. The members were also taken through one of the largest elevators and flour mills in Minneapolis. The Conference concerned itself chiefly with the cereal rusts, particularly with the control of black rust by breeding resistant varieties, and the campaign for eradicating the barberry, on which this parasite spends part of its life; with the diseases caused by *Helminthosporium*, *Fusarium*, and *Sclerospora*; and with the newly introduced "take-all" and "flag-smut" of wheat. There is probably more work being done on these subjects than on any other branch of plant pathology in the United States at the present moment, and we had the benefit of having this work explained, and in some cases demonstrated, by those actually engaged in it. Educationally, the Conference was of considerable value.

Both before and after the Conference I visited a number of scientific institutions east of the Mississippi from Michigan to New Orleans, with a view to establishing direct relations with American mycologists and plant pathologists. Owing to the prominence given to the study of these subjects there are at present more men at work on them in the United States than in any other country. This work is being pursued not only in institutions specifically for applied science, such as the Bureau of Plant Industry at Washington and the State Experiment Stations, but also in many of the Universities, such as (amongst those I visited) Cornell, Purdue, Illinois, St. Paul, and Wisconsin. The study of pure systematic mycology is, after a period of neglect, again showing marked evidence of vitality so that the lead taken by Germany in this branch will, I think, pass to America in the future. It seemed most important to enlist the interest of American workers in the Bureau of Mycology, and I found this the more easy in that the entomologists in several of the institutions visited were very familiar with the Imperial Bureau of Entomology in London and spoke highly of its value. At Wood's Hole, and the Cereal Conference, I met a number of members of the staff of institutions that I was unable to visit. Considerable interest was evinced in what was regarded as a new departure likely to be of value to workers in other countries. Most of the institutions visited are prepared to exchange their publications with those of the Bureau. In several cases I asked if I could count on the direct assistance of specialists in particular subjects, and in all these found the greatest readiness to co-operate. I am sure that our work will be supported and encouraged very generally in America, and that we can get an immense amount of help there. In Washington, in particular, I was promised invaluable assistance, everyone I approached, from Dr. Taylor, Chief of the Bureau of Plant Industry, downwards, being most cordial. The National Research Council and the Editorial Board of *Botanical Abstracts* were other bodies that undertook to give us any help they could, and the discussions I had with members of the latter Board were particularly useful in helping to determine the lines on which our new abstracting journal can be made most serviceable.

The trend of research work in America is towards specialization, as it is elsewhere, but American workers have been accused of carrying this to too great a length. This is, I think, to misunderstand the organization of research in that country. Though the individual is specialized, problems are approached from a wider angle than probably in any other country. One of the best illustrations of this can be got from the "project plan" of the organization of work in the Department of Agriculture. This is merely the co-operative investigation of a problem by a group of specialists under a project leader, each worker taking a particular aspect of the problem in which he is specially competent, but all keeping in touch with one another and with the project leader. The greatest care is taken, as a rule, to preserve the independence of the individual and to give the fullest play to original initiative and freedom of research. The inquiries are carried out at various centres, Federal and State officers co-operating in the work, and the former being posted, when necessary, to the State centres most suitable for the purpose. Half-a-dozen men may be working in several different States in close co-operation and under a common leader, but each carrying out a different side of the investigation, and with complete freedom of action.

The system was a result of the frank recognition of the fact that many, perhaps most, of the chief inquiries that needed to be taken up were beyond the capacity of any single individual to bring to a successful conclusion within a reasonable time, and that, for their solution, the separate aspects of each problem required very highly competent specialistic work, such as can only be acquired by deep or intensive study rather than by a broad survey. I believe this is the correct way to attack such problems, and that it is only in very rare cases that an investigator can be found whose knowledge of the several distinct aspects which the problem may present is deep enough to enable him to explore all or many of them adequately.

It is worthy of note that the National Research Council is working along somewhat similar lines. It is an organization established in 1916 by the National Academy of Sciences to advise and assist in applying the scientific and technical resources of the country to the objects of the War, and made permanent by an Executive Order of President Wilson's Government in 1918. It is not, however, in the usual sense a governmental institution. Its chief objects are to organize research, to stimulate research and its application, to formulate comprehensive projects of research and to promote co-operation "in order to secure concentration of effort, minimise duplication, and stimulate progress; but in all co-operative undertakings to give encouragement to individual initiative." It is controlled by its own members, who include representatives of the chief scientific and technical societies, government representatives, and members at large amongst whom, in 1920–21, were Mr. Elihu Root and Mr. Herbert Hoover, together with several leaders in industry, engineering, and the Press. It is supported by other than Government aid, but maintains close contact with Government departments in several of its divisions. In its attempts to bring together scattered work and workers, and to assist in co-ordinating scientific attack on large problems, it has largely adopted the "project plan," by the establishment of special committees of experts, which plan modes of attack and undertake to find men and means for carrying out the plan. There are about eighty such committees, and many of them have obtained appropriations from industrial and agricultural sources for specific research, *e.g.*, one from the Southern Pine Association of $10,000 for maintaining certain forestry researches, and one which is now being negotiated with a group of tobacco growers and manufacturers for the study of tobacco diseases. Through the Council, there is also being organized an Institute for Research in Tropical America which will have a very definite bearing on some aspects of the work of the Bureau of Mycology. I had the advantage of discussing these and other activities of the Council with Dr. L. R. Jones, Chairman, and Dr. McClung, past Chairman, of the Division of Biology and Agriculture, and Dr. Yerkes, Chairman of the

Research Information Service of the Council, who is Resident Director of the Service at the headquarters in Washington. The opportunity I had of examining the working of the latter service was of particular interest, since it is engaged on work very similar to the "informational" side of the work of the Bureau of Mycology.

The question of abstracting and indexing scientific literature is occupying the attention of various organizations in America. A joint committee of the National Research Council and the American Association for the Advancement of Science was formed to consider this matter in 1920, and the question of taking steps for the establishment of an international institute for scientific bibliographical work is being examined, Dr. Kellogg being now in Switzerland on behalf of the National Research Council with a view to reporting on the utilization of the Concilium Bibliographicum at Zurich as a nucleus for the proposed institute This is a matter of direct interest to the Bureau of Mycology.

In a general way, much more attention is being paid to the "business" side of the organization of scientific work in the United States than elsewhere, and this is coupled with the development of "team work" in attacking important problems. They are recent developments and have not yet begun to produce their full effects, but the thoroughness of the preliminary preparation and the numbers who have combined to give effect to these aims make it certain that the result will be a vast stimulation of research activities. It was several times remarked to me that the formation of the Bureaux of Entomology, Tropical Diseases, and Mycology in London was evidently in response to similar needs, and that we should keep in close touch with one another. In the development of closer international relations, the trend in America is in favour of separate national organizations in the different countries with close mutual relations rather than single international institutions such as the International Institute of Agriculture at Rome. In our work we cannot fail to develop international contacts, and the sympathetic attitude towards such contacts (especially with the British Empire) which I found to be pretty general in the States will be well worth consolidating. I found a very wide recognition of the truth that phytopathology is as definitely an international interest as public health, and in several addresses at functions which I attended the formation of the Bureau of Mycology was welcomed on account of the international significance of its work.

The chief places visited with the special object of seeing the work on crop improvement and diseases were St. Paul (Minnesota) for cereals, Fargo (North Dakota) for flax, Baton Rouge and Audubon Park (Louisiana) for sugarcane and rice, Hartsville (South Carolina) for cotton and maize, New Haven (Connecticut) for tobacco and maize, St. Catherines (Ontario, Canada) for fruit, Lansing (Michigan), Lafayette (Indiana), and Urbana (Illinois) for cereals, fruit, and vegetables, and Cornell (New York for maize.

The principal objects were to see what work was actually being done in certain areas on these crops, and to get into personal touch with the men in charge of this work so as to facilitate future relations. The chief value of this will be that I shall be better able to apply or to refer applications from overseas correspondents of the Bureau to the most likely American source of assistance in special inquiries. Want of time prevented me from fully carrying out my programme in this direction. What I saw convinced me that America is far ahead of other countries in the general application of modern methods of plant breeding and the use of fungicides for the reduction of the wastage due to disease. Maize, wheat, cotton, beans, sugarcane, tobacco, and fruit were the principal crops seen in which these methods were being applied with the greatest success.

The very great attention directed to this matter in the United States is the result not only of the magnitude of their agricultural industry, but also of the generally great severity of the diseases of their crops. On the whole, the diseases of plants that have an economic value are distinctly worse in the United States than in Europe, though not worse than in some of the overseas parts of the British Empire. The reason for this appears to be that there are two factors concerned in intensifying diseases in countries that are newly opened up to settled agriculture. (1) the crops grown are largely exotic, and hence become exposed to the attack of indigenous parasites against which they have not developed powers of resistance; (2) with the introduction of new plants of economic value, exotic parasites are brought in, and some of these develop into serious pests of pre-existing plants in their new home. In Europe both these factors doubtless operated in the past, and the latter was responsible for the enormous ravages of introduced vine diseases in the last century. But the process has been very gradual in Europe as compared with America, and the centuries-long history of the operation of these two factors in Europe has been condensed into the last century, or even half-century, in the United States, especially in the centre and west of the country. The same phenomenon is marked in many of the British overseas possessions, and is likely to become increasingly evident in some in the future.

It is impossible to exaggerate the value to a working mycologist of a tour in the United States at the present time. In the last ten years the study of the diseases of plants in that country has progressed until it now easily leads the rest of the world. Since the War, American phytopathologists have redoubled their energies, and the next ten years will, I believe, see an accelerated progress. The most noticeable feature at the moment is the concentration of numbers of workers on certain fundamental problems, such as the etiology of the mosaic group of diseases, biological specialization in parasitic fungi, and the factors determining resistance or susceptibility to disease. Innumerable new points of view and critical attacks on many existing conceptions regarding parasitism and plant diseases generally are encountered, and a new science of phytopathology is being built up on the basis of the intimate relationship between host-plant, parasite, and external conditions. It is essential for the progress of mycological science in this country that we should keep in close touch with current developments and trends of thought in the United States. Mere knowledge of the literature does not sufficiently satisfy this need, as the value of published work is often difficult to appraise at a distance and trends of thought are usually in advance of publication. The practice of sending British mycologists to the United States in response to the annual invitations that have been issued during the past few years by the American Phytopathological Society is a sound one, and its cost will be more than repaid in the increased efficiency of their work.

To the Bureau of Mycology there is a special advantage over the general one referred to above, in that both as a centre for distributing information and an organization for working out the parasitic fungus flora of the outlying parts of the Empire we will require all the assistance we can get from other workers. As a result of my visit, I feel that we can rely confidently on receiving a great deal of help from workers in the United States.

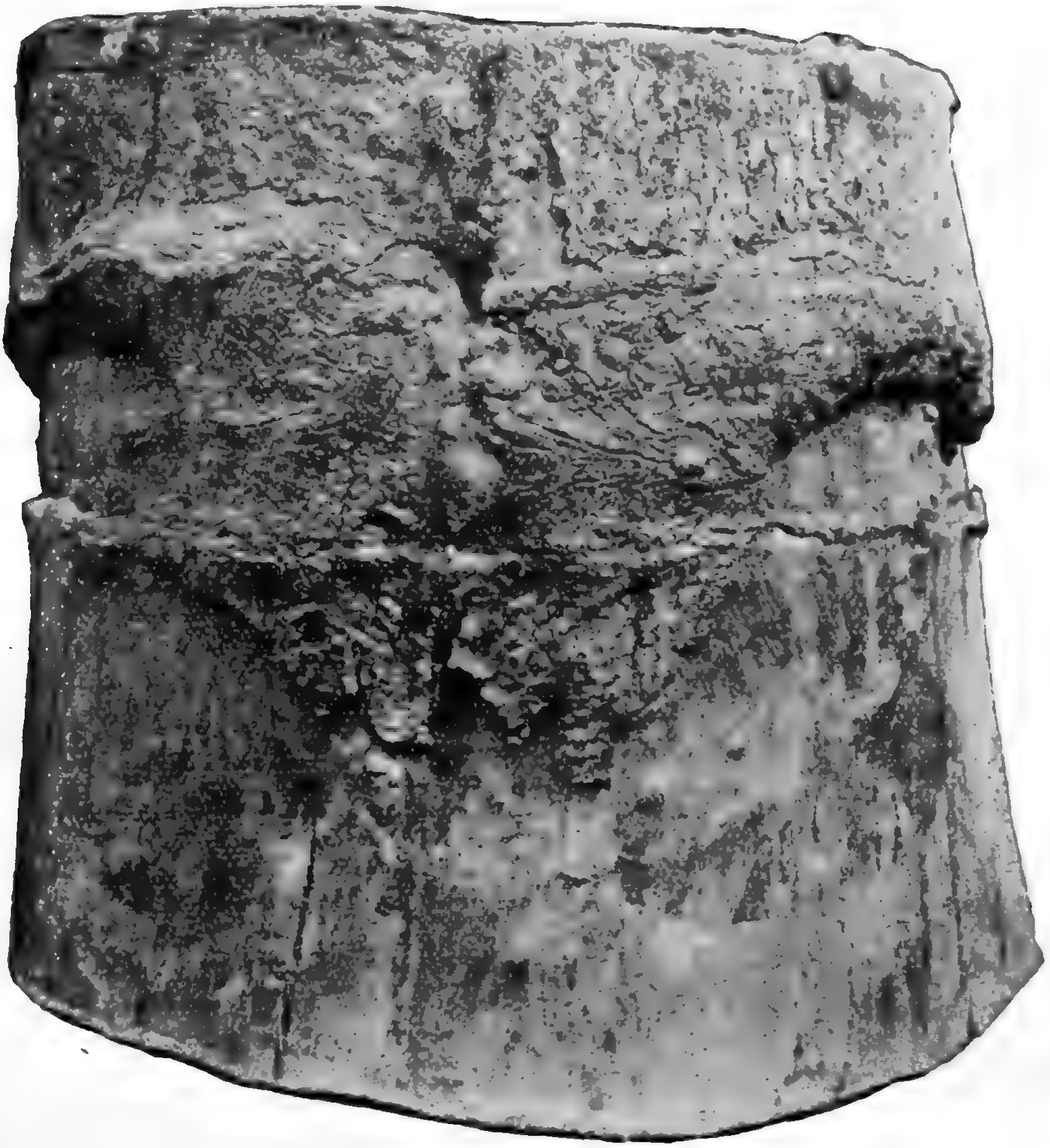
XI.—RECOVERY OF HEVEA TREES AFTER RINGING.

When at the Agege plantation, Nigeria, in the spring of last year (*see K. B.*, 1921, p. 234), I was interested to see the way in which the *Hevea* rubber trees had recovered from the ringing of the stems which had been done with the object of killing superfluous trees in order to thin out the plantations.

Mr. A. H. Kirby, late Asst. Director of Agriculture, Southern Provinces, Nigeria, in whose company I visited the plantation, has been good enough to send over two specimens of ringed trunks to Kew from one of which the photograph, here reproduced, has been taken. Unfortunately the trunks suffered a good deal of damage in transit, but they show remarkably well the bridging across of the ring, more than two inches broad, by the growing down of callous growth from the cortical tissues above the ring to meet and rejoin with the cortical tissues on the lower side of the ring. On account of the rate at which this growth was made, and certain other particulars in the behaviour of the ringed trees, it appears desirable that the results of this ringing experiment should be recorded, and Mr. Boodle has added some notes on the specimens.

A. W. H.

Mr. Kirby has kindly furnished the following particulars of the ringing of the trees and of their recovery :—" The Para rubber trees at Agege, that were tapped severely before their intended removal in order to give room for the remainder, were ringed about a foot above ground in the dry season (December to February inclusive) of 1918–19, the cuts being two inches or so wide and care being taken that everything outside of the wood



was removed. After going on leave in May 1919, I returned in December of the same year and examined them in January 1920. By this time, many of the trees had been cut down to leave stumps eight to twelve feet in height; both these and those which had not been cut in any way since ringing were nearly all still alive and growing well, except where fires had been made against some of the stumps for the purpose of killing them because ringing had failed. In most cases these living stumps and trees had partly or completely grown a layer of wood and bark downward across the ring (*see* figure) in the form of a bridge, the breadth of the latter (horizontally) being usually from two to three inches, but six and seven inches respectively in the two specimens; there was generally only one such bridge, but sometimes two. The ringing had apparently had no effect on the top growth (branches and leaves) of the unlopped trees, whilst the 'stumps' had branched prolifically right at the top, there being, however, a tendency towards the formation of small, weak branches lower down, in almost every case (where they appeared) at the upper part of the new layer across the ring.* I do not remember seeing any such lower, weak branches where this layer had not yet reached the under side of the ring. The leaves of the whippy, green branches formed by the stumps had the abnormally large leaflets that are characteristic of old or transplanted rubber seedlings. This apparently uninterrupted growth after ringing, and energetic renewal of growth after stumping and ringing, say much for the vitality of the Para rubber tree, especially when it is remembered that the trees under discussion had been tapped so severely that cuts for the tapping were made on the untouched half of the trunks before any bark renewal could take place on the half already tapped."

The effect of ringing on these trees, as described by Mr. Kirby, affords an example of rapid partial healing of wounds, involving the growth of callus and the formation of a layer of wood and bark over a vertical distance of two inches or more, within about twelve months from the time of ringing. In the two specimens sent to Kew, the cut appears to have been more than two inches across, the vertical growth made by the bridge being probably about $2\frac{1}{2}$ inches in the smaller stem, and nearly 3 inches in the larger. The specimens measure about 36 and 46 inches in circumference at the upper end, *i.e.*, at about a foot and a half above the soil. The trees were probably about twelve years old.

Petch† notes that "on young *Hevea*, wounds heal rapidly and completely," but adds that "experimental wounds, two and a half inches square, on twenty-three-year-old trees, have made very little progress towards a complete reconstruction of the bark in three years." The latter statement apparently implies a much slower growth of callus than that observed by Mr. Kirby, referable in part, perhaps, to a difference between the two lots of trees as to age and vigour, and possibly depending also on the difference in the nature of the wound.

In the case of some doubly ringed *Hevea* trees (said to be twelve years old, and badly grown), described by Petch,‡ it was found that, after fifteen months, complete or partial healing of one or both rings had taken place in nine out of sixteen trees. Each of the two rings was one inch wide.

These data do not include any record of such rapid growth of callus as that observed by Mr. Kirby.

The lack of appreciable damage to the top growth twelve months after ringing, as noted by Mr. Kirby, is not very surprising in a tree with a large amount of sap-wood like *Hevea*. The sap-wood was in fact found to extend right to the centre of the larger of the two specimens. Hence, although the wood exposed by ringing had, no doubt, become dead, dry and incapable of

* Cf. Petch, The Physiology and Diseases of *Hevea brasiliensis*, 1911, p. 70.

† Petch, loc. cit., p. 71.

‡ Petch, loc. cit., p. 70.

conduction to some slight depth below the bare surface, one may assume that abundant conduction of water upwards through the ringed region would still be possible for a long time. The roots also would be able to carry on efficient absorption for a prolonged period, there being plentiful reserves of food-materials below the ring to provide for their growth.

As soon as a bridge has been formed across the ring, supplies from the crown can naturally pass down to the roots, and an approach to normal conditions for their nutrition is thus made.

XII.—MISCELLANEOUS NOTES.

Mr. L. Lewton Brain.—We learn that Mr. L. Lewton Brain, recently Director of Agriculture, Federated Malay States, has been appointed Technical Adviser in Agriculture to the Government of the Federated Malay States.

Mr. Geoffrey Corbett has been appointed by the Secretary of State for the Colonies, on the recommendation of Kew, Assistant Superintendent of Agriculture in the island of Rodriguez.

Retirement of Lieut.-Col. Sir David Prain.—The late Director retired on February 28th and has been succeeded by Dr. A. W. Hill, F.R.S., Assistant Director of the Royal Botanic Gardens since 1907. Sir David Prain was appointed Director in December 1905 (*see K.B.* 1905, p. 62).

On February 22nd, when the staff were kindly entertained at a farewell party by Sir David and Lady Prain, the occasion was taken advantage of to offer parting gifts to Sir David and Lady Prain and to hand to Sir David the following letter :—

To Lieut.-Colonel Sir David Prain, I.M.S., C.M.G., C.I.E., F.R.S.

We, the undersigned members of the Staff of the Royal Botanic Gardens, Kew, are desirous of taking the occasion of your retirement to express our cordial appreciation of the many and valuable services that you have rendered to Kew, to botanical and horticultural science, and to ourselves personally, during the sixteen years of your beneficent administration.

During a period marked by years of unparalleled difficulty you have been successful, by an unwearying devotion to the interests of the establishment, consummate tact and patience, in carrying on and even extending the innumerable activities with which Kew is identified, and in spite of the hampering influences of the war, great and lasting progress has been made. The splendid work of your predecessors has been consolidated and the reputation of Kew has been advanced from a high to a higher plane.

Your duties as Director of Kew, onerous as they are, have not constituted your only public service. Government have availed themselves freely of your knowledge and judgment by calling upon you to serve on many committees appointed to deal with post-war problems, particularly in the sphere of agricultural research.

You have been unsparing of yourself in the interests of science. You have served it as President of the Botanical Section of the British Association, involving a visit to Winnipeg, as President of the Linnean Society, and as Vice-President and Treasurer of the Royal Society of London.

These are but a few of the many offices to which you have been called, and your election to them has been a well-deserved tribute to your scholarship and your attainments as a Botanist, and has been an honour to Kew.

The welfare of your staff has ever been a matter of deepest concern to you and there is no member of that staff who has not experienced some amelioration in the conditions of service at Kew during your administration.

We earnestly hope that your life and health may be preserved for many years and that they may be happy years for you and Lady Prain.

We take leave of you with regret. We shall remember you with genuine affection and esteem.

(Signed)

Arthur W. Hill	Assistant Director.
J. Aikman	Assistant, Director's Office.
O. Stapf	Keeper of Herbarium and Library.
C. H. Wright	Assistant, Herbarium.
S. A. Skan	do. do.
T. A. Sprague	do. do.
Elsie M. Wakefield	do. do.
W. B. Turrill	do. do.
J. Hutchinson	do. do.
K. W. Braid	do. do.
S. T. Dunn	Assistant for India.
Arthur Kellett	Artist.
A. F. Fitch	Sub-Assistant, Herbarium.
M. G. Aikman	do. do.
D. K. Hughes	Temporary Technical Assistant.
Mabel I. Skan	do. do. do.
Ernest G. Dunk	do do. do.
D. R. Grey	do. do. do.
J. Masters Hillier	Keeper of Museums.
J. H. Holland	Assistant, Museums.
W. Dallimore	do. do.
L. A. Boodle	Assistant Keeper, Jodrell Laboratory.
W. Watson	Curator.
W. J. Bean	Assistant Curator.
W. N. Winn	Assistant, Curator's Office
W. Irving	Foreman.
C. P. Raffill	do.
Arthur Osborn	do.
W. Taylor	do.
J. Coutts	do.
G. Dear	Storekeeper.
Norah G. Watson	Sub-Assistant, Curator's Office.
W. Linney	Sergeant Constable.
L. Cottingham Burrell	Medical Officer.
G. D. Patterson	Clerk of Works.
J. E. Holman	Assistant do.
L. J. Harding	Museum Preparer.

Royal Botanic Gardens, Kew.
February 28, 1922.

Retirement of Dr. O. Stapf.—On February 28th Dr. O. Stapf, F.R.S., who has been Keeper of the Herbarium and Library since 1908, retired having reached the age limit. He is succeeded as Keeper by Mr. A. D. Cotton, F.L.S., formerly a member of the Herbarium staff and lately Mycologist to the Ministry of Agriculture and Fisheries.

Collection of Bark Beetles.—Dr. J. W. Munro, Entomologist of the Forestry Commission, has placed on loan in the Forestry Museum at Kew an almost complete set of workings of beetles which feed upon the inner bark and outer wood of trees in the British Isles. On the different sections of wood and bark the galleries peculiar to each beetle are well defined, and students are afforded a good opportunity for comparing the workings of allied insects. At the same time, the collection of bark beetles bequeathed to Kew, with other insects, by the late Mr. A. T. Gillanders has been rearranged and added to, so that Kew now possesses a very comprehensive collection of bark beetles and their workings. The collection includes the following species :—

BEETLES.—*Scolytus destructor*, Oliv., and *S. multistriatus*, Marsh, on Elm; *S. intricatus*, Ratz., on Oak, *S. rugulosus*, Ratz., on Plum; *Hylesinus oleiperda*, Fabr., *H. crenatus*, Fabr., and *H. fraxini*, Fabr., on Ash, *H. vittatus*, Fabr., on Elm; *Myelophilus minor*, Hart., and *M. piniperda*, L. on Pine; *Phloeophthorus rhododactylus*, Marsh, on Broom; *Hylastes obscurus*, Marsh, on Broom; *Hylastes ater*, Payk., on Pine, *H.* spp. on roots of Pine; *Cissophagus hederae*, Schm., on Ivy; *Cryphalus abietis*, Ratz., on Fir, *C. tiliae*, Panz., on Lime, *C. fagi*, Fabr., on Beech, *C. binodulus*, Ratz., on Poplar; *Trypodendron lineatum*, Ol., on Spruce and Larch; *Pityogenes bidentatus*, Herbst., on Larch and Pine; *P. chalcographus*, L., on Spruce, *P. quadridens*, Hart., on Pine; *Pityophthorus* sp., on Pine; *Tomicus acuminatus*, Gyll., on Pine and Douglas Fir, *T. stenographus*, Duft., on Pine; and *T. typhographus*, L., on Spruce; *Dryocaetes villosus*, F., on Oak; *Xylocleptes bispinus*, Duft., on Clematis; *Xyleborus dispar*, F., on Holly; *Platypus cylindrus*, F., on Oak.

WEEVILS AND LONGHORNS.—*Tetropium gabrieli*, Weise, on Larch; *Pissodes notatus*, F., and *P. pini*, L., on Pine; *Magdalis armigera*, Foure, on Elm; *Hylobius piceus*, Deg., on Spruce; *H. abietis*, Fabr., on Pine; *Rhagium bifasciatum*, F., on Pine.

W. D.

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Plate I.

To face page 97.]

ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 3] [1922

XIV.—A REVISION OF AMOREUXIA.

T. A. SPRAGUE.

The small family *Cochlospermeae* was proposed in 1847 by Planchon* for the reception of two genera *Cochlospermum* and *Amoreuxia*, which had previously been referred to the *Malvaceae*, *Ternstroemiaceae*, *Cistaceae* and other families. Bentham included these genera in *Bixineae*, tribe *Bixeae*,† and Warburg, who treated the *Bixeae* as an independent family, *Bixaceae*, proposed the new tribe *Maximilianeae*, for their accommodation.‡ They were removed from the *Bixaceae* (sensu stricto) in 1897 by Engler, who restored the group to family rank as *Cochlospermaceae*, mainly on account of the presence of oil instead of starch in the food reserves of the seed.§ Van Tieghem also regarded the group as an independent family.||

Cochlospermum includes at least 15 species, natives of tropical and subtropical America, Africa, Asia and Australia, the head-quarters of the genus being in tropical America. *Amoreuxia*, on the other hand, is confined to tropical and subtropical America. *Cochlospermum* has a unilocular ovary, and uniform stamens, whereas *Amoreuxia* has a trilocular ovary, and two sets of stamens on opposite sides of the flower, one with long and the other with short filaments. This makes the flower noticeably zygomorphic.

The genus *Amoreuxia* was dedicated by Mociño and Sessé to a Montpellier botanist, P. J. Amoreux, and was published by A. P. De Candolle in 1825.¶ It was based on one of an extensive series of coloured drawings intended to illustrate Mociño and Sessé's unpublished Flora of Mexico, and is known only from De Candolle's description, and a coloured copy of

* Hook. Lond. Journ. Bot. vi. p. 139 (1847); Ann. Sc. Nat. sér. 4, xvii. p. 90 (1862).

† Benth. et Hook. f. Gen. Pl. i. p. 122 (1862).

‡ Engl. et Prantl, Pflanzenfam. iii. 6, p. 310 (1895).

§ Engl. et Prantl, Pflanzenfam. Nachtr. p. 251 (1897).

|| Journ. de Bot. 1900, xiv. pp. 32–54.

¶ DC. Prodr. ii. p. 638 (1825).

x (78)17291 Wt 31—P 20 1000 4/22

the original drawing preserved in the Candollean Herbarium, and reproduced in the form of a tracing by Alphonse De Candolle in 1874.*

It is not known where the type species, *Amoreuxia palmatifida* was collected: "Sessé and Mociño spent eight years, from 1795 to 1804, in the botanical exploration of Mexico and the adjoining countries, from Punta Arenas in Costa Rica to the mouth of the river Hiaqui or Yaqui in north-western Mexico."†

In 1830 Schlechtendal and Chamisso based a new genus and species, *Euryanthe Schiedeana*, on specimens collected by Schiede and Deppe between Manantial and Paso de Ovejas during a journey from Vera Cruz to Jalapa.‡ *Euryanthe* was reduced to *Amoreuxia* by Planchon in 1847.§ Planchon was at first inclined to reduce *E. Schiedeana* to *A. palmatifida*,‖ but eventually decided to treat them as separate species. Under the new combination *Amoreuxia Schiedeana* he quoted (1) Schiede's specimens, which he had not seen, and the synonym *Euryanthe Schiedeana*; (2) Coulter's No. 789 from Sonora Alta, Mexico; (3) specimens collected by Purdie at Ibagué in Colombia. The plate illustrating his paper was drawn from the Colombian material.

Five years later Asa Gray¶ referred to *A. Schiedeana* specimens collected by Charles Wright (No. 79) on prairies near the San Pedro River, Western Texas. In the following year, Gray based a new species, *A. Wrightii*, on Wright's Texas material, and applied the name *A. Schiedeana* to specimens collected in Sonora, Mexico, by Wright (No. 916) and Coulter.** The diagnostic characters of the two species were as follows:—

A. Schiedeana. Leaves 7–9-partite, with spathulate segments. Capsule 1 inch long. Seeds reniform.—Sonora, Vera Cruz, Colombia.

A. Wrightii. Leaves 5- or sub-7-partite, with obovate segments, cuneate into the base. Capsule $1\frac{1}{2}$–2 inches long. Seeds obovoid.—Western Texas, Nuevo Leon (Monterey).

Gray accepted the geographical distribution ascribed to *A. Schiedeana* by Planchon, and cited *A. palmatifida*, D.C. as being possibly synonymous; he subsequently adopted the name *A. palmatifida* for the species, and treated *A. Schiedeana* as a synonym.††

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* Calques Dess. Fl. Mex. Moc. Sessé, t. 1171 (1874).

† Hemsl. Biol. Centr.-Amer., Bot. iv. p. 120 (1887).

‡ Linnaea, v. p. 224 (1830). Both here and in Schiede's account of his journey (l.c. iv. p. 211, l. 3; 1829), the locality is misprinted "Marantial." A good map of the route between Vera Cruz and Xalapa was given by Humboldt, Atlas Geogr. Mex. t. 9.

§ Hook. Lond. Journ. Bot. vi. p. 139 (1847).

‖ l.c. t. 1.

¶ Pl. Wright. i. p. 29 (1852).

** Pl. Wright. ii. p. 26 (1853).

†† A. Gray, Syn. Fl. N. Am. ed. Robinson i. part 1, p. 207 (1895).

The subsequent discovery of *A. Wrightii* at Tantoyuca by Ervendberg extended the known distribution of that species southwards to the Mexican province of Vera Cruz.*

Hemsley considered that *A. Schiedeana*, Planch. was certainly the same as the original *A. palmatifida*.† He enumerated *A. Wrightii* in addition to *A. palmatifida*, but cited under the latter species Eaton and Edwards' specimens from Monterey, Nuevo Leon, and Parry's No. 37, collected on the way from San Luis Potosi to San Antonio, Texas. These should be referred to *A. Wrightii*, as Sereno Watson shortly afterwards pointed out.‡

Three species of *Amoreuxia* were generally recognized in 1895.§ Van Tieghem added a fourth in 1900, which differed from those previously described in its trilobed leaves and anthers opening by a single terminal pore instead of by two.|| The accepted synonymy and distribution of the four species was as follows :—

1. **A. palmatifida,** *Moc. et Sessé*.—*A. Schiedeana*, Planch. *Euryanthe Schiedeana*, Cham. et Schlecht.
DISTRIB. Arizona, Sonora, Vera Cruz, Colombia.

2. **A. Wrightii,** *A. Gray*.
DISTRIB. S. W. Texas to Arizona, Nuevo Leon, Tamaulipas, Vera Cruz.

3. **A. malvaefolia,** *A. Gray*.
DISTRIB. Chihuahua.

4. **A. unipora,** *Van Tiegh*.
DISTRIB. Bolivia.

The anomalous geographical distribution ascribed to *A. palmatifida* attracted the writer's attention. It seemed improbable that a species found once only in Central Colombia, about 4° 27′ N., should be identical with one whose nearest known locality was in Vera Cruz 15° further north. A critical examination of the material of *Amoreuxia* in the Kew Herbarium and in the British Museum (Nat. Hist.) resulted in the recognition of five distinct species, apart from *A. unipora*, which is unrepresented, and *A. Schiedeana*, which is imperfectly known.

The seeds are so characteristic that each species may be distinguished by them alone (*see* Plate I.). Additional diagnostic characters may be drawn from the shape of the leaves; the flowers, on the other hand, seem relatively uniform. The five species are the three described by Asa Gray under the names *A. Schiedeana* (*palmatifida*), *A. Wrightii* and *A. malvaefolia*, and two new ones, *A. Gonzalezii*, from Sinaloa, and *A. colombiana*, collected by Purdie in Colombia.

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* A. Gray in Proc. Amer. Acad. v. p. 176 (1862).
† Biol. Centr.-Amer. Bot. i. p. 56 (1879).
‡ Proc. Amer. Acad. xvii. p. 324 (1882).
§ A. Gray Syn. Fl. N. Am. ed. Robinson, i. part 1, p. 207 (1895).
|| Journ. de Bot. 1900, xiv. p. 48.

The specimens which served as the type of Gray's description of *A. Schiedeana* (*palmatifida*)* were gathered by Charles Wright in northern Sonora. The same species was subsequently recorded from Arizona.† As might have been expected from the geographical distribution, it is not conspecific with *Euryanthe Schiedeana* (Vera Cruz), a co-type of which is preserved in the Botanical Department of the British Museum. Mature seeds of *E. Schiedeana* are unfortunately not known, but the shape of the leaf-segments seems to indicate a relationship with *A. Wrightii*.

The identification of Wright's Sonora specimens with *A. palmatifida*, Moc. et Sessé, appears to be better founded. Mociño and Sessé's drawing is not very characteristic, but the shape of the leaf-segments of the right-hand leaf lends support to Gray's identification. Moreover, A. P. De Candolle cited under *A. palmatifida*‡ a specimen from the Herbarium of Ruiz and Pavon, then in Lambert's Herbarium and now at the British Museum;§ and this specimen matches Thurber's No. 708, and Wright's No. 916, both from Sonora, the latter being the type of Gray's *palmatifida*.

Seven species of *Amoreuxia* may accordingly be recognised: *A. palmatifida*, Moc. et Sessé, *A. Schiedeana* (Cham. et Schlecht.), *A. Wrightii*, A. Gray, *A. malvaefolia*, A. Gray, *A. unipora*, Van Tiegh., and two new ones, *A. colombiana*, from Ibagué, Colombia, and *A. Gonzalezii*, from northern Sinaloa. Additional species may possibly be represented by specimens collected by Palmer (No. 176) at Guaymas, Sonora, and by Rose (No. 1624) between Rosario and Colomas, Sinaloa. These were distributed as *Amoreuxia palmatifida*, but differ from that species in the shape of the leaf-segments. It seems undesirable to describe them as new species, however, until the capsules and seeds are known.

Amoreuxia, *Moc. et Sessé ex DC.* in DC. Prodr. ii. p. 638 (1825); Endl. Gen. p. 1250 (1840); Planch. in Hook. Lond. Journ. Bot. vi. p. 140, t. 1. (1847); Benth. in Journ. Linn. Soc., Bot. v. Suppl. 2, p. 79 (1861); Triana et Planch. in Ann. Sc. Nat. sér. 4. xvii. p. 92 (1862); Benth. et Hook. f. Gen. Pl. i. p. 124 (1862); Baillon in Adansonia, x. p. 259 (1872); Dict. Bot. i. p. 152 (1876); Warb. in Engl. et Prantl, Pflanzenfam. iii. 6, p. 313 (1895); A. Gray, Syn. Fl. N. Am. ed. Robinson, i. part 1, p. 206 (1895); Van Tiegh. in Journ. de Bot. 1900, xiv. p. 46.

Euryanthe, Cham. et Schlecht. in Linnaea, v. p. 224 (1830).

Cochlospermum, Baillon, Hist. Pl. iv. pp. 289, 321 (1873), pro parte.

Low undershrubs. *Stems* erect, simple or slightly branched, 1·5–4 dm. high, arising from a stout, tuberous or woody root-

* Pl. Wright. ii. p. 26 (1853).
† A. Gray, Syn. Fl. N. Am. ed. Robinson, i. part 1, p. 207 (1895).
‡ DC. Prodr. ii. p. 638 (1825).
§ Hist. Coll. Nat. Hist. Dep. Brit. Mus. i. pp. 161, 178 (1904).

stock. *Leaves* alternate, stipulate, long-petioled, suborbicular in outline, cordate at the base, palmatipartite or palmatifid; segments or lobes serrate (leaves rarely trilobed with crenulate lobes); mesophyll marked, especially on the lower surface, with irregular brownish dots and dashes due to the presence of resin-cells; stipules subulate, conspicuous. *Flowers* large, arranged in a terminal raceme, sometimes in both terminal and axillary racemes. *Sepals* 5, oblong-lanceolate, tardily deciduous. *Petals* 5, obovate, yellow, orange or reddish, contorted in the bud. *Stamens* numerous, in two sets on opposite sides of the flower, one with long and the other with shorter filaments; filaments filiform; anthers linear, basifixed, dithecous, opening by two short terminal slits or pores (rarely by a single terminal pore). *Ovary* subglobose, finely and densely pubescent, trilocular, placentation axile; style undivided, stigma punctiform; ovules numerous, biseriate, campylotropous or amphitropous. *Capsule* large, pendulous, oblong-avoid or ellipsoid, loculicidal; pericarp splitting into a thinly coriaceous epicarp and a membranous endocarp. *Seeds* large, globose, obovoid or reniform, albuminous; testa divided into a thin outer layer (arillode) which forms a loose or closely adherent outer envelope at maturity, and a thick, dark, smooth, lustrous and crustaceous inner layer, perforated by a well-marked chalazal orifice. *Embryo* large, more or less curved; cotyledons large and thin; albumen fleshy, oleaginous.—Species 6–7, natives of the south-western United States (Arizona and S.W. Texas), Mexico (Sonora, Sinaloa, Chihuahua, Coahuila, Nuevo Leon, Tamaulipas, Vera Cruz), Colombia (Tolima) and Bolivia (Santa Cruz).

Type species: *A. palmatifida*, Moc. et Sessé.

KEY TO THE SPECIES.

Leaves 3-lobed, lobes crenulate; anther opening by a single terminal pore - - - - - 7. *unipora*.

Leaves 5–9-lobed, lobes serrate; anther opening by two short terminal slits or pores:

- Seeds not reniform; arillode loosely fitting; rhaphe linear:
  - Seeds globose; arillode pilose - - 1. *Gonzalezii*.
  - Seeds oblong-obovoid, flattened on one side in profile; arillode glabrous - - - 2. *Wrightii*.
- Seeds reniform; arillode closely appressed; rhaphe very broad:
  - Leaves very shortly lobed, lobes subtruncate; seed broadly reniform with a wide shallow sinus; arillode shortly setulose - - - 3. *malvaefolia*.
  - Leaves very deeply lobed:
    - Seeds with a wide shallow sinus; arillode shortly and rather densely pilose - - 4. *colombiana*.
    - Seeds with a narrow deep sinus; arillode sparingly setulose - - - - 5. *palmatifida*.

Imperfectly known species - - - 6. *Schiedeana*.

Some of the most important specific characters being derived from the seed, it is difficult to determine several of the species in a flowering condition. The following key based on leaf-characters may be of assistance in such cases. At the same time it should be pointed out that the lobing and serration of the leaves appears to be less constant than the shape and indumentum of the seeds.

Additional Key.

Leaves very shortly lobed - - - 3. *malvaefolia*.
Leaves deeply lobed :
  Leaves trilobed, lobes crenulate; anther opening by a single pore - - - - - - 7. *unipora*.
  Leaves typically 5-lobed, lobes obovate, serrate; anther opening by two pores - - - 2. *Wrightii*.
  Leaves typically 7–9-lobed, lobes serrate; anther opening by two pores :
    Lobes more or less oblanceolate, gradually narrowed downwards from above the middle :
      Lobes subtruncate or rounded - 5. *palmatifida*.
      Lobes pointed - - - 1. *Gonzalezii*.
    Lobes obovate or subspathulate :
      Lobes subspathulate, serrate in the upper half, entire in the lower (Mexican species) - 6. *Schiedeana*.
      Lobes oblong-obovate, serrate in the upper three-quarters, entire towards the base (Colombian species) - - - - 4. *colombiana*.

1. **A. Gonzalezii,** *Sprague et Riley*, sp. nov.

Caules 3–3·5 dm. alti, pilis crispulis breviter pubescentes. *Folia* usque ad 4–6 mm. supra basin profunde 5–7-partita, segmento medio maximo, ceteris gradatim minoribus, extimis minimis subintegris; segmenta oblanceolata, acuta vel obtusa, puperne grosse irregulariter serrata, a medio vel altius usque ad basin cuneato-angustata, integra; mesophyllum punctis lineolisque brunneis plus minusve pellucidis in facie inferiore magis obviis notatum; petioli, ut nervi subtus, crispule pilosi, folia ceterum glabra. *Flores* desunt. *Capsula* oblongo-ellipsoidea, 4·5–5·5 cm. longa; valvae 1–1·5 cm. latae, grosse pubescentes. *Semina* globosa, sine arillodio vix 4 mm. diametro; arillodium molliter pilosum.

Vernacular Name.—Zaya.

Mexico.—Sinaloa: Choix; Cerro del Muerto, 620 m., *J. Gonzalez Ortega* 897 (type in Herb. Kew.).

Dedicated to Señor J. Gonzalez Ortega, to whom the Kew Herbarium is indebted for a collection of dried plants from various localities in Sinaloa and Tepic. Distinguished by its globose seeds, with a loosely fitting, softly pilose arillode. The shape of the leaf-segments is also characteristic.

2. **A. Wrightii,** *A. Gray,* Pl. Wright. ii. p. 26 (1853); A. Gray in Proc. Amer. Acad. v. p. 176 (1862); Hemsl. Biol. Centr.-Amer., Bot. i. p. 56 (1879); S. Wats. in Proc. Amer. Acad. xvii. p. 324 (1882); Coult. in Contrib. U.S. Nat. Herb. ii. p. 26 (1891); Britton et Kearney in Trans. N.Y. Acad. Sc. xiv. p. 36 (1894) (Contrib. Herb. Columb. Coll. No. 71); A. Gray, Syn. Fl. N. Am. i. part 1, p. 207 (1895); Havard in Bull. Torr. Bot. Cl. xxii. p. 111 (1895). *A. Scheideana,* [sic] A. Gray. Pl. Wright. i. p. 29, t. 3B (1852), excl. syn., non *A. Schiedeana,* A. Gray l.c. ii. p. 26 (1853). *A. palmatifida,* Hemsl. Biol. Centr.-Amer. Bot. i. p. 55 (1879), partim.

S.E. Arizona. Fort Huachuca, *Wilcox* (fide Britton et Kearney, l.c.).

S.W. Texas. Prairies near the San Pedro River, fr. July, *Wright* 79 (co-types in Herb. Kew. et Mus. Brit.); Laredo, Rio Grande River, *Palmer* 58 (Herb. Kew.)

Coahuila. El Toro, near Movano, fl. July, *C. A. Purpus,* 4465 (Mus. Brit.).

Nuevo Leon. Monterey, *Eaton and Edwards* 76 (Herb. Kew.); Monterey, on rocky hills, fl. June, *Pringle* 1881 (Herb. Kew. et Mus. Brit.)

Tamaulipas. Between San Fernando and Crucillas, fl. April, *Berlandier* 3118 (Herb. Kew.)

Vera Cruz. Tantoyuca, *Errendberg* 124 (fide A. Gray in Proc. Amer. Acad. v. p. 176; 1862).

Also collected, without precise locality, en route from San Luis Potosi to San Antonio, Texas, *Parry* 37 (Herb. Kew. et Mus. Brit.). I have seen no specimens of *A. Wrightii* from Arizona or Sonora. S. Watson stated that the specimens collected in Sonora by Thurber belonged to this species. Thurber's No. 708 from Santa Cruz Valley, Sonora (Herb. Kew.), was collected in a flowering state, but I have no hesitation in referring it, in the absence of seeds, to *A. palmatifida,* on account of the number and shape of the leaf segments. In Gray's Synoptical Flora, Thurber's specimen is cited under *A. Wrightii,* but with a mark of interrogation.

As *A. Wrightii* apparently occurs neither in New Mexico* nor in Sonora, the Arizona locality recorded by Britton and Kearney seems to be isolated from the main area occupied by the species. Confirmation of the record is desirable. According to Havard (l.c.) the roots of *A. Wrightii* are greedily devoured by peccaries and other animals.

3. **A. malvaefolia,** *A. Gray,* Pl. Wright. i. p. 29 (1852), in adnot.

Chihuahua. Without precise locality, *Scheer's collector* (type in Herb. Kew.); volcanic hills and mesas near Chihuahua, fl.

* No species of *Amoreuxia* is recorded for New Mexico by Wooton and Standley (Contrib. U.S. Nat. Herb. xix.; 1915).

Sept., *Pringle* 1569 (Mus. Brit.); rocky mesas near Chihuahua, fr. Aug., *Pringle* 1189 (Herb. Kew.).

4. **A. colombiana,** *Sprague,* sp. nov.

Caules 2·2–3·2 dm. alti, pilis crispulis breviter pubescentes. *Folia* usque ad 5–13 mm. supra basin profunde 7-partita, segmento medio maximo, ceteris gradatim minoribus, extimis interdum lobulo integro extra supra basin instructis; segmenta obovata vel subspathulata, apice rotundata, parte basali brevi marginibus parallelis integris usque ad 1 cm. lata, ceterum grosse subdupliciter serrata; petioli, ut nervi subtus, crispule pilosi, folia ceterum glabra; mesophyllum punctis lineolisque brunneis irregularibus in facie inferiore inconspicue notatum. *Inflorescentia* et sepala extra dense pubescentia. *Capsula* ovoidea, acuta, 4·5 cm. longa, in statu applanato 3 cm. lata; valvae circiter 1·5 cm. latae, minute pubescentes. *Semina* late reniformia, 5–5·5 mm. longa, medio 2·5 mm. lato, sinu lato aperto; arillodium breviter dense pilosum.——*A. Schiedeana,* Planch in Hook. Lond. Journ. Bot. vi. p. 140, excl. syn. et stirp. mexican.; Triana et Planch. Prodr. p. 92 (1862). *A. palmatifida,* Planch. l.c. t. 1, non Moc. et Sessé.

Colombia. Tolima: plains of Ibagué, fl. and fr. May, *Purdie* (type in Herb. Kew.).

5. **A. palmatifida,** *Moc. et Sessé ex DC.* in DC. Prodr. ii. p. 638 (1825); Planch. in Hook. Lond. Journ. Bot. vi. p. 141 (1847); Alph. DC. Calques Dess. Fl. Mex. Moc. Sessé, t. 1171 (1874); Hemsl. Biol. Centr.-Amer., Bot. i. p. 55 (1879), excl. syn. et specim. nonnull.; A. Gray, Syn. Fl. N. Am. ed Robinson, i. part 1, p. 207 (1895), excl. syn.; Havard in Bull. Torr. Bot. Cl. xxii. p. 111 (1895).

A. Schiedeana, A. Gray. Pl. Wright. ii. p. 26 (1853), excl. syn. et specim. novogranatens.

Vernacular Name. Sayas (fide *Havard,* l.c.)

Arizona. (Fide *A. Gray,* l.c.; 1895).

Sonora. Northern Sonora: hills along mountain streams near Rancho Desierto, fr. Sept., *Wright* 916 (Herb. Kew. et Mus. Brit.); Santa Cruz Valley, *Thurber* 708 (Herb. Kew.). Sonora Alta, *Coulter* 789 (Herb. Kew.).

Also represented from Mexico without locality by a specimen in *Herb. Pavon* (Mus. Brit.), which was cited by De Candolle. Palmer's No. 176 (Herb. Kew. et Mus. Brit.) from Guaymas, Sonora, has very coarsely serrate leaf-segments approximating in shape to those of *A. Wrightii.* Rose's No. 1624 from between Rosario and Colomas, Sinaloa, has equally coarse serration, and the mesophyll is conspicuously marked on the lower surface with irregular brown dots and dashes due to the presence of resin. These two numbers were distributed as *A. palmatifida,* but the identification will remain in doubt until seeds are known.

Palmer's No. 176 was identified by S. Watson with *A. palmatifida.** According to Palmer, the plant is known by the vernacular name "Sayas" and the roots, which have the taste of the parsnip and carrot, are eaten by the Yaqui Indians, and made into a preserve by the Mexicans.

According to Havard (l.c.) the roots of *A. palmatifida* when roasted have the taste of the parsnip and carrot, and are eaten by the Papago and Pimo Indians as well as by the Mexicans under the name of "Sayas."

6. **A. Schiedeana,** *Sprague.—Euryanthe Schiedeana*, Cham. et Schlecht. in Linnaea, v. p. 225 (1830).

VERA CRUZ. On the way from the town of Vera Cruz to Jalapa, between Manantial and Paso de Ovejas, fl. Aug., *Schiede* (co-type in Mus. Brit.).

Planchon cannot be quoted as the authority for the combination *A. Schiedeana*, inasmuch as the plant which he described and figured under that name belongs to a different species, *A. colombiana*, and the only other specimen seen by him (*Coulter* 789) is referable to a third species, *A. palmatifida*. Nor can Asa Gray be cited as the authority, since the two species which he identified with *Euryanthe Schiedeana* were *A. Wrightii* and *A. palmatifida*. The name *A. Schiedeana*, Planch. is therefore treated as a "nomen delendum" and the combination *A. Schiedeana* is made *de novo.*†

7. **A. unipora,** *Van Tiegh.* in Journ. de Bot. 1900, xiv. p. 48.

BOLIVIA. Santa Cruz: Santiago de Chiquitos, *Orbigny* 915 (Herb. Paris. ex Van Tiegh. l.c.).

Known to me only from Van Tieghem's brief description. It differs from all the other known species by its anthers, which dehisce by means of a single pore instead of by two. If it is really an *Amoreuxia*, we have an interesting case of parallelism between this genus and *Cochlospermum*: *Cochlospermum* subgen *Eucochlospermum* Planch.‡ has anthers which dehisce by a single pore; whereas in subgen. *Diporandra*, Planch.§ the anthers open by two pores.

EXPLANATION OF PLATE.

(Seeds of *Amoreuxia.*)

Fig. 1.—*A. Gonzalezii.*
Fig. 2.—*A. Wrightii.*
Fig. 3.—*A. malvaefolia.*
Fig. 4.—*A. colombiana.*
Fig. 5.—*A. palmatifida.*

Three views of each seed: A, arillode removed, showing chalazal orifice (above) and hilum; B, showing arillode, hilum (below) and raphe; C, arillode removed, profile view.—All magnified $\times$ 8¾.

* Proc. Amer. Acad. xxiv. p. 40 (1889).
† Vide Sprague in Journ. Bot. 1921, p. 156, No. 7
‡ Hook. Lond. Journ. Bot. vi. p. 306 (1847).
§ l c. 310.

XV.—RIGIOLEPIS AND OTHER VACCINIACEAE OF BORNEO.

H. N. Ridley.

The genus *Rigiolepis* was founded by J. D. Hooker on *R. borneensis* figured and described in Hooker's Icones Plantarum, t. 1160. This is an epiphytic climbing shrub with a tuberous root and stiff, thick coriaceous triplinerved leaves; the very short racemes are usually extra-axillary, hairy, with ovate coriaceous bracts and a pair of similar but smaller bracteoles just beneath the flower.

The flowers are very small and crowded, about 40 in a raceme 3 to 4 cm. long. The calyx-lobes are rigid, acute, light yellowish green, becoming yellow after the fall of the corolla, which is little longer than the sepals, nearly globose, about 2 mm. long and white. There are 10 stamens with the filaments shorter than the anthers, and a pair of horns from the connective on the back. The fruit is unknown.

It appears to be confined to the forests on the slopes of Mount Matang in Sarawak, Borneo, where it has been collected by Lobb, Haviland (no. 1020), Hullett and myself (no. 12292).

Several botanists have reduced the genus to *Vaccinium*, but in its epiphytic habit, extra-axillary racemes, and very small flowers, it is so different from typical species of *Vaccinium* that I should be unwilling to include it in that genus; if referred to *Vaccinium*, however, it and the following new species should be placed in a distinct subgenus.

By some curious error Merrill has reduced *Rigiolepis borneensis* to *Vaccinium acuminatissimum*, Miq., with which it has nothing in common.* W. W. Smith described it as *Vaccinium borneense*, without recognising it as the original *Rigiolepis borneensis*.†

Rigiolepis lancifolia, *Ridley*, sp. nov.; affinis *R. borneensi*, Hook. fil., sed ramis virgatis, foliis anguste lanceolatis acuminatis basi rotundatis; racemis axillaribus; sepalis majoribus, corolla paullo longiore, stigmate pulvinato.

Frutex epiphyticus (?), ramis gracilibus, apicibus pubescentibus. *Folia* remota, anguste lanceolata, obtusa, basi rotundata, 3–6 cm. longa, 7–10 mm. lata, coriacea; costa supra depressa, subtus hirta; nervi intramarginales tenuissimi, a basi costae orti; nervuli laterales plurimi, curvi; petiolus crassus, hirtus, 2 mm. longus. *Inflorescentiae* axillares, racemosae, perulatae, perulis lanceolatis acuminatis hirtis; racemi densi, hirti, 5–10 mm. longi. *Bracteae* ovato-lanceolatae, coriaceae, hirtae, costatae, 3 mm. longae. *Pedicelli* breves, crassi. *Calyx* turbinatus, hirtus, lobis 5 lanceolatis acutis coriaceis. *Corolla*

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* Journ. Roy. As. Soc., Straits Branch, Special Number, 1921, p. 465.
† Notes Bot. Gard. Edin. viii. 329 (" 1915 ").

vix longior, ovoidea, extus hirta. *Stamina* 10, filamentis brevissimis crassis; antherae filamentis longiores, superne angustatae, tubis terminalibus brevibus, cornubus duobus in dorse e connectivo ortis quam antherae multo brevioribus. *Stylus* crassus, corollae aequilongus, stigmate pulvinari.

Borneo. Sarawak; near Quop, *Haviland* 619 (Herb. Kew.); Mount Start, on limestone, 540 m., *Haviland* 1462 (Herb. Kew.).

Rigiolepis Lobbii, *Ridley*, sp. nov.; frutex epiphyticus, glaber, pedalis (*Lobb*) foliis elliptico-lanceolatis acuminatis, interdum praeter nervos intramarginales conspicuos nervis submarginalibus praeditis, racemis extra-axillaribus 5-floris.

Frutex epiphyticus, pedalis (teste *Lobb*), ramis gracilibus glabris. *Folia* elliptico-lanceolata, acuminata, obtusa, in basin breviter angustata, 3.5 cm. longa, 1.2 cm. lata, coriacea, glabra; costa supra elevata sed in sulco depressa; nervi intramarginales conspicui, a basi costae orti, nervis submarginalibus tenuissimis obscuris interdum additis; nervuli transversi plurimi, ramulosi; petiolus 1 mm. longus. *Racemi* extra-axillares, 5 mm. longi, 5-flori. *Bracteae* ovato-lanceolatae, costatae, hirtae; bracteolae ad basin floris 2. *Calyx* hirtus lobis 5 lanceolatis. *Corolla* a me non visa, (teste *Lobb*) alba. *Bacca* ovoidea, hirta, 7 mm. longa, calycis lobis erectis coronata.

Borneo. Sarawak; 900 m., *Lobb* (Herb. Kew.).

The single specimen is incomplete; it differs from *R. lancifolia* in the shorter, broader leaves, often showing an indistinct submarginal nerve in addition to the conspicuous intramarginal one.

Vaccinium sulcatum, *Ridley*, sp. nov.; arbuscula ramis validulis, foliis rigide coriaceis, nervis superne depressis subtus prominentibus; racemis in axillis fasciculatim congestis elongatis, floribus dissitis, bracteis parvis; corolla mediocri urceolata; baccis hirtis 10-locularibus; *V. acuminatissimo*, Miq., affinis, sed foliis majoribus.

Arbuscula, ramis juvenibus hirtis. *Folia* rigide coriacea, elliptico-ovata, breviter cuspidata, basi rotundata vel in basin breviter angustata, auriculis 2 parvulis ad petiolum, 9–17 cm. longa, 4–7 cm. lata, supra nitida, utrinque costa et nervis demum exceptis hirtula vel glabrescentia; lamina valde quintuplinervis, nervis exterioribus a basi, interioribus paullo superius ortis, nervis intramarginalibus gracilioribus sed conspicuis additis, nervulis transversis pluribus undulatis; petiolus crassus, 5 mm. latus, 5 mm. longus. *Inflorescentiae* axillares, perulis lanceolatis acuminatis; racemi 4 intra perulas orti, fasciculatim congesti, graciles, hirti, 4 cm. longi, 12–14-flori. *Flores* remoti, pedicellis gracilibus hirtis 5 mm. longis. *Bracteae* parvae, ovatae, longe acuminato-cuspidatae, hirtae. *Calyx* brevis, lobis 5 ovatis acutis. *Corolla* urceolata, glabra, pallide flava, lobis 5 brevibus ovatis recurvis. *Stamina* 10, filamentis gracilibus longis hirtis; antherae conicae basibus crassis rotundatis, tubis terminalibus brevibus, cornubus 2 in dorso brevibus. *Stylus* elongatus, corollae aequilongus, haud incrassatus ad apicem. *Bacca* subglobosa, 4 mm. longa, hirta, 10-locularis, sepalis coronata. *Semina* linearia, complanata, curva.

BORNEO. Sarawak; without precise locality, *Beccari* 3780; Niah, on limestone, *Haviland* and *Hose* 3466; near Kuching, *Haviland* 1625.

The foliage of this plant resembles closely that of *Rigiolepis borneensis,* Hook. fil., being thickly coriaceous, with nerves and reticulations sunk above and raised beneath, but the racemes are elongate, the bracts small and the corolla large, as in some species of *Vaccinium* notably *V. acuminatissimum,* Miq.

Vaccinium monanthum, *Ridley,* sp. nov.; *V. unifloro,* J. J. Sm., affinis, sed virgatum, floribus glabris.

Frutex ramis gracilibus virgatis, partibus juvenibus minute hirtis. *Folia* lanceolata, longe acuminata, basi rotundata vel in basin breviter angustata, 4–5.5 cm. longa, 1–1.5 cm. lata, coriacea; nervi intramarginales tenues sed conspicui, fere a basi costae orti, nervis submarginalibus basalibus brevibus inconspicuis additis; nervuli transversi ad 10, tenues, ramulosi et cum rete venularum in utraque pagina elevati (in sicco); petiolus 1 mm. longus. *Flores* singuli vel bini, axillares, glabri, minimi, e perulis orti; perulae minutae, lanceolatae, subulatae; pedicelli graciles, 3 mm. longi. *Bracteae* et bracteolae nullae. *Calyx* minimus, lobis 5 triangularibus ovatis tubo brevissimo longioribus. *Corolla* globosa, 2 mm. longa, dentibus 5 brevibus. *Stamina* 10, filamentis brevissimis; antherae quam filamenta multo longiores, lanceolatae, superne angustatae, cornubus 2 e dorso. *Stylus* longior, cylindricus.

BORNEO. Sarawak: Niah; on limestone, *Haviland* and *Hose* 3465.

This species is allied to *V. uniflorum,* J. J. Smith in Ic. Bogor. t. 320. It differs in the shape of the foliage, and the completely glabrous flowers. *V. uniflorum* is a slender epiphyte but *V. monanthum* is a longer branched, twiggy plant, apparently not epiphytic.

These two species with their peculiar reduction of inflorescence to a single very small flower emitted from an axillary tuft of narrow perulae are so utterly unlike any other species of the genus *Vaccinium,* that it may eventually be necessary to propose a new genus for their reception.

XVI.—GARDEN NOTES ON NEW OR RARE TREES AND SHRUBS: XX.

W. J. Bean.

Aucuba chinensis, *Bentham.* [Cornaceae.]

For many years the only Aucubas in cultivation were the common *A. japonica* and its numerous forms, but during his earlier journeys in China on behalf of Messrs. Veitch, Mr. E. H. Wilson introduced this species to the Coombe Wood Nursery, whence it was obtained for Kew. Bentham first described it as long ago as 1861 in his "Flora Hongkongensis," p. 138. It is an evergreen shrub found up to 9 feet high in a wild state, with glabrous young shoots and leaves. The leaves appear to be very variable in shape; on the Kew plants they are oblong, acute, rounded to cuneate at the base, coarsely and irregularly dentate, of a greyer green and duller in hue than any of the forms of *A. japonica,* also thicker and stiffer in texture. Mr. Rehder in "Plantae Wilsonianae," Vol. ii. p. 572, describes two forms:—var. *obcordata* with obovate leaves tapering from a truncate apex to the cuneate base; and var. *angustifolia* with narrow, linear-lanceolate leaves up to 8 in. long and ½ to 1½ in. wide. The flowers of *A. chinensis* differ from those of *A. japonica* in the petals being longer and slenderly acuminate. The fruit is red, ovoid, about ½ in. long, produced in short globose panicles.

This shrub is a native of Western China, in the provinces of Hupeh, Yunnan and Szechuen, also of Hong Kong and Formosa. The Western Chinese forms have smaller leaves, fruits and panicles and are probably the hardier. But Wilson's plant is not hardy at Kew and it was much injured by the frosts of December, 1920. It will no doubt be hardy in the south-western counties and of value there for planting in deep shade. There is no large-leaved evergreen shrub so useful as *A. japonica* for providing an undergrowth up to 6 feet high beneath trees casting a dense shade.

Berberis Vernae, *Schneider*; syn. *B. Caroli* var. *hoanghensis,* Schneider. [Berberidaceae.]

This species was originally described by Schneider from specimens collected by the late W. Purdom in Western Kansu, China, but it was introduced to cultivation by E. H. Wilson, who found it in the Upper Min Valley, Western Szechuen, in 1910. It is his No. 4022, the seeds of which were distributed under the synonym given above. Mr. Schneider subsequently came to the conclusion that *B. Caroli* var. *hoanghensis* and *B. Vernae* were the same.

It is a deciduous shrub 6 to 10 ft. high, with glabrous, grooved young shoots, armed at the lower part with stiff three-pronged spines, ½ to 1⅛ in. long, reduced at the terminal flowering part of the shoot to a single, much smaller, needle-like spine. Leaves in fascicles of as many as eight, spathulate or oblanceolate, often quite entire, but occasionally with a few small slender teeth;

very variable in size in each fascicle, the smallest $\frac{1}{3}$ in. long, $\frac{1}{8}$ in. wide, the largest up to $1\frac{3}{4}$ in. long and $\frac{5}{8}$ in. wide; they are quite glabrous. Flowers bright yellow, small, $\frac{1}{6}$ in. wide, produced in April and May densely packed in pendulous racemes 1 to $1\frac{3}{4}$ in. long, $\frac{1}{3}$ in. wide. Fruit globose, $\frac{1}{5}$ in. wide, salmon red.

B. Vernae is a vigorous grower and evidently perfectly hardy. The small pendent racemes thickly packed with flowers are very distinct and give a graceful effect. At one place in China Wilson found this shrub used for forming hedges. The specific name was given in compliment to Miss Verna Berger, daughter of Mr. A. Berger, once of the La Mortola Garden, Ventimiglia.

Buddleia alternifolia, *Maximowicz.* [Loganiaceae.]

A deciduous shrub of very vigorous growth up to 10 or 12 feet high, making shoots several feet long during the summer and forming a widely branched, loose shrub as much through as it is high; young shoots at first covered with grey scurf, soon becoming glabrous; grey and glossy the second year. Leaves alternate, entire, lanceolate, $1\frac{1}{2}$ to 4 in. long, $\frac{1}{4}$ to $\frac{1}{2}$ in. wide, dark dull green above, glaucous beneath. Flowers produced in June from the previous year's growths, crowded in short-stalked clusters borne at the nodes. The corolla is bright lilac-purple, about $\frac{1}{3}$ in. long, the lower part a slender cylindrical tube dividing at the mouth into four lobes. Calyx tubular, $\frac{1}{8}$ in. long, four-lobed, glaucous and scurfy like the pedicels, which are about as long as the calyx.

Although described by Maximowicz as long ago as 1880, this was introduced as lately as 1916 from Kansu by Farrer and Purdom. Its most distinctive character is, of course, the alternate arrangement of the leaves, all the other cultivated species having opposite ones. It is an attractive shrub and flowers best when grown in the sunniest spots. The flowers are fragrant, but are more so in some other species. It thrives exceptionally well in Mr. Lionel de Rothschild's garden at Inchmery, on the Solent. It is propagated with the greatest ease by means of summer leafy cuttings.

Caryopteris tangutica, *Maximowicz.* [Verbenaceae.]

The genus *Caryopteris* has been known in gardens since 1844, when Fortune introduced *C. Mastacanthus* from China. This new species, *C. tangutica,* was introduced by the late Reginald Farrer about 1915 from Western Kansu. *C. Mastacanthus,* a beautiful and satisfactory shrub farther south and west, has not proved wholly hardy at Kew, although it is only during very hard winters that it is killed. It was found by Fortune near Canton, and as the climate of Western Kansu is probably colder, it is possible *C. tangutica* may turn out to be the hardier species. It was discovered in 1880 by the Russian traveller Przewalsky and is described as a bushy shrub 3 to 5 feet high, the semi-woody young stems as well as the undersurface of the leaves and the flowerstalks being covered with a close, grey indumentum. Leaves opposite, ovate, $\frac{3}{4}$ to $1\frac{1}{2}$ in. long, with usually four coarse, rounded teeth at each side. Flowers crowded in terminal and axillary corymbs, each 1 to $1\frac{1}{2}$ in. wide. Corolla $\frac{1}{2}$ in. long, bright violet-blue, with four short lobes and one long, fringed one. The calyx has a campanulate base and five lanceolate lobes which are tipped with violet.

The species is allied to *C. Mastacanthus* but may be distinguished by the more deeply divided lip of its corolla and the more coarsely toothed leaves. Kew is indebted to Major F. C. Stern of Highdown, Goring-on-Sea, for some plants which flowered very prettily last September.

Evodia velutina, *Rehder and Wilson.* [Rutaceae.]

The Evodias are rather handsome small trees of the Rue family and are allied to *Phellodendron*, differing in having exposed axillary buds whereas in *Phellodendron* they are concealed by the base of the petiole. *E. velutina* is a tree 40 to 50 ft. high, its young shoots clothed with velvety down. The pinnate leaves are up to 10 in. long and composed of seven to eleven leaflets, which are oblong-lanceolate, acuminate, obliquely rounded at the base, dull green and downy above, paler and clothed with a thick velvety pubescence beneath. Flowers yellowish white, small and very numerous, produced in August in a cluster of compound umbels at and near the end of the current season's growths, the entire inflorescence being 6 or 7 in. long and wide; flowerstalks velvety. The individual flower is $\frac{1}{8}$ in. wide, with narrowly oblong petals; calyx, ovary and the short, thick pedicel downy. Fruit $\frac{1}{5}$ in. wide, purplish brown, downy, globose with a small beak. Seeds black and shining.

This species is very distinct from the other species in cultivation because of the velvety down on its younger parts. It was discovered and introduced by Wilson in 1908 (No. 994). He found it in one locality only in Western Szechuen. It first flowered in this country in the garden of Mr. C. J. Lucas at Warnham Court, Sussex, in August, 1918. It is evidently perfectly hardy at Kew.

Holboellia coriacea, *Diels.* [Lardizabalaceae.]

Until the introduction of this species, which was effected by Mr. E. H. Wilson in 1907, the genus was only represented in gardens by *H. latifolia*, an old garden plant from the Himalaya which has never been much of a success in the open air except in the milder parts of the country. At Kew it can only be satisfactorily grown in a cool greenhouse. This new species, however, is evidently much hardier and is growing vigorously on the walls at Kew; it flowered very freely there in April 1921.

It is a vigorous evergreen climber and although Wilson gives its height as three to five metres, it appears capable of growing very much higher. The leaves are trifoliolate, the leaflets oval or oblong-obovate, $2\frac{1}{2}$ to 6 in. long, 1 to 3 in. wide (the middle one somewhat larger and longer-stalked than the two lateral ones), acuminate, rounded at the base, dark lustrous green, leathery and quite glabrous. The main leafstalk is $1\frac{1}{2}$ to $3\frac{1}{2}$ in. long, the stalk of the leaflets $\frac{1}{4}$ to 1 in. long. Flowers unisexual, the males produced in a cluster of corymbs 3 or 4 in. wide at the end of short shoots of the previous year or in their leaf-axils; petals dull purple, oblong, $\frac{1}{2}$ in. long, $\frac{1}{8}$ in. wide; stamens with pale purple filaments scarcely longer than the anthers. Female flowers borne usually three or four together in corymbs springing from the lower leaf-axils of the young shoots, the peduncle being up to 6 in. long, pedicels 1 to 2 in. long. They are rather larger than the male flowers, the fleshy petals greenish white tinged with purple; styles three, erect, cylindrical, $\frac{1}{4}$ in. long.

The female flowers were dusted with pollen, but owing probably to several severe late frosts last spring, no fruit developed. It is described by Wilson as purple, oblong, about $2\frac{1}{4}$ in. long and $\frac{4}{5}$ in. wide, the white pulp it contains being edible, rather sweet, but watery and insipid. Seeds jet black. As in many of the *Lardizabalaceae*, the fruits are the most conspicuous, interesting and ornamental feature of the plant. *H. coriacea* is readily distinguished from *H. latifolia* by the uniformly trifoliolate leaves; in the latter the leaves are often quinquefoliolate.

Leucopogon Fraseri, *A. Cunningham.* [Epacridaceae.]

At Kew and over the average climate of the British Isles, this is the only member of the Epacris family that can be grown in the open air. It is a native of New Zealand and according to Cheeseman is found there at altitudes up to 4,500 ft. A plant was obtained from Messrs. Cunningham and Fraser of Edinburgh, in 1911, which has grown ever since without protection and quite uninjured by cold.

It is a dwarf evergreen shrub only 3 to 6 in. high, forming a dense tuft of more or less erect, very slender, minutely pubescent stems, which when young are almost hidden by the leaves. Leaves sessile, alternate, overlapping each other, $\frac{1}{8}$ to $\frac{3}{16}$ in. long, $\frac{1}{16}$ to $\frac{1}{12}$ in. wide, obovate-oblong, abruptly narrowed to a slender, bristle-like apex, dull green, minutely ciliate. Flowers very fragrant, solitary, produced in the leaf-axils in May and June. The corolla is a slender tube $\frac{3}{8}$ in. long, pinkish white, hairy inside, with five short, triangular lobes. The four brown anthers are attached by very short filaments to the corolla tube. Style slender, pubescent. Fruit an oblong drupe, $\frac{1}{3}$ in. long, orange yellow, juicy, sweet and edible.

Besides its habitats in New Zealand it has others on the summit of Mt. Wellington, Gippsland, Australia, and on the Hampshire Hills, Tasmania. It is by no means a showy plant, but it has botanical interest and makes a neat, low tuft for the Rock Garden. The hay-like scent of the Epacris-like flowers is also pleasing.

Meliosma pendens, *Rehder and Wilson.* [Sabiaceae.]

Of the several new species of *Meliosma* introduced from China, *M. pendens* is the most nearly related to *M. cuneifolia.* It is a deciduous shrub 10 to 16 ft. high, very similar in general aspect to that species. The young shoots are purplish and hairy; the leaves obovate-elliptic, abruptly acuminate at the apex, cuneate at the base, sparingly toothed, 2 to 6 in. long, 1 to $2\frac{1}{2}$ in. wide, dull green above with short scattered hairs and a bristly midrib, paler green beneath and more conspicuously hairy there, especially on the midrib and veins. The veins are in 12 to 20 pairs; petiole $\frac{1}{4}$ to $\frac{1}{2}$ in. long. Panicles terminal, pendulous, 4 to 8 in. long, scarcely as wide, carrying many small, fragrant, white flowers each about $\frac{1}{6}$ in. wide. Sepals five, roundish ovate, minutely ciliate; petals five, concave. Fruit globose, about the size of peppercorns, black when ripe.

Meliosma pendens was discovered during 1907 by Wilson in Western Hupeh, China, where it grows in woodlands at 3,000 to 4,000 ft. altitude. A plant was obtained from the Coombe Wood Nursery for Kew in 1913 and is evidently perfectly hardy. It has flowered a few times in July, but not so freely yet as *M. cuneifolia;* nor does it promise to grow quite so freely. Its chief attraction is the hawthorn-like fragrance of its flowers. From *M. cuneifolia* it is distinguished by its pendent, narrower panicles and by the absence of tufts of hairs in the vein-axils of the leaf—so conspicuous in that species.

Salix Matsudana, *Koidzumi.* [Salicaceae.]

The species and hybrids of willow exist in bewildering numbers, but the great majority of them are shrubs. Of genuine trees there are not many in cultivation, not so many at any rate as to preclude a welcome to this new species. It is a deciduous tree growing 40 ft. high and was introduced from China by the late W. Purdom, and from Korea by J. G. Jack, to the Arnold Arboretum, thence to Kew in 1913. Two trees are growing on the "Seven Sisters Lawn" near the fine *Quercus castanaefolia* and they promise to develop into elegant trees. At first minutely pubescent and yellowish, the slender young shoots become brownish grey and glabrous later. The leaves are linear, acuminate, 2 to 4 in. long, $\frac{1}{2}$ to $\frac{3}{5}$ in. wide, bright green above, glaucous beneath and glabrous. Both the trees at Kew are female, and their cylindrical flowerspikes about 1 in. long. The flower is sessile in the axil of an ovate bract two-thirds as long as the ovary which is $\frac{1}{8}$ in. in length, glabrous, surmounted by a dark stigma. The male aments are described as $\frac{3}{5}$ in. long, each flower having two stamens.

This willow is a native of the provinces of Kansu and Chi-li, but is generally cultivated in North China and probably in Korea. Wilson says it is "planted everywhere between Tientsin and Pekin." Its nearest ally is *Salix babylonica*, but its comparatively erect habit makes it quite distinct.

Tilia intonsa, *Wilson.* Syn. *T. tonsura,* Veitch. [Tiliaceae.]

This interesting and distinct new lime was discovered by Wilson in 1903 in Western Szechuen up to altitudes of 10,000 ft., and was introduced by him the same year to Messrs. Veitch's nursery at Coombe Wood. It was obtained for Kew in 1913 since when it has grown admirably and proved quite hardy. Wilson describes it as a tree up to 65 ft. high with a trunk occasionally 9 feet in girth. The young shoots are thickly clothed with hairs. Leaves ovate or roundish-ovate, deeply cordate at the base, contracted at the apex to a shortly acuminate tip, evenly and minutely serrate; they are from 3 to $4\frac{1}{2}$ in. long, rather less wide, glabrous above except on the main nerves, covered with stellate pubescence beneath; petioles $1\frac{1}{2}$ to $2\frac{3}{4}$ in. long, pubescent. Sepals ovate-lanceolate, $\frac{1}{4}$ in. long; petals oblong-lanceolate, $\frac{1}{3}$ in. long, $\frac{1}{10}$ in. wide. Fruit ovoid, $\frac{3}{8}$ in. long, distinctly five-ribbed.

Tilia intonsa is distinguished from all the other Chinese limes by its very hairy young branchlets. Other distinctive characters are the absence of tufts of pubescence from beneath the leaf in the axils of the chief veins, and the stellate form of the pubescence. The species was originally called "Tilia tonsura" by Messrs. Veitch and offered by them under that name in their catalogue of New Chinese Plants for 1913. It may still be grown as such in some gardens or under Wilson's seed number 1569, but it is not common.

XVII.—THE GENUS HEYWOODIA.

J. Hutchinson.

In his work* on the Forest Flora of Cape Colony, published in 1907, Mr. T. R. Sim described a striking new genus of *Euphorbiaceae* from South East Africa which he named in honour of Mr. A. W. Heywood, Conservator of Forests, Transkei. In describing this plant for the Flora Capensis the present writer had before him only very imperfect material, and in consequence the account given therein was somewhat inadequate. In revising the naming of the South African *Euphorbiaceae* for the National Herbarium, Pretoria, a fine series of specimens of this genus, preserved in the Forestry Herbarium of Cape Colony, has been seen, from which the following more complete and accurate description has been drawn up.

These specimens show a remarkable difference between the leaves of the seedlings and those of the flowering shoots. In the seedlings, one of which is shown in the text figure, most of the leaves are peltately attached about 1 cm. above the base, whilst on the flowering branches they are basally attached and are either cuneate or rarely shortly cordate. This condition is noted by Mr. C. C. Robertson, of the Forestry Department, who states that very few seedlings were seen. He also makes the interesting statement that the same kind of leaf was observed on an adventitious shoot. This fact seems to point to the peltate character being an ancestral type which is retained in the seedling and in adventitious shoots produced by injury or other causes, and that the basally attached leaf is an ecological condition not yet finally established. Peltate leaves are almost

* Sim, For. Fl. of Cape Colony, 326, pl. 140, fig. 1 (1907).

unknown in Tribe *Phyllantheae*, so that their occurrence in this distinct and somewhat isolated genus is remarkable. They are, however, a common feature of several genera of Tribe *Crotoneae*, well known examples being *Mallotus*, *Macaranga*, and *Ricinus*.

Heywoodia, *Sim*, For. Fl. Cape Col. 326, pl. 140, fig. 1; Hutchinson in Dyer, Fl. Cap. v. ii. 384.

Descript. emend.—*Flores* dioici. *Petala* adsunt. *Flores* ♂. *Sepala* 3, imbricata, rotundata, inaequalia, in petala sensim transita. *Petala* 5, quam sepala majora, imbricata, membranacea. *Discus* breviter cupularis, carnosus, margine irregulariter undulatus. *Stamina* intra discum inserta, 8–12, biseriata, exteriora libera, interiora basi circa ovarium rudimentarium trifidum minutum breviter connata; antherae 2-loculares, loculis distinctis parallelis ellipticis. *Flores* ♀ non visi. *Fructus* subsessiles, axillares, plerumque solitarii, depresso-quadrati, 4-loculares, in coccos 2-valves dissilientes demum loculicidale dehiscentes, exocarpio verrucoso tenui, endocarpio osseo stramineo 5–7-striato medio circiter 1 mm. crasso. *Semina* oblique ellipsoidea, crebre longitudinaliter striata. *Embryo* parvus, cotyledonibus transverse elliptico-rotundatis 2 mm. latis. *Endospermum* papyraceo-elasticum.—*Arbor* magna, sempervirens. *Folia* alterna, coriacea, integra, breviter petiolata, nervosa. *Flores* axillares, ♂ dense fasciculati, sessiles, ♀ solitarii vel subsolitarii, brevissime pedicellati.

Heywoodia lucens, *Sim*, l.c.; Hutchinson, l.c.

Arbor usque ad 17 m. alta; rami cortice cinereo obtecti, junioribus gracilibus obtuse angulatis vel subteretibus glabris. *Folia* late elliptica vel ovato-elliptica, plerumque basi cuneata rarius leviter cordata, apice sensim et obtuse acuminata, 6–12 cm. longa, 2·5–8·5 cm. lata, integra, rigide coriacea, utrinque glabra et nitida; nervi laterales intra marginem conjuncti et ramosi, a costa sub angulo 45°–60° abeuntes, venis laxis utrinque distinctis; petioli 0·5–2 cm. longi, supra canaliculati, glabri. *Flores* ♂ dense glomerati, glomerulis fere 1·5 cm. diametro; bracteae parvae, coriaceae. *Sepala* late ovato-orbicularia, subcoriacea, glabra, nitida. *Petala* orbicularia ad oblongo-elliptica, interiora apice rotundata et leviter crenulata, usque ad 2 mm. longa. *Discus* carnosus, circiter 0·5 mm. altus, crenulato-lobulatus, glaber. *Stamina* 8–12; filamenta glabra; antherae 1·5 mm. longae. *Ovarium rudimentarium* minutum, trifidum. *Fructus* circiter 1·5 cm. diametro, quadrangulares, sicco straminei et verrucosi. *Semina* circiter 8 mm. longa, brunnea.

South Africa. Transkei: Dwessa Forest, *Sim* 2594. Cwebe Forest, Elliotdale district, 19 Jan. 1916, seedling specimen, *C. C. Robertson* in S. Afr. For. Herb. 1852. Cwebe and Sasa Forests, in young fruit, S. Afr. For. Herb. 2408. Ntsubane Forest, ♂ fls. Sept. 1916, *G. Fraser* in S. Afr. For. Herb. 2071. Pondoland: Port St. John, in forest on river bank, 20 Dec. 1896, *E. E. Galpin* 3486; in fruit July and Oct. 1916, *P. T. Doran* in S. Afr. For. Herb. 1892; 2113. Pungwane Forest, ♂ fls. June, 1916, S. Afr. For. Herb. 1972.

FIG. 1.

HEYWOODIA LUCENS, Sim. 1, seedling; 2, flowering shoot; a, male flower with perianth removed; b, anther; c, fruit seen from above; d, valve of capsule from within; e, the same from outside.

XVIII.—DECADES KEWENSES

Plantarum Novarum in Herbario Horti Regii Conservatarum.

DECAS CV.

1041. **Indigofera rubro-violacea,** *Dunn* [Leguminosae–Indigoferae] *I. Gerardianae*, Wall., affinis, sed racemis pedunculatis habituque laxo distincta.

Frutex erectus, ramis elongatis gracilibus. *Folia* imparipinnata, 5–6 cm. longa; foliola 6–10-paria, oblongo-ovata, apice basique obtusa, mucronata, 0·8–1 cm. longa, utrinque tenuiter adpresse pubescentia, primo stipellata. *Racemi* foliis multo longiores, pedunculis 1·5–2 cm longis suffulti. *Flores* subsessiles, 0·9–1·1 cm. longi, rubro-violacei; bracteae filiformes, caducae. *Calyx* fere explanatus, 3 mm. longus, ut vexillum tenuiter sericeus; dentes ovato-caudati. *Vexillum* ovatum, 0·8–1 cm. longum, breviter unguiculatum, ungue vix 1 mm. longo. *Legumen* cylindricum vel subquadrangulare, acuminatum, glabrum.

India. Chamba State, *Robert Ellis*, 1880; Parthi, 2500 m. *R. N. Parker;* Kashmir, Mari, Aug. 1880, *A. P. Young* (Herb. Brit. Mus.). Cult. Hort. Kew; Hort. Glasnevin.

This species has long been in cultivation at Kew under the name *I. Gerardiana*. A very similar *Indigofera* of old cultivation in France was described by Ventenat in 1803 as *I. macrostachya* (Jard. Malm. t. 44). Both these species occur in Chamba, from which State excellent dried material has recently been received at Kew from Mr. R. N. Parker. All the Indigoferas of this group vary considerably in the number of leaflets and length of peduncles at different stages of their growth and offer few reliable characters for distinction in the herbarium.

1042. **Tanacetum Kennedyi,** *Dunn* [Compositae–Anthemideae] *T. nano*, C. B. Clarke, affinis, sed inflorescentia subsessili et involucri bracteis lineari-spathulatis differt.

Herba perennis, 2–4 cm. alta. *Radix* valida, longa, verticalis, 2–4 mm. crassa. *Folia* pinnata, parce sericea, segmentis ovatis acutis integris vel pauci-lobatis, basi in vaginam lineari-oblongam angustata, partem basalem caulis vestientia. *Caulis* 0 vel brevis, laxe lanatus. *Capitula* 10–12, in caput 3–4 cm. latum congesta, 7–8 mm diametro, subsessilia. *Involucrum* campanulatum, parce lanatum; bracteae multiseriatae, lineares, 5–6 mm. longae, 1 mm. latae, virides, versus apicem rotundatum dilatatum et latera margine angusto fusco scarioso cinctae. *Corolla* ☿ tubulosa, 5-dentata. *Antherae* inclusae, basi muticae. *Ovarium* glabrum; pappus 0; stylus tandem exsertus; stigmata obtusa.

Tibet. "Near Yerpa Monastery, 4342 m. in August. *Sorong Serpo*." Kennedy's Tibetan Drug n. 13.

This plant was in a collection of 27 Tibetan drugs sent in 1921 to Messrs. Burroughs and Wellcome by Col. R. S. Kennedy, I.M.S., D.S.O., M.C., and submitted by them to Kew in the condition in which they arrived, i.e., small bundles of dry and very brittle plants. It has, however, been possible with care to restore the various species to a recognisable condition and even, as in this case, to make one the type of an undescribed species. As these plants are collected by Tibetans who visit localities near their homes as yet possibly unknown to Europeans and who collect moreover a mass of material with the fragments of fruit, and old and young leaves so valuable to the systematist, this small collection throws some light on the Autumn flora of Tibet.

The Royal Geographical Society informs us that there is a Ye-pa 24 miles north of Lhasa, and it is possibly from a monastery situated there that the plants came.

1043. **Pulicaria insignis,** *J. R. Drummond* MS. ex *Dunn;* [Compositae-Inuleae]; e sectione nova **Pentachaeta,** *Dunn*, pappi interioris setis 5 plumosis distincta; a speciebus caeteris asiaticis pappo differt.

Herba insignis, perennis, erecta vel adscendens, 10–15 cm. alta, omnino dense hirsuta. *Radix* valida, longa, verticalis, 5–8 mm. crassa, ramosa, multiceps; radicis apices molliter lanati. *Caulis* foliosus, 1–3-capitatus, basi lanuginosus, foliis radicalibus vestitus et vetustorum vestigiis cinctus. *Folia* integra; radicalia oblanceolata, acuta, 6–8 cm. longa, 1·5–2. cm. lata, in petiolum longe attenuata; caulina oblongo-ovata, acuta, sessilia, basi obtusa, semi-amplexicaulia. *Capitula* heterogama, radiata, 4–6 cm. lata, floribus in ambitu ♀ plurimis 1-seriatis, disci ☿ fertilibus; pedunculi laterales, breves. *Involucrum* late campanulatum; bracteae multiseriatae, lineares, acuminatae, 1·5–2 cm. longae, intimae scariosae, exteriores breviores. *Receptaculum* planum, foveolatum. *Corollae* radii ligulatae, 2–3 cm. longae, 1 mm. latae, patentes; stylorum rami complanati, obtusi; disci, ☿ tubulosae, 5-dentatae. *Antherae* inclusae, basi caudatae. *Achaenia* 2–2·5 mm. longa, costata, dense sericea. *Pappus* duplex; exterior e paleis 5 laceris 1 mm. longis, interior setis 5, 6 mm. longis plumosis.

TIBET. Gyantse Hills, 8. 7. 07. *H. M. Stewart:* Chaksam, Tsangpo Valley, 4310 m. 26. 9. 04, *Col. L. A. Waddell:* near Yerpa Monastery, N. of Lhasa, Aug. 1921, 4310 m., a Tibetan drug *Ming-chen-serpo*, comm. by *Col. R. S. Kennedy* 26.

As observed by Bentham (Benth. & Hook. f. Gen. Pl. ii. 335), *Pulicaria* hardly differs from *Inula* except in the nature of the pappus, the former has two series of hairs or scales, the latter only one. This species must for that reason be placed in *Pulicaria*, but the 5 plumose setae distinguish it from all other Asiatic species of that genus. As a section in *Pulicaria* it is equivalent in that respect to Jaubert & Spach's ten-plumed section *Decachaeta* (Jaub. & Spach Ill. Pl. Or. iv. 71, t. 344). It seems therefore convenient to make it the type of a new section as above.

1044. **Ligustrum travancoricum,** *Gamble* [Oleaceae–Oleineae] *L. Roxburghii*, C. B. Clarke affinis quoad corollae tubus calyci aequalis sed panicula brevi depressa drupa ellipsoidea et foliis magis coriaceis differt.

Arbor parva, foliis persistentibus, ramulis eximie lenticellatis. *Folia* opposita, coriacea, glabra, lanceolata, apice acuminata saepe curvata, basi attenuata et in petiolum decurrentia, 5–7 cm. longa, 2–2·5 cm. lata, nervi primarii utrinque 5–6, breves, arcuatim juncti; petiolus conspicuus 1–1·5 cm. longus. *Flores* in paniculis brevibus supra complanatis, circiter 6–7 cm. longis, ad 10 cm. latis; pedunculus et rami glabri, pedicelli breves. *Calyx* campanulatus, truncatus, 1 mm. longus. *Corollae* tubus calyci aequalis: lobi patentes tubo paullo longiores. *Stamina* paullo exserta. *Drupa* ellipsoidea, 7·5 mm. longa, glabra.

SOUTHERN INDIA. Travancore: Mutthu Kuli Vayal; 1500 m., *T. F. Bourdillon* 337, Oct. 4, 1894, also near Trevandrum, without number; Tinnevelly District, Mundanthviai to Karyar, *Herb. Madras* 12206, Sept. 17, 1915.

1045. **Toxocarpus Beddomei,** *Gamble* [Asclepiadaceae–Secamoneae] *T. Kleinii*, W. & A., affinis, foliis lanceolatis magis nervosis, calycis lobis brevioribus obtusis differt.

Frutex gracilis scandens, ramulis teretibus lenticellatis puberulis. *Folia* opposita, lanceolata vel elliptico-lanceolata, apice acuminata, basi cuneata, costa excepta glabra, 8–10 cm. longa, 3–4 cm. lata; costa paullo incrassata parce furfuracea praecipue ad basin, nervi primarii prominentes, utrinque 7–8, primarii recti deinde in nervum intra marginalem curvati, secundarii pauci, reticulatio obscura; petiolus 2–2·5 cm. longus, ferrugineo-villosus. *Flores* in cymis dichotomis axillaribus ferrugineo-villosis, 3–4 cm. longis paucifloris, alabastro longe conico 6–7 mm. longo lobis sinistrorsam obtegentibus, bracteolae ovatae minutae. *Calycis* lobi ovati, brevissimi, eglandulosi. *Corollae* tubus brevis, 2 mm. longus, intus villosus, lobi lineares, 5–6 mm. longi. *Corona* e lobis 5 oblongis obtusis, staminum columnae adnatis. *Staminum* columna brevis; antherae appendiculo minute fimbriato ornatae. *Stylus* gracilis, apice incrassatus, stigmate gracili recto. *Fructus* ignotus.

SOUTHERN INDIA. Tinnevelly; Ahraymalai Hills, *Col. R. H. Beddome* in Herb. Madr.

1046. **Toxocarpus palghatensis,** *Gamble* [Asclepiadaceae–Secamoneae] *T. Roxburghii*, W. & A., quoad corona affinis sed foliis et floribus multo majoribus differt.

Frutex gracilis scandens, ramulis teretibus puberulis, altioribus et innovationibus fere nigro-pubescentibus. *Folia* opposita, elliptica vel elliptico-obovata, apice abrupte acuminata, basi obtusa vel aliquando cuneata, supra glabra, subtus ad costam prope basin furfuraceo-villosa, 10–12 cm. longa, 4–5 cm. lata; costa lata, supra impressa; nervi primarii utrinque 6–7 recti, prope marginem solum in nervum intra-marginale inconspicuum juncti. *Flores* in cymis dichotomis axillaribus fere nigro-villosis 2–2·5 cm. longis paucifloris, alabastro conico 5–7 mm. longo, lobis sinistrorsum obtegentibus; bracteae et bracteolae ovatae, minutae. *Calycis* lobi oblongi, 1–2 mm. longi, minute glandulosi (?). *Corollae* tubus brevis, vix 2 mm. longus; lobi oblongi, conspicui, fere ad 1 cm. longi. *Corona* e lobis 5 brevibus acutis staminum columnae adnatis. *Staminum* columna brevis; antherae appendiculis minutis incurvatis ornatae. *Stylus* brevis in annulum incrassatus, stigmate brevi fere capitato. *Fructus* ignotus.

SOUTHERN INDIA. Malabar: Palghat Hills; about 1000 m., *Col. R. H. Beddome* in Herb. Madr.

1047. **Brachystelma Bourneae,** *Gamble* [Asclepiadaceae–Ceropegieae] *B. maculato*, Hook. f., affinis sed major, corollae lobis fere 1 cm. longis, pilis purpureis patentibus vel retrorsis conspicue tectis; coronae processubus subulatis 1 mm. longis.

Herba erecta, tuberosa, tubere fusiformi, a 1 m. alta, caudice 3–4 mm. diametro. *Folia* linearia, 7–10 cm. longa, 2 mm. lata, opposita. *Flores* in cymis axillaribus sessilibus vel breviter pedunculatis 3-floris, pedicellis filiformibus 5–15 mm. longis, bracteolis minutis; alabastra conica, acuta, fere 1 cm. longa. *Calyx* 5-partitus; lobi 5 lineares, glabri, 2 mm. longi. *Corollae* tubus brevis, rotatus, albus, viridi-maculatus; lobi triangulari-lanceolati, apice torti, circiter 1 cm. longi, pilis purpureis patentibus vel retrorsis tecti; corona annularis, lobis subulatis 5, 1 mm. longis supra stamina inflexis. *Stamina* brevissima, obtusa; pollinia globosa, apicem versus pellucida, caudiculis brevissimis. *Styli* apex pentagonus. *Folliculus* ignotus.

SOUTHERN INDIA. Madura District: Pulney Hills; on Kodaikanal Ghat and in Perumal and Vilpatti Valley, east slope, May 1898 and June 1899, *Sir A. G. and Lady Bourne*, 1020, 2751, 2752.

1048. **Brachystelma Rangacharii,** *Gamble* [Asclepiadaceae–Ceropegieae] species insignis, ab aliis speciebus indicis corollae lobis longis linearibus gradatim attenuatis intus lanitie albida tectis facile distinguenda.

Herba erecta, tuberosa, ad 80 cm. alta, glabra, caudice 2–3 mm. diametro. *Folia* linearia, 6–8 cm. longa, vix 2 mm. lata, verticillata (3 in verticillis). *Flores* in cymis umbelliformibus axillaribus sessilibus circiter 5, pedicellis filiformibus, 1 cm. longis, bracteolis multis minutis. *Calyx* 5-partitus; lobi 5 lanceolati, acuminati, glabri. *Corollae* tubus brevissime campanulatus; lobi lineares, erecti, 1–1·5 cm. longi, intus lanitie albida eximie tecti; corona annularis undulata, lobis subulatis 5 circiter 2 mm. longis glabris. *Stamina* brevissima, obtusa; pollinia globosa apicem versus pellucida, caudiculis brevissimis. *Styli* apex pentagonus, fere planus. *Folliculus* ignotus.

Southern India. Coimbatore District; Hassanur, Aug. 26. 1914, *K. Rangachari* in Herb. Madr. 10654.

1049. **Stereospermum angustifolium,** *Haines* [Bignoniaceae–Tecomeae]; species *Stereospermo chelonoidi* et *S. suaveolenti*, DC., affinis; ab utraque foliolorum forma indumentoque differt, ab illa corolla purpurea intus circa filamentorum basin sine squamis lanatis, ab hac fructu inter alios characteres etiam differt.

Arbor parva ramulis nodosis, foliis ramulorum apicibus confertis, rhachide pubescente. *Foliola* 7–9, oblonga vel lanceolato-oblonga, acuminata, 8–16 cm. longa, 3–5 cm. lata, infima autem saepissime minima, basi acuta vel subacuta, subtus pubescentia aut rarius glabra, nervis lateralibus utrinque 6–10 saepe rufis; petioluli 3–9 mm. longi, neque tantum tenues quam ei *S. chelonoidis*, DC., neque tantum crassi quam ei *S. suaveolentis*. *Panicula* laxa, brachiata, 12–25 cm. longa, pubescentia sed quam ea *S. uaveolentis* minus viscosa, ramulis ultimis 3-floris. *Flores* purpurei, 2–2·5 cm. longi. *Calyx* pubescens, 5–8 mm. longus, dentibus 3–6 brevibus apiculatis (praesertim in alabastro). *Corolla* extus glabra vel parce pilosa, intus antice dense villosa, postice glabra, circa filamentorum basin non lanata. *Stamina* glabra aut versus basin parce pilosa, antherarum thecis divaricatis. *Capsula* cylindrica, 30–45 cm. longa, 7–9 mm. diametro, interdum 4 lineis tenuibus longitudinalibus instructa, brunnea, dense lenticellata. *Semina* cum alis membranaceis 2·5–3·1 cm. longa, alis apicibus obtusis aut sublaceris.—*S. chelonoides*, var. *angustifolium*, Haines, Descr. List Trees, etc. Southern Circle, Centr. Prov. p. 169 (1916).

India. Central Provinces, *Haines* 3433; Province of Bihar & Orissa: Angul, *Haines* 4959; Sambalpur, *Haines*.

S. chelonoides of De Candolle does not appear to me to be the *Bignonia chelonoides* of Linnaeus filius. There is a specimen of the latter in the Linnean herbarium, named, according to Dr. Jackson, in the handwriting of the younger Linnaeus. It was collected by König in 1777 and Dr. Jackson kindly referred to a letter from König of the same date written from Tranquebar which leaves no doubt that it is a South Indian tree collected near that locality. It is a very pubescent or even hirsute plant with the young leaves tomentose whereas *S. chelonoides* according to De Candolle is glabrous. The shape of the leaflets is elliptic and caudate exactly as in *S. chelonoides*, DC. but there is an important difference in the petiolules being short and rather stout instead of slender and the panicle is closely pubescent not glabrous as in De Candolle's species. In the North Indian *Stereospermum tetragonum*, DC., united with *S. chelonoides*, DC., in the Flora of British India, the corolla has woolly scales at the base of the filaments and these also are present in *S. chelonoides*, DC., but they do not occur in our plant. Whether or not they are present in the Linnean *Bignonia chelonoides* could not be ascertained without dissection, but the general appearance of the corolla and its indumentum is more like that of our plant and of *S. suaveolens* than of *S. chelonoides*, DC.

1050. **Premna calycina,** *Haines* [Verbenaceae–Viticeae]: species adhuc cum *P. barbata*, Wall., conjuncta, sed inter alia calyce magno venoso anthesi nec alte 4-lobato nec lobis angustis, etiam floribus majoribus, foliis glabrioribus magis dentatis differt.

Arbor parva, inermis, usque ad 10 m. alta, cortice pallido. *Folia* elliptico-oblonga, lanceolata vel ovata, rarius obovata, acuminata, plus minusve serrata vel dentata, 8–20 cm. longa, 4–11 cm. lata, glabra vel in nervis subtus puberula, basi rotundata, obtusa vel breviter cuneata, nervis lateralibus 4–6, quorum 1–2 prope basin, petiolis 1·5–4 cm. longis glabris, vel supra leviter pubescentibus. *Panicula* parva, terminalis, minute pubescens, corymbosa, 3–6 cm. diametro, bracteis minimis caducis. *Calyx* inflato-campanulatus, anthesi sub-bilabiatus, 2 mm. longus, parce glandulosus, labio superiore nunc perspicue 2-lobato lobis imbricatis rotundatis nunc subintegro, labio inferiore obscure 3-lobato; calyx fructifer 2·5 mm. longus latusque, insigniter venosus, alte 2-labiatus vel inaequaliter 2–5-lobatus. *Corolla* alba, 5–6 mm. longa, tubo 3 mm. longo, lobis 4 late-oblongis rotundatis, fauce villosa. *Stamina* exserta. *Stylus* minute 2-fidus. *Drupa* globosa, 3 mm. diametro, putamine verrucoso.

India. Bengal, Bihar and Orissa, and the Central Provinces, frequent.

Whereas *P. barbata*, Wall., is chiefly a species of the lower Himalaya and adjacent moister regions, *P. calycina* extends into the Peninsula. The typical *Premna barbata* (Wall. No. 1768) from Nepal has pubescent entire or very slightly toothed leaves though Clarke in Flora of British India iv, 579 appears to regard as typical the form with more toothed leaves and to class the sub-entire leaved form as a variety "anodon." The calyx of *P. barbata* is very little enlarged in fruit and the latter is often pyriform. Brandis (Forest Trees, p. 511) states under *P. barbata* "calyx lobes enlarged and ribbed in fruit." This remark no doubt is applied to his specimens from Singbhum and the Central Provinces which are *P. calycina* mihi.

XIX.—NOTES ON CYPERACEAE. I.

(*Pycreus pumilus* and *Pycreus hyalinus*.)

W. B. Turrill.

An unfortunate question of nomenclature has arisen in connection with the writer's revision of North Indian *Cyperaceae* for Mr. J. F. Duthie's "Flora of the Upper Gangetic Plain," and it seems advisable to clear the matter up in a separate paper.

Following C. B. Clarke in Hooker's "Flora of British India" and elsewhere the genera *Pycreus* and *Cyperus* are being kept distinct for the present as a matter of convenience, although it is realized that *Pycreus* is polyphyletic, its species having been derived from various sections of the genus *Cyperus*, by reduction of the trigonous nut and 3-fid style to a laterally compressed biconvex nut and 2-fid style. Similarly the genus *Juncellus* is composed of species derived from several different sections of *Cyperus* by reduction to a dorsally compressed nut and 2-fid style. It is therefore acknowledged that these genera are, in one sense, artificial. On the other hand they are convenient, definitely delimited and therefore easily determined. If they are not accepted the species belonging to them have all to be reduced to the already unwieldly genus *Cyperus*, or a fresh generic classification of the *Cyperaceae* has to be evolved. It is probable that this last suggestion will eventually yield a working classification in accord with phylogenetic principles but for the present it is impracticable. It is to be further noted that a reduction of *Pycreus* and *Juncellus* to *Cyperus* logically implies other reductions. *Mariscus* must be sunk in *Kyllinga*, or both genera in *Cyperus*. *Courtoisia* and *Torulinium* also become involved and the final result is the reduction of all the genera of the tribe *Eucypereae* to the one genus *Cyperus*. Lastly, it appears to the writer to be no improvement to reduce some or all of the above mentioned genera to *Cyperus* and to keep them as "Sections" within this genus. This course is followed, for example, by Pax in Engler and Prantl "Die Natürlichen Pflanzenfamilien" ii. 2., and implied by the arrangement of species in Britton, "Sedges of Jamaica" and Cooke "Flora of Bombay."

The genus *Pycreus* was established by Beauvois in Fl. Owar. ii., p. 48. (1807) and the species *Pycreus polystachyos* is well figured at tab. 86. and being the only species mentioned by name is to be considered the type of the genus. To the genus *Pycreus* Nees in 1835 (in Linnaea ix, p. 283) transferred without comment a number of species previously placed in *Cyperus* and amongst these was *Cyperus pumilus*. This name was first used by Linnaeus (Linn. Amoen. Acad. iv. p. 302, 1759 and Sp. Pl. ed. 2. p. 69, 1762) to designate a small Indian species. The description and a reference to a figure of Plukenet's (Pluk. alm. 179. t. 191. f. 8.) leave no doubt as to the plant intended. The Linnean Herbarium contains one sheet written up in Linnaeus's hand-writing "*Cyperus pumilus*." On this sheet one original specimen, pasted down, is the plant represented by Plukenet (l. c.) and the plant generally accepted as *C. pumilus*, Linn. A second fragment added later with a pencil note "Hort. Fothergill 1778 Fairbairn J.E.S." is *Cyperus flavescens*, L. What Linnaeus intended by *Cyperus pumilus* is therefore clear and *pumilus* is the earliest specific name for the species, which, according to the Vienna Rules, must on transference to *Pycreus* become known as *Pycreus pumilus*. Nees, in 1835, as mentioned above, made this combination but although he then quoted no specimens or synonyms his previous reference in Wight, Contributions to the Botany of India (1834), p. 74, shows that the plant which he understood as *Cyperus pumilus* was not the species of Linnaeus but a species for which the combination *Pycreus hyalinus* (Vahl), Turrill, has to be made. In other words the transference was associated with specimens belonging to another species. This being so it seems advisable, logical and in accordance with established rules to remake the combination *Pycreus pumilus* as *Pycreus pumilus,* Turrill, non Nees, intending thereby the true *Cyperus pumilus,* L. non Nees. C. B. Clarke in the Flora of British India and numerous other works on the *Cyperaceae* has accepted the combination *Pycreus pumilus,* Nees (non *Cyperus pumilus* L.), not for our plant but for a species whose history we have yet to trace.

In 1789 Retzius (Obs. v. p. 13.) described *Cyperus nitens,* a species which was accepted by Vahl (Enum. Plant. ii. p. 329.). Exactly what plant was intended is doubtful but probably *Pycreus pumilus,* Turrill (*Cyperus pumilus,* L.), was meant, certainly this interpretation has been the one generally accepted by specialists. Nees in 1843 (Nov. Act. Acad. C.L.C. Nat. Cur. xix., Suppl. l, 53) transferring *Cyperus nitens,* Retz to *Pycreus,* gives a description which certainly applies to *Pycreus pumilus,* Turrill, non Nees. This name *Pycreus nitens,* Nees, is the one used by C. B. Clarke in the majority of his works. The same species was described by Nees and Meyen as *Cyperus pulvinatus,* in Wight, Contributions to the Botany of India, 1834, p. 74, and this was transferred to *Pycreus* by Nees in Linnaea ix. 1834, p. 283. Hence in *Kew Bull. Addit. Ser.* viii. p. 94. the name *Pycreus pulvinatus,* Nees, is accepted by Clarke.

In 1806 Vahl (Enum. Plant. ii. p. 329), published under the name of *Cyperus hyalinus,* a quite distinct species which has been frequently confused, as by Nees, with *Pycreus pumilus,* Turrill, (*Cyperus pumilus,* L.). This is apparently the earliest trivial for the species recorded in C. B. Clarke's works as *Pycreus pumilus,* Nees, and a new combination—*Pycreus hyalinus,* Turrill, has to be made in accord with the Vienna Rules, since the plant is undoubtedly a *Pycreus,* as the genus is accepted here.

It will be well finally to sum up the chief synonymy involved in the unfortunate confusion which is unravelled above:

Pycreus pumilus, *Turrill,* non Nees. *Cyperus pumilus,* L., Amoen. Acad. iv. (1788) p. 302, et Sp. Pl. ed. 2. p. 69 et herb. propr. *Cyperus nitens,* Retz., Obs. v. (1789) p. 13? *Cyperus pulvinatus,* Nees et Meyen in Wight Contrib. (1834), p. 74. *Pycreus pulvinatus,* Nees, in Linnaea ix. (1834), p. 283. *Pycreus nitens,* Nees, l. c., and C. B. Clarke in Fl. Brit. India vi. p. 591.

Pycreus hyalinus, *Turrill.* *Cyperus hyalinus,* Vahl, Enum. ii. (1806) p. 329. *Cyperus pumilus,* Nees in Wight Contrib. (1834). p. 74 excl. syn., non Linn. *Pycreus pumilus,* Nees, in Linnaea ix. (1834) p. 283, and C. B. Clarke in Fl. Brit. India vi. p. 591.

XX.—MISCELLANEOUS NOTES.

Mr. A. J. Thornton, a member of the gardening staff of the Royal Botanic Gardens, Kew, has been appointed by the Secretary of State for the Colonies, on the recommendation of Kew, Assistant Superintendent of the Botanical and Forestry Department, Hong Kong.

John Firminger Duthie.—On the 23rd February last there died at West Worthing, Sussex, one of the oldest of the correspondents of Kew. For some years he had been in poor health so that his visits had not been so frequent as formerly. But he had always been held in great regard by the Staff and frequenters of the Herbarium, and the news of his death was received by them with great sorrow and regret.

J. F. Duthie was born on the 12th May, 1845, the son of the Rev. A. H. Duthie, Rector successively of Sittingbourne and Deal. He was educated at Marlborough College and at Jesus College, Cambridge, where he took the B.A. degree in 1867 with a 3rd class in the Natural Science Tripos. After leaving College he spent some time as a tutor in Somersetshire and then travelled with his mother and sister in Italy, living chiefly at Florence. He collected specimens largely, both in Italy and also in the islands of Malta and Gozo, and he published, chiefly in the "Journal of Botany," accounts of the Flora of those islands and of that of Tuscany and Monte Generoso in the Italian Lake country. It was a most unfortunate circumstance that all his valuable collections made at the time were lost in a fire at a repository in Scotland where they had been stored. He was then, for a time, Professor of Natural History at the Royal Agricultural College at Cirencester, and in 1875 he was elected a Fellow of the Linnean Society.

In 1876 Duthie was offered by Lord Salisbury, then Secretary of State for India, and accepted, the post of Superintendent of the Botanic Garden at Saharanpur in the North-Western Provinces of India, vacant by the retirement of Dr. W. Jameson. In those days the Garden of Saharanpur was for the Upper Gangetic Plain what that at Calcutta was for the Lower country and the regions bordering the Bay of Bengal, and Duthie at once set to work to carry on the labours of distinguished predecessors like Doctors Royle, Falconer, King and Jameson. He spent 27 years in that appointment, retiring in 1903, and during his service he travelled over nearly the whole of the North-Western Provinces, the Punjab and Central Provinces, and especially explored the Himalayan regions of Kumaon (with Mr. J. R. Reid), Garhwal, Simla and Kashmir, making everywhere large and well preserved collections not only for the enrichment of the Herbarium at Saharanpur, but for distribution to Kew, the British Museum, Edinburgh, Calcutta and elsewhere and to private friends.

Among other important journeys he was attached to the Staff of the General Commanding in the "Black Mountain" Campaign of 1888 and greatly prized the medal he had earned under fire. He paid special attention to the grasses of Northern India, and his list of them was published at Roorkee in 1883 and 1886. He also, as might have been expected from his work in the Saharanpur Garden, where so much was done in cultivating for seed and for improved varieties the edible vegetables of India, published in 3 Parts in 1882–93, partly in conjunction with Mr. J. B. (now Sir J. Bampfylde) Fuller, a full account, with plates, of the Field and Garden Crops of the North-Western Provinces. His tours produced also many papers on the Floras of the regions visited by himself or by those who sent their collections to Saharanpur from Kashmir, Merwara, Kumaon, Chitral, &c.

In addition to his work at Saharanpur, he lectured every year on the Systematic Botany of India at the Forest School at Dehra Dun and usually accompanied the students on their annual tour in the Hills of Jaunsar and Tehri-Garhwal, where the Forests were under the management of the Government. He also paid a yearly visit to Calcutta, where he spent a fortnight of strenuous work in the Herbarium, and Sir George King and his successor held his work in very high esteem.

On his retirement in 1903 he returned to England, and in September of that year was appointed Assistant for India in the Herbarium at Kew, a post which he held till obliged to relinquish it, owing to illness, in April, 1907. During his time at Kew, his wide knowledge of Indian plants was always at the disposal of those who were working on them and he described and published in the Kew Bulletin, the Botanical Magazine, the Gardeners' Chronicle and elsewhere many important new species sent from India and the neighbouring regions. At the request of Sir Richard Strachey he revised the list of the great collection of the plants of Kumaon and neighbouring Himalayan regions known as the "Strachey and Winterbottom" collection, the first edition of which was published in 1882, and the new revision issued in 1906. On receiving a copy of it Sir Joseph Hooker wrote to him "I am rejoicing over the 'Strachey and Winterbottom Kumaon plants' which is doubly important as showing what a marvellous collection they made in one season and as being an up-to-date catalogue of Kumaon plants. It appears to me to have been very carefully compiled by you."

He also commenced and carried on from 1903 onwards, the "Flora of the Upper Gangetic Plain," which he was able before his death to see very near completion, and it is hoped that arrangements will shortly be made to publish the final part. The work was, in late years, very sadly hampered by failing health.

Duthie married in 1879 Miss Coape-Smith, daughter of Col. Coape-Smith, then in charge of the Army Remount Establishment at Saharanpur, and we are indebted to Mrs. Duthie for kindly providing much information about him. He leaves two children: Lt.-Col. A. M. Duthie, D.S.O., Lég. d'Honneur, O.B.E., now Commanding the Artillery School at Quetta, and Mrs. W. H. Norman, wife of Col. W. H. Norman, C.B., D.S.O., now on the Staff in India.

During the whole of his service in India, Duthie was in constant and regular correspondence with Sir Joseph Hooker The originals of Sir Joseph's letters to him were presented by him before his death to the Kew Library and many of them were quoted or otherwise referred to in the Life of Sir Joseph Hooker prepared by Mr. Leonard Huxley and published by Lady Hooker. They show well how much Sir Joseph appreciated Duthie's work and the warm regard he always felt for him.

Duthie was a slow worker and very cautious, so that he was often unable quickly to make up his mind on systematic questions, but he always came to a decision in the end and the result was the more valuable in consequence. He was always extremely anxious to avoid inaccuracy and used to polish up his work and descriptions over and over again in order to make sure that they were quite right. The most unassuming of men, he never put himself forward in the least, leaving it to his friends to estimate the value of what he did. He was a delightful travelling companion and an excellent climber, and many Indian Forest Officers and other friends will long remember the kindly, good-natured botanist who accompanied them on their marches over the plains or mountains of Northern India. They will all hear of his death with great regret.

J. S. Gamble.

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BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 4] [1922

XXI.—A REVISION OF CANAVALIA.

C. V. Piper and S. T. Dunn.

Early in 1920 Mr. C. V. Piper, whose work on the two Canavalias, the Jack Bean and the Sword Bean, is well known, asked for the assistance of Kew in clearing up one or two points of confused nomenclature in the genus as well as in a revision of the whole of *Canavalia*. Sir David Prain allowed Mr. S. T. Dunn (Assistant for India at Kew), to co-operate with Mr. Piper in this matter. The joint revision was to be published in America. This, however, has not proved convenient and at Mr. Piper's request the Director has agreed to publish in the *Kew Bulletin* the part concerning the Old World species. The second part dealing with the Canavalias of the New World will appear later in an American periodical.

Canavalia, *Adans.* Fam. 325 (Canavali); DC. Mem. Leg. 375; Benth. in Benth. & Hook. f. Gen. Pl. i. 537. Descr. Benth. addenda. Calyx tubuloso-campanulatus. Vexillum basi bicallosum; stylus imberbis vel raro apice hirtellus. Legumen nonnunquam endocarpio papyraceo separabili.

Species circiter 50 in regionibus calidioribus utriusque orbis crescentes.

Canavalias of the Old World.

Early botanical history. The first botanist to publish descriptions and figures of these plants was Rheede, who, in 1688, included in his *Hortus Malabaricus* the three species that grow on the coast of Malabar. He described the cultivated *C. gladiata* under the name *Bara-mareca* (*Hort. Malabar.* viii. t. 44), the sea-shore *C. podocarpa* as *Catu tsjandi* (t. 43) and the large-podded *C. turgida* as *Catu-baramareca* (t. 45). Nearly half a century later Kaempfer (*Amoen.* 836) alluded to *C. gladiata* as cultivated in Japan under the name of *Natta mame.* In 1747 Rumphius wrote his *Herbarium Amboinense* and with very indifferent figures and descriptions referred to *C. rosea*

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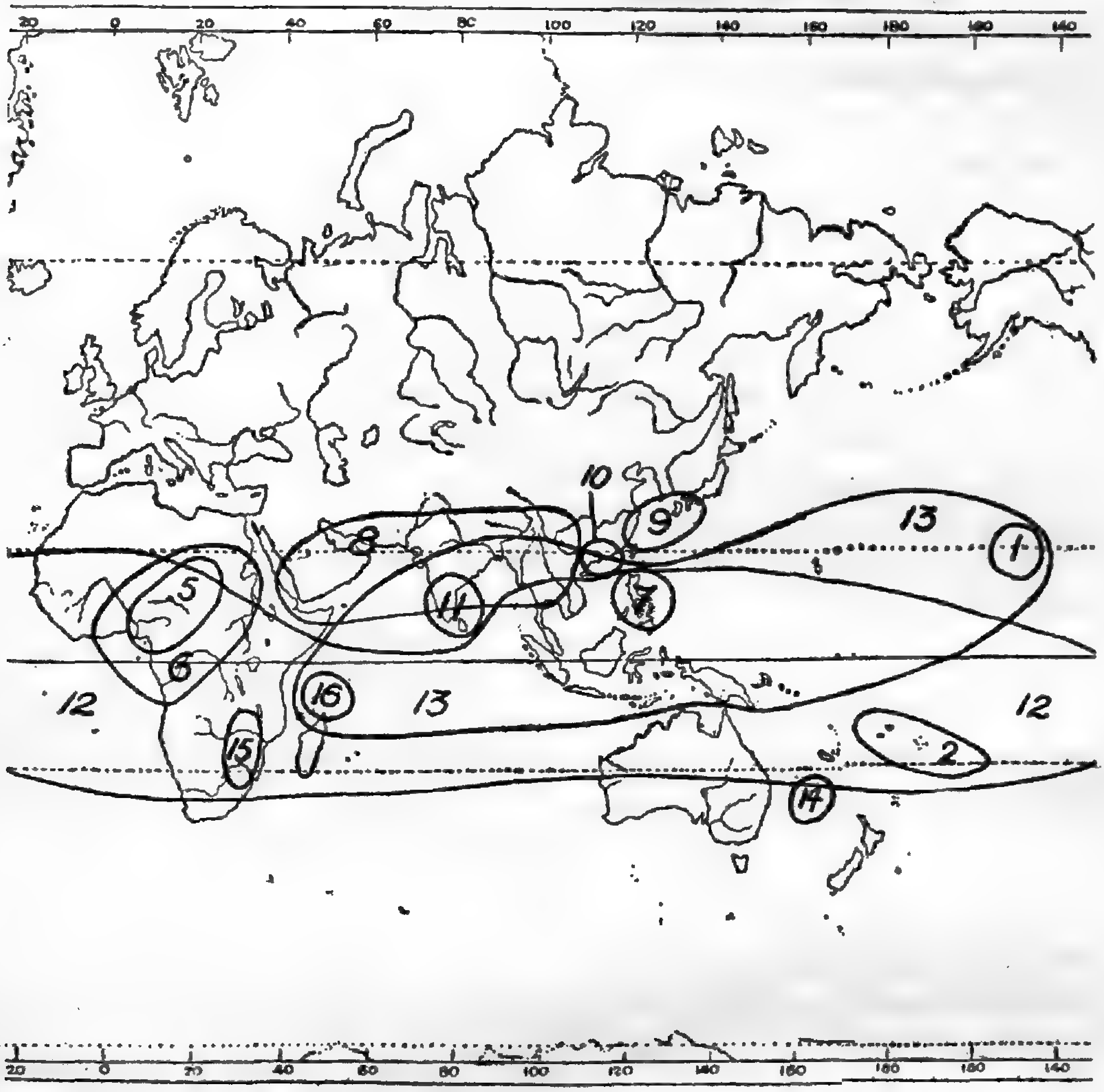
under the name of *Cacara litorea* (t. 141), *C. gladiata* as *Lobus machaeroides* (t. 135). *C. turgida* which occurs in Amboina but was not apparently figured by Rumphius was identified by Merrill with t. 141. In 1784 Thunberg published his *Flora Japonica* in which *C. lineata*, the only wild species in the islands is recognised under the name of *Dolichos lineatus* (p. 280) as growing on the sea-shore round Nagasaki, while the cultivated *Natta mame*, appears as *Dolichos ensiformis* (p. 279).

It was now 50 years before any further additions were made to the genus by workers in the field. But meanwhile the group had been recognised as distinct from *Dolichos* by Adanson in 1763 (*Adans. Fam.* ii. 325) and established as *Canavali*, enumerating most of the characters now relied on to distinguish it from neighbouring genera. Under a Latinised form, *Canavalia*, Aug. De Candolle collected all the species known in 1825 (Prodr. ii. 404) and defined Adanson's genus with greater accuracy (*Mem. Leg.* 375). It was about this time that various botanical writers, endeavouring to reconcile the figures, descriptions and vernacular names of previous workers, which of course could not be clearly done without specimens, caused a complicated synonymy. The chief confusion was caused by De Candolle himself by the designation of the Malabar sea-shore plant as *C. obtusifolia*. And it is largely this mistake and its prolific progeny which has impelled us to undertake a critical review of the whole subject and to offer in the following pages our final conclusions on the question of the nomenclature of the species. It is not necessary to lay stress on the progressive stages of the confusion. It may be clearly traced in our synonymy of each of the older species.

In 1832 Roxburgh (*Fl. Ind.* iii. 300) enumerated all the species known to him under *Dolichos*, though two of the maritime forms are probably included under the name of *D. rotundifolius*, Vahl under a misapprehension as to the true meaning of Vahl's name. Two years later Wight and Arnott (*Prodr.* ii. 253) correctly described the S. Indian species under *Canavalia*, but in endeavouring to adjust the synonymy introduced the prolific source of confusion centring on the inclusion of Lamarck's name of *Dolichos obtusifolius* as a synonym of the sea-shore species.

Distribution.—The most widely distributed member of the genus is *C. rosea*, which encircles the globe, abounding on the hot, sandy shores of the tropics and seldom found beyond them. Away from the sea it is represented in the interior of Africa by *C. regalis* towards the north and by *C. ferruginea* in the south. Another allied species *C. plagiosperma* has been described as a cultivated plant probably from Mauritius. Just north of the range of *C. rosea* on the China coast we find its near ally *C. obcordata*, in the S. Pacific on the very south of its range it is represented by the closely allied *C. Baueriana* in Norfolk Island, while in India and Ceylon it is replaced by *C. podocarpa*.

C. virosa extends from the south of Asia to the East of Africa and is continued beyond this range as far as the Pacific by the allied *C. lineata* from Japan to Formosa and by *C. luzonica*, a little further to the south in the Philippine Islands. On the other extremity of its range *C. africana* replaces it as far as the Atlantic.



Canavalias of the Old World.

C. turgida is distinguished from all the other species as Prain pointed out, by its separable endocarp. This integument closely invests the seeds and possibly aids in their dispersal in a living state by sea-currents. Its range is a large one reaching from Hawaii to the Mascarene Islands and including India, the Malay Islands and New Guinea, in all of which it is found climbing on the bushes that fringe the sea-shore.

The two remaining species *C. galeata* and *C. sericea* inhabit Polynesia, the first to the north and the second to the south of the equator. Their peculiar floral characteristics unite them into a group by themselves.

Fertilisation.—Every mature flower that has been examined in Old World material presents the following general characters :—The blade of the standard is expanded in a vertical plane, the claw being held with those of the other petals in a horizontal position by the tubular calyx. The rectangular bend of the standard necessitated to secure these relative positions occurs just at the end of the blade. The four lower petals project horizontally past this point, concealing the staminal sheath, and the ovary, style and stigma which it contains. At the point where the base of the wing- and keel-petal blades leave the standard owing to its upward bend there are two prominent ear-shaped callosities close together at the middle of the base of the standard blade. These hold between them the upper edges of the lower petals just as the fingers and thumb may hold together the pages of a book. A weight such as that of an insect alighting on the lower petals will depress them and so liberate them from the callosities which hold them together. They are thus enabled to open and to slide down on each side of the stiff genital core. This brings the under side of the insect on to the brush of stamens or if the staminal sheath has split (which it does after the pollen is used), on to the exposed stigma. After each insect-visit, the petals, according to a field note by Mr. Keith on a sheet of *Canavalia* from Siam in the Singapore Herbarium, rise again, protecting the genitalia. The correct position of the insect is presumably encouraged by the offer of nectar round the disc which can only be reached through the slits in the upper side of the base of the staminal sheath. The position of the flower is not, however, always standard upwards as indicated above. Mr. I. H. Burkill records observations made by him on the fertilisation of *Canavalia rosea* as follows :—"The flowers commonly upside down, but sometimes face upwards. *Xylocopa aestuans* was visiting and in either case stood on the standard and caused the stamens to dust the back of its thorax as it does in *Eriosema*." But in each case the deposit of pollen occurs of course on a different surface of the visiting insect.

Our thanks are due to the Director of the Royal Botanic Gardens, Kew, and to the Keeper, Botanical Department, Natural History Museum, London, for leave to use the material in the establishments under their charge, to the Director of the Singapore Botanic Gardens for the loan of all the *Canavalia* sheets in the Singapore Herbarium, and to Mr. H. N. Ridley for notes and for a collection of specimens specially made for us on a recent visit to the Malay Peninsula.

Key to the Old World Canavalias.

1. Pod with two supplementary ribs close to the upper suture - - - - - - - 2
   Pod with two supplementary ribs 5 mm. or more distant from the upper suture - - - - - 13
2. Upper lip of calyx equal to the tube; flowers 4 cm. long (Polynesian plants) - - - - 3
   Upper lip of calyx shorter than the tube - - 4

3. Leaves glabrous - - - - 1. *galeata.*
Leaves silky - - - - 2. *sericea.*
4. Pod 20 times longer than broad; seeds white; hilum $\frac{1}{10}$ circum. of the seed - - 3. *ensiformis.*
Pod 2–6 times longer than broad; seeds red, brown or white; hilum $\frac{1}{6}$ to $\frac{1}{3}$ circumference of seed - 5
5. Strongly climbing plants with hilum $\frac{1}{6}$–$\frac{1}{3}$ circumference of seed - - - - - - - 6
Creeping plants with hilum $\frac{1}{5}$ circumference of seed - 11
6. Pod 4–5 cm. broad; hilum $\frac{1}{6}$–$\frac{1}{3}$ circumference of seed 7
Pod 1·3–3 cm. broad; hilum $\frac{1}{3}$ circumference of seed 8
7. Seed red, white or brown with hilum $\frac{1}{3}$ of circumference of seed - - - - - 4. *gladiata.*
Seed crimson with hilum $\frac{1}{6}$ of circumference of seed 5. *regalis.*
8. Ripe pod-valves dull brown, woody, convex, six times as long as broad - - - - - 9
Ripe pod-valves coriaceous, flat, yellow - - 10
9. Ripe pods about 3 cm. wide (African plants) 6. *africana.*
Ripe pods about 2 cm. wide (Philippine plants) 7. *luzonica.*
10. Pods, long, parallel-sided - - - 8. *virosa.*
Pods short, semi-elliptic - - - 9. *lineata.*
11. Pod-valves firm and flat when mature - - 12
Pod-valves thinly leathery and turgid when mature 10. *obcordata.*
12. Pods gradually acuminate at the base 11. *podocarpa.*
Pods abruptly acuminate at the base - 12. *rosea.*
13. Pods about twice as long as broad; endocarp separating 13. *turgida.*
Pod about 6 times as long as broad; endocarp adherent to valves - - - - - - 14
14. Plant pubescent - - - - - 15
Plant glabrous - - - - 14. *Baueriana.*
15. Calyx densely ferrugineous - - 15. *ferruginea.*
Calyx strigillose - - - 16. *plagiosperma.*

1. **C. galeata,** *Gaud.* in Freyc. Bot. Voy. Uranie (1825) 486 (adnot.); Hillebr. Fl. Hawaii (1888) 102; Rock, Legum. Pl. Hawaii (1920) 209. *C. Gaudichaudii,* Endl. in Ann. Wien Mus. i. 186 (1836). *Dolichos galeatus,* Gaud. l.c. 486 t. 115. *C. pubescens,* Hook. & Arn. Bot. Beechey Voy. 81 (1841). *C. galeata,* Gaud. var. *pubescens,* A. Gray in U.S. Expl. Exped. (1854) 441; Rock, l.c. 211 t. 86.

The pubescent state cannot be separated from the type by its leaves and flowers; the pods are not described and have not been seen by the writers.

Sandwich Islands. *Douglas* 6; *Hildebrand*; *Hinds.*

2. **C. sericea,** *A. Gray* l.c. 440. Rock. l. c. 287 t. 85.

Society Islands. Anno 1769, *Banks and Solander.*

FIJI ISLANDS. Herb. U.S. Expl. Exped.

FRIENDLY ISLANDS. *W. H. Harvey.*

COOK ISLANDS. Rorotonga, *T. E. Cheeseman.*

3. **C. ensiformis,** *DC.* Cultivated in various parts of the Old World. Native of the West Indies.

4. **C. gladiata,** *DC.*, Prodr. ii. 404 (1825); Piper, Circ. 110, Bur. Pl. Industr. U.S.A. Dept. Agric. (1913) 34. *C. incurva,* Thou. in Desv. Journ. Bot. ii (1843) 80; Hiern. Cat. Welw. Afr. Pl. i. (1896) 254 (non DC.). *C. ensiformis,* Baker in Oliv. Fl. Trop. Afr. ii. (1871) 190; Baker in Hook. f. Fl. Brit. Ind. ii (1879) 62; Prain in Journ. As. Soc. Beng. lxvi. (1897) 62; Prain Beng. Pl. i. (1903) 394; Cook, Fl. Bomb. i. (1903) 372; Gamble Fl. Madr. ii. (1918) 359; Gagnep. in Lecomte, Fl. Indo-Chine ii. (1916) 260; Chev. in Expl. Bot. Afr. Occ. Fr. (1920) 196 (non DC.); *C. maxima,* Thou. l.c. *Dolichos gladiatus,* Jacq. Ic. Rar. t. 560 (1785–1793); Roxb. Fl. Ind. iii. (1832) 300. *Baramareca,* Rheede, Hort. Malabar. viii. t. 44 (1688). *Natta Mame,* Kaempf. Amoen. 836 (1712)? *Lobus machaeroides,* Rumph. Herb. Amboin. v. t. 135 f. 1 (1747).

INDIA. Bengal, *C. B. Clarke* 13809; Sylhet, *C. B. Clarke* 17395A; Soane River, *J. D. Hooker;* Assam, *Jenkins* 22; N. Cachar Hills, *Craib;* Kuala Lumpur, *Yapp* 256 (Cult.).

PHILIPPINE ISLANDS. Cult. *Manila, Bur. of Sci.* 5167.

TROPICAL AFRICA. Loanda, *Welwitsch.*

The Sword Bean, as far as is known, does not occur in a truly wild state but it is widely cultivated by the natives of India and other tropical countries and runs wild everywhere. In the naturalized condition it has smaller pods but it can always be distinguished by its acuminate leaflets and the length of the hilum of its seeds. Messrs. Thomstone and Sawyer in their account of the Peas and Beans of Burma (*Bull.* No. 12 of 1914 of the *Dept. of Agric. Burma*), classify the well known forms of the species according to the colour of their flowers and seeds. But Var. 2 which has smaller and narrower pods is possibly another species (*C. virosa,* W. & A.). The Sword Bean might well be considered as derived originally from *C. virosa,* W. & A., an inland climber extending from W. Africa to the Philippines. When found as an escape from cultivation it is not easily distinguished from that species.

5. **C. regalis,** *Dunn,* sp. nov., affinis *C. gladiatae,* DC., sed seminibus majoribus hiloque breviore differt.

Herba perennis, scandens, 4–5 m. alta, primo pubescens, tandem calycibus exceptis glaberrima. *Folia* pinnatim trifoliolata; petioli foliis breviores, sulcati; petioluli 1–1·5 cm. longi; stipulae et stipellae parvae, caducae; foliola ovata, apice acuta, basi obtusa, abrupte acuminata vel acuta, membranacea, lateralia paullo obliqua, 10–20 cm. longa. *Racemi* 10–14-flori; pedunculi racemis subaequales, foliis vix breviores; pedicelli e nodis 2–3-ni, calyce breviores. *Flores* albi, fragrantes. *Calyx* campanulatus, 1·5 cm. longus; labium superius tubo paullo brevius, emarginatum, erectum; inferius dimidio brevius 3-lobatum, lobis ovatis cordatis acuminatis medio exteriore, lateralibus obliquis labio superiori exterioribus. *Petala* 2–3 cm. longa. *Vexillum* late ovatum, emarginatum, basi in unguem lamina breviorem abrupte angustatum, medio callis 2 ornatum, qui cum laminae auriculis calcara petalorum aliorum tenent. *Alae* oblongae, obtusae, sub-falcatae, basi semisagittatae. *Carina* curvata. *Stamina* 10, sub anthesi monadelpha, tubo versus basin staminis vexillaris utrinque hiante. *Discus* circum basem ovarii breviter cylindricus. *Ovarium* pubescens, breviter stipitatum; stigma capitatum. *Legumen* oblongo-lineare, 20–30 cm. longum, 3·5–4·5 cm. latum, 2–2·5 cm. crassum, costis duobus 4 mm. altis a sutura superiore 5 mm. utrinque distantibus, sutura inferiore nonnunquam valde intrusa. *Semina* 10–12, 2·5–3 cm. longa, 1·5–2 cm. lata, 1·25 cm. crassa, coccinea; hilum 1·2 cm. longum.

TROPICAL AFRICA. Nigeria; Nupe, *Barter* 1607; Jeba, on the Kworra, *Barter*; Sudan; S. Kordofan, Jebel Eliri, *Mr. & Mrs. A. F. Broun* 1375; Jebel Eliri (Nuba Hills) name *Tambui*. "The seeds are strung as bracelets in the Bahr-el-Ghazal to bring luck when shooting."

6. **C. africana,** *Dunn,* sp. nov., affinis *C. virosae*, W. & A., sed legumine lignoso tumido differt.

Herba perennis, scandens, mox omnino glabra. *Folia* pinnatim trifoliolata; petioli foliolis breviores; petioluli 5 mm. longi; stipulae et stipellae caducae; foliola ovata, apice breviter acuminata, basi truncata vel obtusa, 10–17 cm. longa, membranacea; lateralia vix obliqua. *Racemi* 20–40-flori; pedunculi racemis bis vel ter longiores, foliis aequales; pedicelli e nodis 2–3. *Flores* purpurei. *Calyx* campanulatus, chartaceus, 15 mm. longus; labium inferius superiore bis brevius; lobi ovati, obtusi *Petala* rubella, 3 cm. longa. *Vexillum* late ovatum, apice truncatum, emarginatum, basi laminae truncatum, abrupte inflexum et in unguem angustatum, eoque appendicibus duabus auriformibus contiguis notatum et auriculis membranaceis eodem ornatum. *Alae* angustae, ovato-lanceolatae, supra unguem inflexae. *Stamina* basi excepta monadelpha. *Discus* cylindricus, brevis. *Ovarium* pubescens; stylus glaber; stigma capitatum. *Legumen* maturum lineari-oblongum, apice basique obtusum; 30–50 cm. longum; valvae lignosae, brunneae, turgidae, costis prope suturam superiorem notatae. *Semina* 6–8, ovalia, 1·8 × 0·2 × 0·8 cm.; hilum 1·5 cm. longum circiter ter circulo seminis superatum.

TROPICAL AFRICA. Nile bank; Uchopeh, *Speke* and *Grant* 628. Lagos; Oloke Meji, *Foster* 129; Poloula *MacGregor* 177. Nigeria; Mongu, 1320 m., used for rattles (Hausa *Borran*); Kashi, *Lely* 387. Angola; *Gossweiler* 5626.

7. **C. luzonica,** *Piper* in Biol. Soc. Wash. xxx. 177 (1917). *C. ensiformis,* Merrill in Philipp. Journ. Sci. v. 125 (non DC.).

Philippine Islands. Luzon; Lamao River, *Merrill* 3172, 3811; *Loher* 2293, 2295; Lubang, *Merrill* 963; Bataan, *Elmer* 6870.

8. **C. virosa,** *Wight & Arnott,* Prodr. ii. (1834) 253: Gamble l.c. 359. *C. polystachios,* Schweinf. Rel. Kotsch. (1868) 25. *C. ensiformis,* var. *virosa,* Baker in Hook. f. Fl. Brit. Ind. ii. 196; Prain Beng. Pl. i. (1903) 394. *C. ensiformis* var. *mollis,* Baker l.c. *C. ensiformis* var. *mucunoides,* Baill. in Bull. Soc. Linn. Par. i. 384 (1883). *C. mollis,* Wight & Arnott l.c. *Dolichos polystachios,* Forskal Fl. Aegypt. (1775) 134 (non Linn.) *D. virosus* Roxb. l.c. 301.

China. Yunnan; Szemao, *Henry* 12424.

India. Madras Pres., *Roxburgh*; Penins. Ind. Or. *Wight* 736; Nopoly, *Wallich* 5531D, E; Palamcottah and Sirumalais, *Wight* 750; Maisor & Carnatic, *G. Thomson*; Madras, *Bourne*; Sirumalais, *Bourne* 882; Godavari District, *Bourne* 3222, 3371; Chingleput Dist., Madras, *Bourne* 11186; Kodaikanal, Pulney Hills, *Sauliere* 587; Bombay Pres. Konkan, *Edgeworth*; *Stocks*; Belgaum Jungles, *Ritchie* 201; N.W. Provinces, Jungle, Banda, *Bell* 270.

Siam. Chengmai, *Kerr* 1532B; Bangkok, *Zimmermann* 52; Bangtaphan, *Keith* 321.

Tropical Africa. Mittu; Uokko, *Schweinfurth* 2816.

Socotra. Hillsides, *Balfour* 424.

Arabia. Yemen, *Barbey* 1829.

Mascarene Islands. Madagascar, *Baron* 1442, 4370; *Methuen*; Mauritius, *Bouton*.

In his original description Roxburgh describes the seeds as light grey, but his unpublished figure in the Kew library shows them as mottled brown.

9. **C. lineata,** *DC.*, Prodr., ii. 404. *Dolichos lineatus,* Thunb., Fl. Jap. (1784) 280.

Herba perennis, scandens, glabra, caulibus, striatis. *Folia* pinnatim trifoliolata; petioli foliolis vix breviores, sulcati; petioluli 0·8–1 cm. longi; foliola membranacea, siccitate reticulata, late ovata, obtusa vel obtuse acuminata, basi truncata vel breviter acuminata, 8–14 cm. longa; stipulae stipellaeque minutae, caducae. *Pedunculi* foliis breviores vel rarius multo longiores. *Flores* in racemis saepius quam pedunculi multo brevioribus, ex nodis in paribus 5–6 enati. *Calyx* robustus, striatus; labium superius tubo brevius, emarginatum, erectum; labium inferius dimidium superioris attingens, 3-lobatum; lobi ovati, cordati, medio acuminato, lateralibus oblique acutis. *Petala* aequalia, rubella, calyce bis longiora. *Vexillum* ovatum, reflexum, apice emarginatum, basi truncatum, auriculis 2 membranaceis incurvatis notatum et inter eis bicallosum. *Alae* lineari-oblongae, paullo falcatae, in latere superiore callosae. *Carinae* petala obovato-oblonga, fere recta, basi sagittata. *Discus* brevis. *Ovarium* stipitatum, suturis sericeum, 4–5-ovulatum. *Legumen* semi-ellipticum, compressum, chartaceum, ochraceum, juxta suturam superiorem utrinque costo longitudinali instructum, 6–10 cm. longum, 2·5–3·5 cm. latum, 1 cm. crassum, apice basique obtusum; endocarpium valvis adherens. *Semina* 2–3, ovalia, 1·7 cm. longa, 7 mm. lata, brunnea, maculata; hilum tertiae parti circumscriptionis seminis aequale.

JAPAN. Nagasaki (in rupestribus maritimis 40-pedalis), *Maximowicz* (1863).

JAPAN & KOREAN ARCHIPELAGO. *Oldham* 358.

CHINA. (Fortune ?); French Island; Whampoa, *Hance* 5196; Hongkong, *Lamont;* Hainan, *Henry* 8046.

FORMOSA. *Oldham* 176, 177; litore, Tamsui, *Faurie* 152; Apes Hill, Takow, *Henry* 153.

10. **C. obcordata,** *Voigt*, Hort. Suburb. Calc. 235. *Dolichos obcordatus*, Roxb. Fl. Ind. iii. 303; Roxb. Fig. 2327 (unpubl.)

Herba perennis, procumbens, in arena maritima repens, cito glabra, caulibus striatis. *Folia* pinnatim trifoliolata; petioluli foliolis breviores, supra sulcati, vix 1 cm. longi; foliola membranacea, late ovata, obtusa, apiculata vel retusa, basi obtusa, 7–10 cm. longa; stipulae e disco calloso basi producto enatae; stipellae lineares, caducae. *Pedunculi* foliis breviores. *Flores* 5–9, e nodis bini, racemos pedunculis breviores formantes. *Calyx* robustus, 1–1·4 cm. longus; labium superius tubo bis brevius, late ovatum, emarginatum; labium inferius dimidium superioris attingens, lobis 3, acuminatis. *Petala* 2·5 cm. longa, splendide rubella. *Vexillum* late ovatum, reflexum, emarginatum, basi truncatum bicallosum. *Alae* oblongae, supra unquem incrassatae. *Carinae* petala ovata, infra rotundata, breviter caudata, supra in rostrum obtusum incurvata. *Ovarium* dense pubescens, basi disco brevi cinctum. *Legumen* lineari-oblongum, apice obtusum, basi acutum, 10–11 cm. longum, 2·5 cm. latum, 7·5 mm. crassum, turgidulum; valvae molliter coriaceae. *Semina* 6–9, ovalia, opace brunnea, 1·2 cm. longa, 7·5 mm. lata et 5 mm. crassa; hilum 6–7 mm. longum, $\frac{1}{5}$–$\frac{1}{6}$ seminis circumscriptionis.

CHINA. Stanley, Hongkong, *Ford* 636; Lantao Island, *Lamont* 183A; *Tutcher* 652 (Hongkong Bot. Gard. from seed of *Ford* 636); Hongkong, *C. Wright*, 129.

11. **C. podocarpa,** *Dunn*, sp. nov.; *C. obtusifolia*, Wight & Arnott l.c. 253; Cleghorn in Madr. Journ. i. 27 (1857) t. 4; Baker l.c. 196 (partly); Trimen, Fl. Ceyl. ii. (1894) 68; Talbot For. Fl. Bombay, i. (1909) 405 (non DC.); *C. lineata*, Cook, Fl. Bomb. i. (1906) 373; Prain, Beng. Pl. i. (1903) 394; Gamble,

Fl. Madr. ii. (1918) 359, (non DC.). *Catu-tsjandi*, Rheede l.c. t. 43.

Herba perennis, procumbens, cito glabra. *Folia* pinnatim trifoliolata; petioli foliis paullo longiores, supra vix sulcati; petioluli 5–8 mm. longi; foliola paullo carnosa, obovata vel rotundata, obtusa, apice apiculata, basi obtusa, 2–5 cm. longa; stipulae stipellaeque parvae et caducae. *Pedunculi* foliis saepius multo longiores. *Racemi* 5–7-flori, pedunculis bis breviores. *Flores* 1–2-ni ex nodis enati; pedicelli calyce bis breviores. *Calyx* 1·3–1·5 cm. longus; labium superius tubo bis brevius, emarginatum, erectum; labium inferius 1–2 mm. longum, 3-lobatum, lobis latis obtusis vel breviter acuminatis. *Petala* rubella vel alba. *Vexillum* late ovatum, reflexum, emarginatum, 3·5–4 cm. longum, basi plicatum bicallosum. *Alae* anguste oblongae fere rectae, sagittatae, vexillo breviores. *Carinae* petala arcuata, alis aequilonga. *Ovarium* stipitatum, primo pubescens. *Stylus* glaber. *Stigma* capitatum. *Legumen* lineari-oblongum, rectum, circiter 9 cm. longum, 2 cm. latum, basi in stipitem longum angustatum; valvae maturae flavidae, planae, chartaceae, juxta suturam superiorem utrinque costa forti longitudinali instructum. *Semina* 4–5, ovoidea, compressa, siccitate nigra; hilum $\frac{1}{5}$ circumscriptionis seminis.

INDIA. Madras Presidency; in arena mobile inter Quilon et Anjengo prope mare, *Wallich* 5532B; Quilon, *Wight Cat.* 748, *Wight Herb. propr.* 253; Madras, *Bourne* 2219; Cuddalore sea-shore, *Barber* 716; Ceylon, *Thwaites* C.P. 1484; Cult. in Calcutta Bot. Gard. *Wallich* 5532B.

Common on sandy sea shores in the south of the Indian peninsula and Ceylon and referred to by Cleghorn (l.c.) as a useful sand-binding creeper.

12. **C. rosea,** *DC.*, Prodr. ii. (1825) 404. *C. obtusifolia*, DC. Prodr. ii. 402; Miq. Fl. Ind. Bot. i. (1855) 215; Benth. in Ann. Wien. Mus. ii. 135; Baker in Hook. f. Fl. Brit. Ind. ii. (1876) 196 (as far as regards Malay Penins. plants); Bailey, Queensland Fl. (1900) 431; Gagnep. in Bull. Soc. Bot. Fr. lxii. (1915) 292; in Lecomte Fl. Gen. Indo-Chine ii. 262 (1916); Chevalier in Expl. Bot. Afr. Occ. Fr. (1920) 1971. *C. maritima*, Thou. in Desf. Journ. de Bot. 1813, 80; Hiern, Cat. Welw. Afr. Pl. i. 254. *C. lineata*, Prain in Journ. As. Soc. Beng. lxvi. ii. (1897) 63; Merrill Philipp. Journ. Sci. v. (1910) 125; ix. (1914) 92; Merrill, in Interpret. Rumph. Herb. Amboin. (1917) 281; Rock, Legum. Hawaii (1920) 207 t. 32 (non DC.) ; *C. emarginata*, G. Don, Gen. Syst. ii. 362? *C. Findlaysoniana*, R. Grah. in Wall. Cat. 5535? *C. moneta*, Welw. Apont. 588 n. 62; Hiern. l.c. 254. *Dolichos roseus*, Sw. Fl. Ind. Occ. 1243 (1806). *D. obovatus*, Schum. et Thonn. Beskr. Guin. Pl. (1827) 341. *Cacara litorea*, Rumph. Herb. Amboin. v. t. 141. f. 1.

MALAY PENINSULA. Pangalan Balak; Malacca, *Burkill* 3514; Pahang, *Burn Murdoch; Ridley;* Pahang, *Curtis;* Tringganu, *Roslade;* Singapore, *J. S. Gamble.*

Malay Archipelago. N. Borneo, *Burbidge ;* Java, *Junghuhn* 206, *Horsfield, Savinierre* 1144; Amboina, *Robinson* 553; Sarawak, Baram, *Hose* 605; Sarawak, *Hose* 54; Borneo, *Haviland* 1016; Timor Laut, *H. O. Forbes* 3347; N. Guinea, *Meyer ;* Celebes, *Koorders* 17571.

Philippine Islands. Malabon, *Loher* 2297, 2298; Manila, *Merrill* 379, 3423; Bauang, *Elmer* 5650; Bataam, *Elmer* 7033.

Indo-China. Siam; Sriracha, *Kerr* 2130, *Collins* 31; Ha-tua, *Godefroy.*

N.E. Australia. Howick Is., *Muller ;* Lord Howe's Is., *Moore* 55; *R. Brown* 4224; Queensland, *Banks & Solander ; Hann* 77; Port Curtis, *MacGillivray* B49; Cape York, *Daniel ;* Port Darwin, *Schomburgh* 185.

N.W. Australia. Dampier's Arch., *A. Cunningham ;* Foul Point Bay, *A. Cunningham ;* Nicol Bay and Grey River, *Ridley's Exped. ;* Point Pearse, *Muller ;* Upper Victoria River, *Miller ;* N.W. Coast, *Bynde ;* between Ashburton and Grey Rivers, *Clement.*

New Zealand. Kermadec Group; Meyer Islet, *Cheeseman.*

Polynesia. New Caledonia, Isle of Pines, *MacGillivray* (H.M.S. Herald) 789; Solomon Islands, Gaudalcuat, *Milne* (H.M.S. Herald) 547; Fiji Islands, Vuna, *Seeman* 122; Samoa, *Whitmee* 83; Fuemaga, *Powell* 67; Society Islands, *Forster Herb.*

Tropical Africa. Liberia, *Whyte ;* Gold Coast, *Chipp* 57; Nigeria, Brass, *Barter* 53, Mouth of Kwalbo River, *Talbot* 3089; Lagos, *Dalziel* 1212; Benin, *Debeaux* 149; Kamerun, *Preuss* 1281; Batanga, *Bates* 68; Congo, Mayoniba, *Debeaux* 103; St. Thomas Island, *Mollen* 104; Ambriz, *Welwitsch* 2192; Praia de S. Thiago, *Welw.* 533, (the seeds are here used by the natives as small change); Zanzibar Island, *Hildebrandt* 1197; Mouth of W. Luabo, *Kirk* 9; Beira, *Cecil* 243.

Mascarene Islands. Madagascar, *Baron* 6700; Mauritius, *Ayres :* Rodrigues, *Balfour ;* cult. from seed from Seychelles at Biloxi, Miss. U.S.A. *S.P.I.* 34625.

South Africa. *Drege ;* Durban, *J. M. Wood* 1299; *Rudatis* 1611; Coast of Natal, *Cooper.*

As appears in the synonymy Rumphius's figure of *Cacara litorea* is here regarded as intended for *C. rosea* and not *C. turgida.* Rumphius describes it as creeping like *Soldanella* on the sea-shore. De Candolle founded his *Lablab microcarpus* on this figure and some authors taking it for *C. turgida* have proposed to make it supersede Graham's appropriate name on the ground of priority. Rumphius's figure, however, and the names founded on it belong to the present species.

13. **C. turgida,** *Grah.* in Wall. Cat. (1832) 5534; Miq. Fl. Ned. Ind. i. 215 (1885); Prain in Journ. As. Soc. Beng. lxvi

(1897) 417; Gagn. in Lecomte, Fl. Gen. Indo-Chine ii. 161 (1916). *C. gladiata*, DC. var. *turgida*, Baker, Fl. Brit. Ind. ii. 196. *C. obtusifolia*, Prain, Beng. Pl. i. 394; Journ. As. Soc. Beng. lxvi. (1897) 63; Gamble Fl. Madr. i. 360 (non DC.) *C. cathartica*, Thou. in Desf. Journ. de Bot. 1813, 81 ?. *C. microcarpa*, Piper in Proc. Biol. Soc. Wash. xxx. 176 (Oct. 23, 1917); Merrill, Interpret. Rumph. Herb. (Nov. 1. 1917) 280. *Dolichos rotundifolius*, Roxb. Fl. Ind. iii. (1832) 302 (non Vahl). *Lablab microcarpus*, DC. Prodr. ii. (1825) 402. *Katu Tsjandi*, Rheede, Mal. l.c. t. 45.

India. Sunderbuns, *Hook. f. & Thoms.* 18; Bengal coast, Noakhali, *Clarke* 6618; Concan, *Stocks;* Rangoon, *Wallich* 5531 F; Amherst, *Wallich* 5534; Tenasserim, *Helfer ;* Andamans, *Parkinson* 658; *King*.

Malay Peninsula. Pulau Redang, *Jensen* 28; Penang, *Wallich* 5534, 5534B; Kelantan, *Ridley ;* Perak, *Scortechini* 1391; Pahang, *Ridley* 1198: Singapore, *Burn Murdoch* 159; *Hullett* 330; Durian Shabang, *King's Collector* 1123; Pulau Buru, *Ridley ;* Pulau Obin, *Hullett* 463.

Malaya. Sumatra, *Robinson & Kloss ;* Christmas Island, *Ridley* 146; N. Borneo, *Fraser* 210; *Gibbs*, 2738; Amboina, *Robinson* 562; New Guinea, *Pulle* 1871; *Barclay* 4087.

Philippine Islands. Luzon, *Whitford* 707; Mindoro, *Merrill* 1292; Paragua, *Merrill* 700; Negros Oriental, *Elmer* 10303.

Polynesia. Solomon Islands, *Comins* 171; *Guppy* 117; Fiji Islands, *Seeman* 112; Ellice Islands, *McNaughton ;* Samoa, *Powell* 37.

Mascarene Islands. Seychelles, *Horne* 472.

The synonymy of the species and of its sea-shore ally is discussed by Prain (Journ. Beng. As. Soc. lxvi. 419), by Merrill (Interpret. Rumph. Herb. 280) and by Gagnepain (Bull. Soc. Bot. Fr. lxii (1915) 292)

14. **C. Baueriana**, *Endl.*, Prodr. Fl. Norf. (1883) 91.

The only note which should be added to Endlicher's precise and exhaustive description (l.c.) is that the pods vary in length from 9–18 cm. and in width from 2·5–3·5 cm. The endocarp is adherent to the valves of the pod, otherwise it might be confused with *C. turgida*, Graham, which also occurs in the S. Pacific. The ripe seeds are pale brown with a circumference 5 times the length of the hilum.

We have not seen the drawing quoted by Endl. (l.c.) but a specimen collected in Norfolk Island by Backhouse is stated on the label in the Kew Herbarium to be "apparently Endlicher's plant: compared with Bauer's drawing Nov. 1867." It exactly corresponds with the description.

Norfolk Island: *Backhouse* 644.

Cook Island. Roratonga, *Cheeseman* 540; Cult. Washington, D.C., U.S.A., *S.P.I.* 41619, (seeds New South Wales).

15. **C. ferruginea,** *Piper*, sp. nov., *C. roseae*, DC., affinis, sed habitu scandente et legumine ferrugineo distat.

Herba scandens; caules teretes, dense deflexo-puberuli. *Folia* pinnatim trifoliolata; stipulae lanceolatae, basi latiores, rubro-puberulae, caducae. *Foliola* membranacea, late ovata, apice acuta vel breviter acuminata, apiculata, basi rotundata, reticulata, utrinque parce praecipue subtus strigillosa, 7–15 cm. longa, 4–10 cm. lata; petioluli carnosi, densissime ferrugineo-puberuli; stipellae lineari-lanceolatae et similiter puberulae. *Racemi* 12-20-flori; pedunculi robusti, ad 40 cm. longi, dense ferrugineo-reflexo-puberuli; pedicelli brevissimi, basi glandula magna globosa instructi. *Calyx* campanulatus, dense adpresse ferrugineus, 15 mm. longus; labium superius latum, marginatum; labium inferius parvum, dentibus 3 obtusis, late deltoideis, medio paullo longiore. *Corolla* rubella vel purpureo-rubella, 2–2·5 cm. longa. *Vexillum* obovatum, alte emarginatum, lateribus reflexis, medio plicatum, basi bicallosum, obtuse bi-auriculatum, ungue longo angusto. *Alae* carinis aequilongae, medio obtuse dentatae, basi inflexo-auriculatae, lamina unguibus bis longioribus. *Carina* lata, obtusa; petala apice libera, medio cohaerentia, basi anguste hamata, laminis unguibus bis longioribus. *Stamina* pistillo aequilonga, ad basem monadelpha. *Ovarium* dense breviter ferrugineo-tomentosum. *Stylus* subtus hirsutus; stigma terminale paullo obliquum. *Legumen* robuste pedicellatum, parce brunneo-puberulum, fere rectum, compressum, 15 cm. longum, 2·5 latum, rostro valido recurvato, juxta suturam superiorem utrinque costa contigua longitudinali instructum, costis a suturis 4-5 mm. distantibus, endocarpio valvis adhaerente. *Semen* ellipsoideum, compressiusculum, fulvum, micans, 16 mm. longum, 10 mm. latum, 8 mm. crassum; hilum late lineare, nigrum, 10 mm. longum, anguste brunneo-marginatum.

Tropical Africa. Lake Nyasa; east shore, *W. P. Johnson* 70; Nyasaland, *J. Buchanan* 1086; Moweh, Shire River, *Dr. J. Kirk*.

South Africa. Transvaal; Barberton, *E. E. Galpin* 866, Crocodile River Drift, *H. Bolus* 7734; Natal, *W. T. Gerrard* 304, Inanda, *J. M. Wood* 1238.

16. **C. plagiosperma,** *Piper*, sp. nov., *C. roseae*, DC., affinis, sed seminis figura et calyce strigilloso distat.

Herba annua, scandens, 1-plures m. alta, omnino strigillosa; caules teretes. *Foliola* membranacea, obscure reticulata, late ovata, apice acuta, basi rotundata vel obtusa, 10-13 cm. longa; petioluli carnosi, puberuli. *Racemi* circiter 10-flori. *Calyx* viridis, nigro-maculatus, strigillosus; labium superius emarginatus; labii inferioris dentes 3 late deltoidei, acuti, subaequales. *Corolla* purpurea. *Alae* carinam obtusam aequantes. *Legumen* lineare compressissimum, subrectum, strigillosum, 20-25 cm. longum, 4 cm. latum, rostro recurvo, costis a sutura superiore 5 mm. distantibus. *Semina* circiter 10, ellipsoidea, compressissima, micantia, basi abrupte angustata, 2.7 cm. longa, 1·7 cm. lata, 1 cm. crassa, ochraceo-rubida; hilum lanceolatum 1 cm. longum, saepe basale, nigrum, anguste brunneo-marginatum.

Secured from Dr. P. Boname, Director of Agriculture, Mauritiu* sand grown at Biloxi, Mississippi, Miami, Florida and in the greenhouse at Washington, DC. No. 02053; also from Nicaragua No. 02735.

COLLECTORS' NUMBERS.

Backhouse 644 *C. Baueriana*, Endl.
Balfour 424 *C. virosa*, W. & A.
Barber 716 *C. podocarpa*, Dunn.
Barbey 829 *C. virosa*, W. & A.
Barclay 4087 *C. turgida*, Grah.
Baron 1442, 4370 *C. virosa*, W. & A.; 6700 *C. rosea*, DC.
Barter 1607 *C. regalis*, Dunn; 53 *C. rosea*, DC.
Bates 68 *C. rosea*, DC.
Bell 270 *C. virosa*, W. & A.
Bolus, H. 7734 *C. ferruginea*, Piper.
Bourne 882, 3222, 3371, 11186 *C. virosa*, W. & A.; 2219 *C. podocarpa*, Dunn
Broun, Mr. & Mrs. A. F. 1375 *C. regalis*, Dunn.
Brown R. 4224 *C. rosea*, DC.
Buchanan, J. 1086 *C. ferruginea*, Piper.
Burkill 3514 *C. rosea*, DC.
Burn Murdoch 159 *C. turgida*, Grah.
Cecil 243 *C. rosea*, DC.
Cheeseman 540 *C. Baueriana*, Endl.
Chipp 57 *C. rosea*, DC.
Clarke 13809, 17395 *C. gladiata* DC.; 6618 *C. turgida*, Grah.
Collins 31 *C. rosea*, DC.
Comins 171 *C. turgida*, Grah.
Dalziel 1212 *C. rosea*, DC.
Debeaux 103, 149 *C. rosea*, DC.
Douglas 6 *C. galeata*, Gaud.
Elmer 6870, *C. luzonica*, Piper; 10303 *C. turgida*, Grah.; 5650, 7033 *C. rosea*, DC.
Eyles 1445 *C. ferruginea*, Piper.
Faurie 152 *C. lineata*, DC.
Forbes, H.O. 3347 *C. rosea*, DC.
Ford 636 *C. obcordata*, Voigt.
Foster 129 *C. africana*, Dunn.
Fraser 210 *C. turgida*, Grah.
Galpin 866 *C. ferruginea*, Piper.
Gerrard, W. T. 304 *C. ferruginea*, Piper.
Gibbs 2738 *C. turgida*, Grah.
Gossweiler 5626 *C. africana*, Dunn.
Guppy 117 *C. turgida*, Grah.
Hance 5196 *C. lineata*, DC.

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* Since the paper was set up we find that *C. plagiosperma* is a native of Cuba.

Hann 77 *C. rosea*, DC.
Haviland 1016 *C. rosea*, DC.
Henry 12424 *C. virosa*, W. & A.; 153, 8046 *C. lineata*, DC.
Hildebrandt 1197 *C. rosea*, DC.
Hook. f. & Thoms. 18 *C. turgida*, Grah.
Horne 472 *C. turgida*, Grah.
Hose 54, 605 *C. rosea*, DC.
Hullett 330, 463 *C. turgida*, Grah.
Jenkins 22 *C. gladiata*, DC.
Jensen 28 *C. turgida*, Grah.
Johnson 70 *C. ferruginea*, Piper.
Junghuhn 206 *C. rosea*, DC.
Keith 321 *C. virosa*, W. & A.?
Kerr 1532 B. *C. virosa*, W. & A.; 2130 *C. rosea*, DC.
King's Collector 1123 *C. turgida*, Grah.
Kirk 9 *C. rosea* DC.
Koorders 17571 *C. rosea*, DC.
Lamont 183A *C. obcordata*, Voigt.
Loher 2293, 2295 *C. luzonica*, Piper; 2297, 2298 *C. rosea*, DC.
MacGregor 177 *C. africana*, Dunn.
Macgillivray 49B *C. rosea*, DC.
Manila, Bur. Sci. 167 *C. gladiata*, DC.
Merrill 3172, 3811, 963 *C. luzonica*, Piper; 379, 3423, *C. rosea*, DC.? 700, 1292 *C. turgida*, Grah.
Milne 547 *C. rosea*, DC.
Mollen 104 *C. rosea*, DC.
Moore 55 *C. rosea*, DC.
Oldham 176, 177, 358 *C. lineata*, DC.
Parkinson 658 *C. turgida*, Grah.
Powell 67 *C. rosea*, DC.; 37 *C. turgida*, Grah.
Preuss 1281 *C. rosea*, DC.
Pulle 1871 *C. turgida*, Grah.
Ridley, 146, 1198 *C. turgida*, Grah.
Ritchie 201 *C. virosa*, W. & A.
Robinson 553 *C. rosea*, DC. 562 *C. turgida*, Grah.
Rudatis 1611 *C. rosea*, DC.
Sauliere 587 *C. virosa*, W. & A.
Savinierre 1144 *C. rosea*, DC.
Schomberg 185 *C. rosea*, DC.
Schweinfurth 2816 *C. virosa*, W. & A.
Scortechini 1391 *C. turgida*, Grah.
Seeman 112 *C. turgida*, Grah.; 122 *C. rosea*, DC.
Speke & Grant 628 *C. africana*, Dunn.
Swynnerton 442 *C. ferruginea*, Piper.
Talbot 3089 *C. rosea*, DC.
Thwaites 1484 *C. podocarpa*, Dunn.
U.S.A. Dept. Agric. S.P.I. 34625 *C. rosea*, DC.; 02053, 02735 *C. plagiosperma*, Piper; 416 C. *Baueriana*, Endl.
Wallich 5531F, 5534, 5534B *C. turgida*, Grah.; 5531D, 5531E *C. virosa*, W. & A.; 5532A *C. podocarpa*, Dunn.

Welwitsch 533, 2192 *C. rosea*, DC.
Whitford 707 *C. turgida*, Grah.
Whitmee 83 *C. rosea*, DC.
Wight 736, 750 *C. virosa*, W. & A.
Wight Cat. 748 *C. podocarpa*, Dunn.
Wight Herb. 253 *C. podocarpa*, Dunn.
Wood, J. M. 1238, *C. ferruginea*, Piper; 1299 *C. rosea*, DC.
Wright, C. 129 *C. obcordata*, Voigt.
Yapp 256 *C. gladiata*, DC.

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virosa, W. & A. Prodr. ii. 253—As. et Afr. trop.
tortilis, Frappier[3] ex Cordem. Fl. Ile Reunion (1895) 396—Ins. Bourbon.

Dolichos emarginatus, Jacq. Hort. Schoenbr. ii. t. 221 = C. podocarpa. ?
galeatus, Gaud. Bot. Voy. Uranio (1826) 486 = C. galeatus.
gladiatus, Jacq. Ic. Rav. t. 560 (1786–93) = C. gladiatus.
obovatus, Schum. & Thonn. Guin. Pl. 341 = C. rosea.
obtusifolius, Lam. Encycl. ii. 295 (1786) = C. rosea.
roseus, Sw. Fl. Ind. Occ. 1243 (1806) = C. rosea.
rotundifolius, Roxb. Fl. Ind. iii. 302 = C. turgida.
rotundifolius, Vahl, Symb. Bot. ii. 87 = C. rosea.

Lablab microcarpus, DC. Prodr. ii. 402 = turgida, Grah.

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1. *C. Bouquete*, Montr. Specimen not seen. Neither the genus nor the species is determinable from the description.

2. *C. incurva*, DC. is not a *Canavalia*. The name is founded on *Dolichos incurvus*, Thunb., which the author identified with Japanese *Nata mame*. That name means "sword bean" and has been given by some Japanese authors as equivalent to the Sword Bean, *Canavalia gladiata*. But Thunberg's description shows his plant to be different in many respects from that species and even from the genus. It seems probable therefore that Thunberg connected the plant he was describing with *Nata mame* wrongly.

3. *C. macrobotrys*, Merr., *C. megalantha*, Merr. and *C. tortilis* Frapp. We have seen no specimens and the species cannot from the descriptions be placed in the Key.

XXII.—A SHORT TRIP ON MT. ELGON, UGANDA.

C. H. Lankester.

In August last year, at the conclusion of a visit to inspect the Native Coffee Cultivations of the Bagisu, on the western slopes of Mt. Elgon, I had the good fortune to meet there, on Safari, the District Commissioner on tour, and proximity to the nearest route up the mountain suggested a hurried trip to the Jackson Summit. This was planned and duly carried out, four days being taken in all, including the return to Mbale.

The folds and valleys of the Elgon foothills where these meet the Bukedi plain are very densely populated, the lowest hills especially are almost covered by banana "shambas" of the native Bagisu, who differ very widely from the type of negro inhabiting the Kingdom of Buganda, with whom I had had a short introductory acquaintance.

The Bagisu are of smaller stature and are a much more primitive people, approximating to the Congo Pigmy group. The men wear heavy neck-collars of iron and frequently anklets of the same, the women, scanty costumes, either of fresh banana leaves, made into a short close-fitting skirt, or from strings of banana fibre, often adorned by a string of blue beads.

As in Uganda proper, at convenient intervals, well kept and picturesque thatched rest houses exist, and from that at Buhugu (about 4,500 ft.) we started on the 23rd August, 1921, for the Bamboo Camp (about 10,000 ft.), having a very steep climb up the grassy slope leading to Butandiga, 7000 ft. This hill seemed interminable, though the porters went up very cheerily. Bananas and "wimbi" lined the road on either hand, with occasional open spaces of scrubby pasturage for sheep and goats, a rather monotonous stretch. One has only to turn round to have a fine panorama of hill and plain, and on attaining the ledge on the road to and nearly at Butandiga, one stands on the periphery of a huge amphitheatre. The varied colours of the cultivated patches below stand out in relief, the "wimbi" shows a vivid yellow, contrasting admirably with the bluish green of the bananas and the deeper green of the small isolated patches of forest. At this ledge and onwards there is much of botanical interest. The road lies to the left of an almost perpendicular rocky bluff covered with Aloes, Crassulas and many species of ferns, including fine Adiantums. From here to the Bamboo Camp the slope is gentle, the road is of soft close turf, making walking easy and goes through low scrub with much bracken and bramble on either hand, among which, near the camp, were some gigantic Crinums, not then in flower. At one point the track lies very close to the edge of a rock precipice and one looks down nearly 3,000 ft. into the tumbled valley below. The road itself is of rock for a hundred yards or so, and in all soil-retaining cracks is a lovely little blue-flowered *Commelina* with finely fimbriate segments.

Upwards the vegetation begins to change and definitely montane types appear, occasionally Helichrysums and a terrestrial orchid with inconspicuous, dull green flowers are noticed. There was on the whole a marked absence of bloom, and evidently the visit was unfortunately timed in this respect. Heather of a tall straggling form (*Erica arborea*) increased in abundance as we climbed; buds were showing, but did not promise great attractiveness. The Helichrysums though full of buds showed only here and there an occasional silvery white, pink-tipped flower-head. On one of the ridges were several patches of a fine *Impatiens*, 3 to 4 ft. high, supported in the surrounding vegetation, with broad, white, maroon-centred flowers and deliciously fragrant. Higher up we reached a belt of forest of medium height, mainly *Podocarpus* (*P. milanjianus*, Rendle), picturesquely draped with *Usnea*, so reminiscent of the common tropical American *Tillandsia usneoides*, and shortly after, we reached the outposts of the bamboos. The species here, slender, erect and with very long nodes, is not nearly so beautiful as the feathery, arching Chusqueas of the Central American uplands. From here on we had occasional glimpses of the summit, very fine in the afternoon sun, but drifting clouds soon cut them off and enveloped us also before we reached camp. After a short rest we took an evening stroll to the Sasa river, some two miles above the camp. Close to the river, especially on the swampy ground bordering it, was a wealth of floral display. A low bridge of bamboo spans the creek and on the left grew at odd intervals, for a distance of some twenty yards up the river side, a fine white *Begonia*, eighteen or more inches in height, with pure white flowers of good size. Dotted about, the spikes of *Kniphofia Snowdenii* stood like solidified flames. Two species of terrestrial orchids, one rose-pink, the other a marvellous Tyrian Red, adorned the mossy openings in the low herbage, and close to the *Begonia* were two groups of a curious *Gladiolus* (?) with large plum-pink bracts, concealing the inconspicuous greenish flowers, one plant of a small *Echinops*, with bluish heads, and a tiny *Veronica* (*V. abyssinica*, Hk. f. ?), quite abundant, with unopened buds. Everywhere a scentless violet (*Viola abyssinica*, Steud.), decked the ground or climbed up amongst every kind of growth and in many places a silvery-blue *Anagallis* starred the green carpet of short moss. Near here, a very ornamental epiphytic *Canarina* (*C. Eminii* Asch. & Schweinf.), with large pendant orange-coloured bells, occurred on the lower branches and trunks of trees, but was not abundant. We returned to camp with material of our finds, losing to my regret, the only specimen of a charming blue Acanthaceous plant, not again encountered.

The next morning, after an intensely cold night, saw us off rather later than usual and within half an hour of our start rain began to fall and with the briefest interruptions continued all day, until nearing camp on our return in the evening. Then it continued fine, and we had glorious views of the mountain behind us, and in front right over the plain to Lake Kioǵa. The rain had spoilt much of the enjoyment of the tramp and only the determination of my companion kept me going, as my own inclination would have led me to potter around botanizing in likely spots. The vicinity of the Jackson Summit is rather bleak and on such a day the occasional glimpses we had of our surroundings were rather gruesome, but might be very different in blazing sunshine. One little shallow valley, full of the tree *Senecio* (*A. adnivalis*, Stapf), common all over the mountain at 12,000 ft. or so, was a very eerie spot in the mist, the dank, dead, black leaves hanging below the terminal green tuft, forming funereal and depressing objects. The general colouring of the landscape was a dull rusty brown varied by the grey lichen covered rocks. Not many of the extraordinary hollow-stemmed giant Lobelias were up, the majority were in the early stages of growth, a rosette close to the ground. A few were in flower at over 13,000 ft., fascinating plants, alone worth the journey to see. On the moorland, stretches were brightened by the spikes of *Kniphofia Snowdenii* and patches of a dainty Iridaceous plant with hanging pink flowers on very slender peduncles were frequent. Here also occasional Habenarias, singly or in little groups, the best being *H. praestans*, with ciliated lip. A *Rubus*, with huge yellow fruits, nestled in one rock group, but did not appear again. Usually any species of this genus is so abundant in any region it occurs, the seeds being dispersed everywhere by the birds. Again, a finer day might have disclosed quantities of it. A tiny inconspicuous *Sisyrinchium* grows in the path and was in flower. The Helichrysums, so dense everywhere, were less advanced than those at the Bamboo Camp. An acaulescent Composite with bright yellow flowers was dotted all over one stretch, the under side of the green leaves covered with white tomentum. The scramble up the boulder strewn summit, where we recorded our visit in the jar at the cairn, just about finished the interest of the day. Sleet fell up there and whitened the ground in places where it lodged. Below timber line on the way down the going was very soft. A species of Rhus, 25–40 ft. high grows here, with long pendant panicles, the ferruginous red of the dead leaves contrasting well with the pale green of the living. Not seen on the way up, a species of *Gentianaceae* with dull purple flowers was found here, the undergrowth being studded by a pretty pink Impatiens, a foot in height. Few epiphytic orchids were encountered, one *Angraecum*, a *Listrostachys* with small orange-red flowers and three species of *Polystachya*; and these not abundantly. Next day, the 25th, we returned from the Bamboo Camp to Budadiri, a long downhill march by the same route traversed two days previously. The morning was gloriously fine and camp was reached at 11.30. The day following we returned to Mbale, cycling wherever possible. At one place some six miles from our destination the knee-high grass was studded by a tall herbaceous plant with handsome white flowers, one of the most ornamental of the wild flowers of Uganda. At any point of the road, fine views of the immense cliffs of Elgon, could be obtained by looking back until nearing Mbale, when they are shut off by the grey forest-crowned mass of Nkokenjira, the westernmost bastion of Elgon, which hides from view at that station nearly the whole of the mountain, except the spurs to the northward. It may not be fair to draw inferences from so short and hurried a visit, though comparison is only natural. My impression is that the flora of the American Cordilleras at near the same elevation and latitude, is incomparably richer and more attractive; of the epiphytes this is overwhelmingly true. What renders comparison of the two floras so fascinating, is the production, under almost identical climatic conditions, of similar types in widely divergent families, especially in those of xerophytic forms.

For this delightful trip, marred only by the unfortunate weather prevailing at the summit, my warmest thanks are due to my fellow traveller, who made the journey possible and ensured its success.

XXIII.—NEW SPECIES FROM MOUNT EVEREST.

These new plants were collected by Mr. A. F. R. Wollaston, Medical Officer and Naturalist to the Mount Everest Expedition, 1921, and a complete set of the whole collection was presented to the Royal Botanic Gardens, Kew, by the Mount Everest Committee.

Mr. Wollaston has kindly supplied some particulars concerning the habitats :—

" The plants described in the following paper were collected in Tibet between May and September 1921, and with two exceptions they were all found in the neighbourhood of Mount Everest. The *Androsace* was found flowering in May at 17,000 ft. on Chumolhari, a mountain about 130 miles E. of Mt. Everest. *Primula Buryana* was found near Lapche Kang, about 50 miles W. of Mt. Everest ; it was seen in one place only where it covered the ground for an acre or more, and so white was it that it was difficult to see when the ground was covered with a sprinkling of snow.

" The region of about 13,000 ft. represented by a *Tanacetum* and a *Dracocephalum*, is a comparatively dry zone, more Tibetan than Himalayan in character. The region above 15,000 ft., from which come two Primulas and a Gentian, is characterised by an abundant moisture, that is to say, it is more often than not enveloped in a dense and dripping fog. Of the two Primulas *P. Wollastonii*, which was also found near Lapche Kang, has a very restricted range at 15,000 ft., where it is found growing on sheltered mossy slopes : *P. Younghusbandii* was found from 17,000 to nearly 19,000 ft. under the shelter of large boulders ; the newly-opened flowers of this species are white, becoming a pale mauve after a few days. *Gentiana stellata* has a still wider distribution from 14,000 to 18,000 ft. being most abundant at 16,000 ft. in the early part of September."

Aconitum orochryseum, *Stapf* [Ranunculaceae-Helleboreae] ; affinitatis dubiae ob tubera et semina ignota, nectariis ut in *A. Anthora*, L., sed inflorescentia pauciflora laxa, galeae forma foliisque admodum diversa ; potius ad sectionem Napellum referendum sed corolla aurea, galea, nectariis a species Asiae centralis et Indiae distinctissimum.

Tubera ignota. *Caulis* pars exstans 20 cm. longa, gracilis, subflexuosa, superne aureo-tomentella, inferne mox glabrescens pilis crispis, simplex. *Folia* caulina 2-na, versus laminae ortum densius caeterum parce aureo-pubescentia vel praeter nervos subglabra, petiolata, petiolo folii inferioris 2·5–5·5 cm. longo, superioris (florem infimum subpetentis) 0·7–1 cm. longo ; lamina folii inferioris ambitu late reniformis vel late cordato-ovata, sinu lato, a sinu ad apicem 3–4 cm. longa, 4–7 cm. lata, 5-subpedati-partita, divisionibus ambitu oblongis vel obovato-oblongis vel intermedia lanceolata grosse laciniato-dentatis, laciniis ve dentibus utrinque circiter 3 majoribus iterum dentatis; lamina folii superioris similis nisi redacta. *Inflorescentia* racemum laxum 3-florum referens; axis primarius et pedicelli indumento eodem ac caulis; pedicelli 3·5–1·5 cm. longi, recti vel subflexuosi, apice in discum ad 3 mm. latum dilatati, unus ex axilla folii summi ortus, secundus cum bractea quam folium praecedens multo magis reducta et ex eo ipso 2–10 mm. supra basin emissa; bracteolae 2-nae vel in pedicello summo 3-nae, tenuiter filiformes, 5–3 mm. longae, flexuosae. *Sepala* aurea, tenuiter pubescentia; summum galeiforme, erectum, rostratum, pone rostrum magis minusve constrictum, 2·4–2·8 cm. altum, 1·5–2·2 cm. latum (a latere visum et rostro incluso), rostro 0·6–1 cm. longo; lateralia late oblique obovato-rotundata, vix unguiculata, 1·5–1·8 cm. longa et lata; inferiora subdeflexa, oblongo-lanceolata, 1·5–1·8 cm. longa, 6–7 mm. lata. *Nectaria* cucullata, unguibus erectis 1·6–1·7 cm. longis aureo-pilosis, cuculla sigmatoideo-curvata, apice obtuso plane recurvo nigricante, labio lato 2-lobo atroviolaceo, caeterum pallida. *Filamenta* circiter 1·2 cm. longa, ultra medium subanguste alata, alis subito contractis, supra eas aureo-pilosa. *Carpella* 5, sub anthesi arcte conniventia, dense flavo-pubescentia, 4–4·5 mm. longa; styli 2 mm. longi.

MOUNT EVEREST EXPEDITION, 1921, 15,000 feet, yellow, August, *Wollaston* 16.

Tanacetum khartense, *Dunn* [Compositae-Anthemideae]; affinis *T. tibetico,* Hook. f. & Thoms., sed involucri bracteis oblongis nec orbiculatis differt.

Herba gracilis, perennis, diffusa, superne indumento albo tenui vestita, ramis ascendentibus ad 15 cm. longis, infra nuda. *Folia* ambitu orbicularia, breviter petiolata, 1–2-pinnata, 1-1·2 cm. longa, laciniis linearibus obtusis. *Capitula* numerosa, mediocria, cymoso-corymbosa, 0·7–1 cm. lata, pedicellis ad 1 cm. longis. *Involucrum* campanulatum; bracteae multiseriatae, imbricatae, oblongae, obtusae, 4 mm. longae, margine anguste scariosae, breviter fimbriatae, paucae exteriores breviores. *Receptaculum* conicum, nudum. *Corolla* ☿ tubulosa, infra abrupte angustata, 5-dentata. *Antherae* inclusae, basi muticae. *Ovarium* glabrum, pappo 0; stylus tandem exsertus; stigmata linearia, obtusa.

MOUNT EVEREST EXPEDITION, 1921, Kharta Valley at 13,000 ft. August, 1921, *Wollaston* 133.

Androsace sessiliflora, *Turrill* [Primulaceae-Primuleae]; affinis *A. Selago,* Hook. fil. et Thoms. ex Klatt, sed foliis superioribus praecipue longe villosis, floribus minoribus sessilibus distinguitur.

Planta dense caespitosa, ramosa, ramis parte inferiore fusco-atris foliis emarcidis squamosis obtectis. *Folia* dense imbricata in globulos multos compactos 3 mm. diametro albovirides densissime coarctata; inferiora late oblanceolata, 2 mm. longa, 1 mm. lata, plus minusve longe villosa; folia media elliptica, 3·25 mm. longa, 1·5 mm. lata, margine praecipue pilosa; folia superiora anguste lanceolata, 3·25 mm. longa, 0·75 mm. lata, dorso margineque longe albo-villosa. *Flores* solitarii, sessiles, 3 mm. longi. *Calyx* 2·5 mm. longus, alte quinquefidus, segmentis late oblongo-lanceolatis obtusis villosis 1·5 mm. longis 1 mm. latis. *Corollae tubus* 2·5 mm. longus, fauce 1·5 mm. diametro; lobi rotundato-obovati, 1·5 mm. longi, 1·25 mm. lati, leviter emarginati, flavi (?); fornices aurantiaci (?), 0·5 mm. longi, truncati. *Antherae* 1 mm. longae. *Ovarium* late subspheroideum, 0·75 mm. altum; stylus vix 1 mm. longus.

MOUNT EVEREST EXPEDITION, 1921, *Wollaston* 303.

This interesting species of *Androsace* must be a very beautiful plant when in flower. The stems grow together in dense compact masses. Each branch terminates in a close small mass of leaves, from the centre of which a solitary sessile flower arises. In this "globulus" it is scarcely possible to distinguish the individual leaves without dissecting, since the long white villose hairs form a grey felt covering. It would appear from the material available that the entire plant scarcely exceeds 2 cm. in height. The flowers are always completely sessile so far as can be judged from the material collected by Mr. Wollaston.

The species is to be placed in the section *Aretia*, and is compared above with *Androsace Selago*, Hook. fil. et Thoms., which is found in the Sikkim Himalaya and Tibet.

It is interesting to mention some of the species, belonging to widely different genera, occurring in the Himalayas, which have a similar habit of growth with short stems and dense terminal "globuli" of small leaves. Besides various species of *Androsace*, especially some belonging to the section *Aretia*, there may be recalled *Myosotis Hookeri*, C. B. Clarke, *Saxifraga hemisphaerica*, Hook. f., and several other related species of *Saxifraga*.

1756 **Primula Buryana,** *Balf. f.* [Primulaceae-Primuleae]; species *P. Wattii*, King, affinis sed foliis plus minusve ovalibus graciloribus, floribus albis hirtis longe scaposis differt.

Folia petiolata sub anthesi 4 cm. longa; lamina tenuis ovalis vel elliptico-ovalis vel oblongo-ovalis vel subovalis utrinque laevis et pilis vesiculosis septatis sparsim pilosa apice rotundata, margine irregulariter grosse dentato-crenulata ciliata, basi in petiolum aequilongum anguste membranaceoalatum attenuata. *Scapus* circiter 18 cm. altus ex toto lanatus; capitulum albiflorum flores 5 evolutos gerens et aliis sterilibus nigro-coronatum; bracteae lanceolatae nunc atro-purpureae. *Calyx* cupularis laxus submembranaceus viridis vel nunc postice nigro-purpureus circiter 6 mm. longus ad medium 5-lobatus extus pilis vesiculosis dense vestitus; lobi subaequales posteriores paullo latiores ovati obtusi vel subacuti. *Corolla* tenuis ad 1·8 cm. longa; tubus in flore longistylo infundibuliformis 7 mm. longus calycem longe superans intus puberulus extus dense pubescens exannulatus in limbum 5-lobum subzygomorphum infundibuliformem extus pilis farini-potentibus indutum expansus, lobi ad 8 mm.

longi, 7 mm. lati, obovatis bifidi segmentis integris vel obscure crenulatis acutis. *Stamina* in flore longistylo infra medium tubi corollini inserta. *Gynaeceum* in flore longistylo tubum corollinum aequans; ovarium discoideum circiter 1·5 mm. latum; stylus albus; stigma capitatum magnum fere 1 mm. diam.

Mount Everest Expedition, 1921: Lapchi Kang, 15,000 ft. Flowers white. Delicious scent. *A. F. R. Wollaston*, 180, July.

1271 **Primula Wollastonii,** *Balf. f.* [Primulaceae–Primuleae]; species *P. Wattii*, King, affinis sed floribus majoribus, lobis corollae haud dentatis.

Folia efarinosa sub anthesi oblanceolata ab apice rotundata deorsum gradatim attenuata circiter 4·5 cm. longa, 1 cm. lata, utrinque pilos septatos vesiculosos numerosos gerentia et glandulis farini-potentibus vestita, costa media erubescente, margine irregulariter et grosse dentata dense ciliata. *Scapus* ad 18 cm. latus infra glaber sub capitulo dense albo-farinosus; capitulum flores deflexos 5–6 evolutos gerens et aliis sterilibus parvis nigro-coronatum; bracteae parvae lanceolatae. *Calyx* cupularis laxus submembranaceus ad 1 cm. longus in flore longistylo tubum corollinum aequans in brevistylo eo brevior extus glandulis farini-potentibus indutus postice atro-purpureus antice viridis vel flavido-viridis; lobi inaequales posteriores maximi ad 5 mm. longi ovati vel rotundati apiculati nunc obscure denticulati. *Corolla* atro-purpurea circiter 2 cm. longa; tubus ad 7 mm. longus exannulatus glaber in limbum glabrum apertum latum infundibuliformi-campanulatum breviter 5-lobatum expansus; lobi late triangulares integri ad 4 mm. longi acuti vel subapiculati. *Stamina* in flore brevistylo ad os tubi corollini in longistylo ad medium inserta; antherae oblongae. *Gynaeceum* in flore longistylo tubum corollinum aequans; ovarium discoideum circiter 1·5 mm. longum; stylus albus; stigma album discoideum recurvum circiter 1·5 mm. diam.

Mount Everest Expedition 1921: 14–15,000 ft.; 15,000 ft., blue; *A. F. R. Wollaston,* 181 and 189, July and August.

1558 **Primula Younghusbandiana,** *Balf. f.* [Primulaceae–Primuleae]; Alba farinosa. *Folia* petiolata; juvenilia 7–8 cm. longa spathulata, parte petiolari complanata 6–7 cm. longa sub parte laminari obovata vel suborbiculari plus minusve dentata gradatim expansa, ubique glandulis longe stipitatis farini-potentibus induta plus minusve praesertim subtus albo-farinosa; lamina adulta elliptica circiter 2·5 cm. longa 2 cm. lata grosse serratodentata subtus rugulosa et dense albo-farinosa; petiolus adultus ut videtur quam juvenilis brevior. *Scapus* 9 cm. longus cum bracteis, pedicellis, et calyce extus intusque plus minusve albo-farinosus vel glandulis longe stipitatis saepe contortis farini-potentibus vestitus; umbella ad 5-flora; bracteae lineari-subulatae ad 1 mm. longae basi submembranaceae expansae et obscure gibbosae; pedicelli graciles ad 2 cm. longi in anthopodium obconoideum circiter 1 mm. longum expansi. *Calyx* ad 7 mm. longus; tubus cupularis anthopodium duplo superans ultra medium 5-lobatus; lobi anguste lineari-lanceolati stellatim expansi acuminati. *Corolla* alba in flore longistylo 1·7 cm. longa; tubus fere 1 cm. longus anguste cylindricus erugulosus glaber ad faucem pentagonam annulo parvo flavido 5-lobatus cinctus; limbi plani discus circiter 1·5 mm. latus; lobi obovales 6 mm. lati integri vel obscure crenulati. *Stamina* infra medium tubi corollini inserta calyce multo breviora; filamenta 0·–2·5 mm. longa strumis corollinis conjuncta; antherae 1·25 mm. longae oblongae apiculatae. *Gynaeceum* tubo corollino brevius calyce paullo longius stigmate ab annulo circiter 2 mm. distante; ovarium globosum stylopodio coronatum; stylus in stigma obconoideum angustum sursum dilatatus. *Capsula* parva calycis cupula paullo aucta inclusa.

Mount Everest Expedition, 1921: Under boulders, 17,500 ft., white; *A. F. R. Wollaston*, 197, September.

Dr. Wollaston writes to me about this species.—It "was the highest species found. It grows up to 18,000 ft. and above. The flowers are white but they fade into a poor kind of pale mauve. The plant is very scarce and was only found on the East (shaded) side of large boulders in the Kharta Valley. I got a small quantity of seed." It belongs to a section of the genus that is purely Himalayan, the species grouping round the Nepalese *P. rotundifolia* of Wallich—not the Sikkim plant in cultivation under that name, which is *P. cardiophylla*, Balf. f. Other species of the series are *P. cana*, Balf. f., and *P. Littledalei*, Balf. f. The epidermal protective devices in this Mt. Everest species are very conspicuous. The plant is everywhere covered with remarkable long-stalked glands often tortuous and interlocking, secreting white meal.

2515 **Gentiana stellata,** *Turrill* [Gentianaceae-Swertieae]; *G. Piasezkii*, Maxim., valde affinis, sed foliis et calyce minus scabris, corollae plicis acutis irregulariter serratis, stylo alte bifido, stigmatibus lamellatis differt.

Herba parva. *Folia* caulina superiora, lanceolata vel spathulato-lanceolata, acuminato-mucronata, sessilia, saepissime lateraliter plicata et plus minusve falcata, usque ad 9 mm. longa, anguste albo-marginata, margine minutissime serrulata, costa in pagina inferiore acuta. *Flores* solitarii ad ramulorum apices positi. *Calyx* tubuloso-conicus, alatus, 1·6 cm. longus, 4 mm. diametro, dentibus subulatis acuminato-mucronatis vix serrulatis 4·5 mm. longis. *Corolla* subhypocrateriformis, usque ad 2·5 cm. longa, tubo 2 cm. longo fauce 5 mm. diametro, lobis anguste ovatis acutis 5 mm. longis, 3·5 mm. latis extus viridibus intus intense coeruleis, plicis late ovatis acutis vel subacutis 4 mm. longis 4·5 mm. latis margine irregulariter serratis. *Stamina* vix exserta, antheris 2·5 mm. longis. *Ovarium* stipitatum, circiter 1 cm. longum, stipite 6 mm. longo, stylo 3 mm. longo, stigmatibus lamellatis fere rotundatis vix revolutis.

Mount Everest Expedition 1921, 14,000–18,000 ft., September, blue, *Wollaston* 215.

This plant is certainly very closely related to *Gentiana Piasezkii*, Maxim., and it has been described as a new species with some hesitation. Of the characters enumerated in the differential diagnosis it seems probable that the shape of the stigmatic lobes will prove most definite.

253 **Gentiana tubiflora,** *Wall.*, var. **longiflora,** *Turrill*, a planta typica floribus longioribus usque ad 4 cm. longis differt.

MOUNT EVEREST EXPEDITION, 1921, 17,000 ft., August, flowers blue, *Wollaston* 212.

The species, *Gentiana tubiflora*, Wall., was originally described from specimens collected in Nepal. It is not uncommon at considerable altitudes in the Central Himalayas and is recorded from Sikkim, Nepal, Kumaon, Tihri-Garhwal and Western Tibet.

6213 **Dracocephalum breviflorum,** *Turrill* [Labiatae–Nepeteae]; affinis *D. heterophyllo*, Benth., sed foliis breviter petiolatis, floribus multo minoribus, calyce fere ad basem in labiis duobus diviso facile distinguitur.

Planta herbacea, caulibus erectis vel subascendentibus breviter hispidulis. *Folia* elliptico-lanceolata, apice acuta vel subacuta, basi rotundata vel subcordata, usque ad 3 cm. longa et 1·4 cm. lata, superne hispidula, inferne subpilosa, margine crenato-dentata, in pagina inferiore costa nervisque prominentibus, in pagina superiore impressis, nervis lateralibus utrinque 5–7. *Inflorescentia* fere spicato-capitata, 3 cm. longa; bracteae primariae foliis subsimiles sed minores et margines plus minusve integrae; bracteae secondariae lanceolatae vel lineari-lanceolatae, acutae, 0·6–11 cm. longae, glanduloso-hispidulae. *Calyx* bilabiatus, hispidulus, glandulis sessilibus instructus, labiis fere ad basem liberis, tubo 1 mm. longo; labium superius 6·5 mm. longum, trilobum, lobis lanceolatis acutis 2 mm. longis trinervis; inferius 5·5 mm. longum, bilobum, lobis anguste lanceolatis apicem versus angustatis acuminatis 3·5 mm. longis. *Corolla* purpurea (ex *Wollaston*), tubo 1 cm. longo fauce ampliato, extra leviter hispidula; labium superius bilobum, lobis subrotundatis 2 mm. longis; inferius trilobum, lobis lateralibus subrotundatis 1·5 mm. longis, lobo medio valde emarginato 3 mm. longo 4·5 mm. lato in linea media piloso. *Stamina* vix exserta, glabra. *Stylus* 1·3 cm. longus, glaber.

MOUNT EVEREST EXPEDITION, 1921, 13,000 ft., July, purple, *Wollaston* 255.

A comparison of this species with *Dracocephalum heterophyllum*, Benth., has been given above, but the alliance is not close, differences being found in the habit, the leaves, and flowers, most especially in the calyx, which in our plant has a remarkably short, common tube only about 1 mm. in length. The calyx is perhaps more distinctly 2-lipped than that of any previously known species of the genus, and though there is little doubt that it should be placed in Briquet's section *Stenodracontes*, it does not appear to be closely related to any of the species composing this section, such as *D. heterophyllum*, Benth., *D. acanthoides*, Edgw., from the Himalayas, and *D. Ruprechtii*, Reg., from Tibet.

XXIV.—MISCELLANEOUS NOTES.

Gift of Orchids by Sir George Holford.—Kew is indebted to Lt.-Col. Sir George Holford for many gifts of plants. In 1913 he presented over 200 orchids, chiefly Cattleyas, Cymbidiums, and Cypripediums, which enriched the collection by adding a large number of the best hybrids of these popular genera. The collection was seriously depleted last year by salt poisoning (see *Kew Bulletin*, 1922, p. 7), and Sir George has generously assisted towards its restoration by presenting over 600 plants, including a large number of Miltonias, Cymbidiums, Cattleyas, Laelias, Laelio-Cattleyas, Brasso-Cattleyas and Dendrobiums, many of them large specimens. The value of this noble gift is very great and visitors to Kew have already been able to appreciate Sir George's generosity as many of the plants are now in flower and making a beautiful display in the Orchid Houses.

Pelargonium citriodorum.—Two very different plants have borne the name *P. citriodorum*. One was described by Cavanilles in 1791 under the name *Geranium citriodorum*,* and was transferred to the genus *Pelargonium* by Martius in 1814.† It is presumably a hybrid, and is evidently related to *P. acerifolium*, L'Hérit.,‡ which was regarded by Harvey§ as a variety of *P. angulosum*, Ait., but is now treated by Knuth‖ as an indepenent species.

The second *Pelargonium citriodorum* appeared as a bare name in C. A. Breiter's Hortus Breiterianus, p. 331 (1817), and was not described until 1828.¶ It is almost certainly a hybrid, and is apparently related to *P. crispum*, L'Hérit. and *P. limoneum*, Sweet, having the narrow lower petals of the former and the general colouration of the latter. It differs from both in the one-flowered peduncles. *P. limoneum* is supposed to be a hybrid, of which *P. crispum* may be one of the parents. As the name *P. citriodorum* is preoccupied, Breiter's *citriodorum* may be known in the future as *P. citrosum*, Voigt, a manuscript synonym quoted by Breiter. The synonymy of the two supposed hybrids is as follows :—

P. citriodorum, *Mart.*, Pl. Hort. Acad. Erlang. Enum. p. 143 (1814); Dietr. Lexik. Gärtn. Nachtr. vi. p. 50 (1820), excl. syn. nonnull.—*Geranium citriodorum*, Cav. Ic. i. p. 6, t. 8 (1791).

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* Cav. Ic. i. p. 6, t. 8 (1791).
† Mart. Pl. Hort. Acad. Erlang. Enum. p. 143 (1814).
‡ L'Hérit. Geraniologia, t. 21 (1787–88).
§ Harv. and Sond. Fl. Cap. i. p. 303 (1860).
‖ Engl. Pflanzenreich, Geraniac. p. 461 (1912).
¶ Schrank in Syll. Pl. Nov., Ratisbon, p. 67 (1828).

P. citrosum, *Voigt ex Breiter*, Hortus Breiterianus, p. 351 (1817), in syn.—*P. citriodorum*, Breiter, l.c., nomen, non Mart.; Schrank in Syll. Pl. Nov. Ratisb. p. 67 (1828), descr.

It may be noted that Dietrich (l.c.) cites *P. citrosum*, Hort., as a synonym of *P. citriodorum*, Mart., and questions whether the latter is synonymous with *Geranium citriodorum*, Cav. This suggests that he may have confused the two hybrids.

T. A. S.

Dates and Date Cultivation of the Iraq.—The subject of Date Cultivation in Mesopotamia was dealt with in the *Kew Bulletin* for 1908, pp. 283–286, and a summary of known authors on the subject in general in the *Bulletin* for 1921, p. 95. The work at present under review was published in 1921 for the Agricultural Directorate of Mesopotamia by W. Heffer and Sons, Ltd., Cambridge. The author, V. H. W. Dowson, states that "the most important area of date cultivation in the Iraq, and, indeed in the whole world is that of the Shat Al'Arab" (opening into the Persian Gulf), where both banks are lined with date gardens from Fao to Qarna a distance of 108 miles, covering over an average width of about a mile on either side of the river, it is estimated, an area of about 138,000 acres of date palms. Bagdad is the next largest centre of date cultivation in the country—it lies amongst 20 miles of date gardens lining both banks of the Tigris. Generally in the Iraq the date palm flourishes everywhere it is watered and attended, from Ana on the Euphrates and Samara on the Tigris southwards. North of these towns the winters are too cold—and nearly all towns in the Iraq are surrounded by date groves and on the Euphrates date groves are common even where there are no towns. Of the many important details that go to make up so thorough an enquiry into the Agricultural practice of a cultivation like the present, it may be sufficient to select a few details on the subjects of fertilization, yield and other crops to be found in the date gardens, as being of special interest.

"Wind pollination cannot be relied upon, and if the pollen from the male flowers does not reach the stigmas of the female flowers, the latter develop into small, stoneless fruit (*A. Shish*) of very little value. Hence, to ensure that fertilization (*A. Ligah*) takes place, the *fellah* in every properly cultivated garden takes a sprig of the ripe male inflorescence (*A. Talaa*, or, more rarely, *Goosh*) and sets it firmly in the middle of that of the female. Both the male and female inflorescences are enclosed in woody spathes (*A. Sharaba*, pl. *Sharabat*) which split open before the flowers mature. It is the custom for the whole, unopened, male spathe to be cut from the palm immediately before ripening and the inflorescence extracted therefrom through an artificial incision, and left a day or two in a small basket to mature. In this way no pollen is wasted. If the *fellah* sees an unopened spathe among the female inflorescences he is fertilizing, he frequently splits it open and sticks the male sprig amongst its unripe flowers. In a day or so these will ripen, and there will be sufficient pollen left to fertilize them. The *fellah* thus is saved a second journey up the palm." "Occasionally, when the male pollen is scarce, or where there is an unusually large number of females to fertilize in a short time, the pollen is shaken out of the ripe male flowers and tied up in a bag of fine muslin. This bag is tied to the end of a stick. The *fellah* can quickly fertilize a large number of female inflorescences by dusting them with this bag." The period may vary within a week or two but the writer when in Amara in 1918 and 1919 found the process of fertilization confined to the month of April.

A number of tables are given from which a few facts are drawn—"Palms are most dense in Area D, where the average number is 176 per acre, and least dense in Area E, where the average is 84 per acre. The relative frequencies are illustrated in Sketch Map III."

"Throughout the Shat Al 'Arab date zone the average frequency of palms and fruit trees per acre appears to be as follows :—Total Palms and Trees, 179. Total Palms, 140. Total Female Palms, 122 :—"Istaamran" 59, "Halawi" 36, "Khadhrawi" 10, "Dairi" 5, "Zahidi" 3, "Digal" 3, "Gantar" 2, "Braim" 2, "Shoorar" 1, "Others" 1. Total Male Palms, 3 :—"Gainami" 1, "Khikri" 1, "Others" 1. Total Offshoot Palms, 15 :—"Halawi" 9, "Istaamran" 4, "Zahidi" 1, "Others" 1. Total Fruit Trees, 39 :—"Fig" 9, "Pomegranate" 8, "Citrus" 6, "Vine" 4, "Mulberry" 3, "Quince" 3, "Nectarine" 3, "Apple" 1, "Peach" 1, "Apricot" 1. Other crops in the date gardens included fruits, in addition to those above-mentioned, the "Olive," "Jujube," "Water Melon," &c., several of the ordinary vegetables—"Beetroot," "Cabbage," "Turnip," "Onion," &c. and various, as "Rice," "Wheat," "Barley," "Cotton," "Lucerne," "Ground-nut," "Sesame," &c.

The average yield of "tamar" dates (the third and last stage in the ripening of the date, usually toffee-like and dark coloured, the form in which dates are seen in foreign markets) per acre in the Shat Al 'Arab date lands in the year 1919 appears to have been 4920 lbs. made up as follows :—"Istaamran," 2183 lbs.; "Halawi," 1584 lbs.; "Khadhrawi" 300 lbs.; "Dairi," 160 lbs.; "Zahidi," 378 lbs.; and "Others," 315 lbs.; Total, 4920 lbs.

"The price of dates fluctuates rapidly and between wide limits, so that it is not easy to state with any exactness what is the average price. A very rough approximation to the prices paid to garden-owners during the last two years would be somewhat as follows :—

"Istaamran"	Rs. 300 a Kara of 6048 lbs.	"Halawi"	Rs. 400 a Kara of 6048 lbs.
"Dairi" -		"Khadhrawi"	
"Others" -		"Zahidi" -	Rs. 250 a Kara of 6048 lbs.

"Taking these figures as a basis, the gross value of *tamar* dates per acre of Shat Al 'Arab date lands would seem to lie somewhere about 272 Rs. Many conversations with garden-owners tend to confirm this figure. The value per acre over the whole district of the "khalal" (second stage in the development, generally yellow) and "ratab" (soft, juicy—between the hard "khalal" stage and toffee-like "tamar" stage) dates sold might be estimated roughly at 20 Rs."

"No attempt was made during the inquiry to ascertain the value of the fruit other than dates produced in this region. Its value per acre in Areas A and D (*vide* Table xiv.) must be considerable : elsewhere it is negligible."

The primary object of the inquiry was stated to be that of providing reliable statistics of the average yield of dates per unit area with the view to discovering a broad basis for equitable taxation." For the rest the work covers Cultivation, Marketing, Uses, Diseases, Vocabulary of Terms and Map—showing distribution of Date-palms in the area covered by the report and it is well illustrated. The whole is in two parts and a third is promised.

J. H. H.

Rangachari's Manual of Elementary Botany*.—After five years Mr. Rangachari has issued through the Madras Government Press a second edition of his Manual of Elementary Botany for India. The object of the present edition is to enlarge the scope of the Manual and to make it more suitable for general use in the wider circle of professional colleges. It was originally intended for the students of the Coimbatore Agricultural College but has proved of much wider use. Five chapters have therefore been added dealing with the cryptogams of the Indian flora and two more giving introductory essays on evolution, heredity and mendelism.

There must be some doubt, however, whether this edition will be widely required in the north of India, for in the interval between the issue of the two editions a strong competitor has sprung up in the shape of Prof. Bose's Manual intended especially for Calcutta students and a smaller (though of equivalent scope) cheaper and better printed book. Under these circumstances it is unfortunate that the Government Press of Madras have not improved on the first edition. The paper on the contrary is not so good and the printing both of the letterpress and of the illustrations is much worse.

It must however be admitted that the matter both of the original part and of the additional chapters is excellent and reflects great credit on Mr. Rangachari as a careful and successful teacher.

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* K. Rangachari. A Manual of Elementary Botany for India. (Second edition; revised and enlarged), Madras 1921.

Botany of Juan Fernandez and Easter Island.*—The first part of the volume under consideration was noticed in the Kew Bulletin for 1921, p. 48. The present part contains four papers as follows :—" Die Gasteromyceten der Juan Fernandez und Osterinseln " by T. C. E. Fries, " Freshwater Algae from Juan Fernandez and Easter Island " by K. Münster Ström, and two papers by Dr. Skottsberg dealing with the Phanerogams of Easter Island and Juan Fernandez respectively.

The flora of Easter Island is poor. Skottsberg records 30 species of native Phanerogams, 12 for the first time. Four are considered to be endemic, and three represent an American element; the majority, 23, are Australian and Polynesian.

The Phanerogams considered indigenous to Juan Fernandez number 142. In his two visits to the islands Dr. Skottsberg has added 41 species not previously recorded, 31 of these being listed in the present paper for the first time. The peculiar nature of the Juan Fernandez flora is well brought out by the following figures. Of the genera, 81 in number, 10 are endemic, and *Lactoris* is the type of a separate order. Of the 142 species 98, or 69 per cent. are endemic. There is a marked floristic difference between the floras of the two chief islands, Masatierra and Masafuera.

It is pointed out that many of the endemic types are extremely scarce and it is suggested that the leading scientific circles of the world might well join in an action for the protection of Juan Fernandez. Goats and the spread of " maqui," *Aristotelia maqui*, are the worst causes of the reduction of the indigenous vegetation.

Dr. Skottsberg's valuable contributions to taxonomic and geographical botany are enhanced by his careful references to exact localities and dates of collecting. Many valuable discussions regarding systematic points are to be found in the text and are often illustrated by clear text-figures and plates.

W. B. T.

Agricultural News.—In the issue of March 18, 1922, of this well-known publication of the Imperial Department of Agriculture for the West Indies, it is announced " that consequent on the amalgamation of the Imperial Department of Agriculture with the West Indian Agricultural College, and pending a reconsideration of West Indian requirements in respect of agricultural literature, the publication of this Journal will cease as from March 31 of the current year." It is further announced that the present number (for March 18) is the last that will be issued. There is cause for regret that this useful fortnightly review, which was founded in April 1902 by Sir Daniel Morris, the first Commissioner of the Imperial Department of Agriculture for the West Indies, has thus come to an end. From first to last it has been published at one penny each number, and must have proved

* The Natural History of Juan Fernandez and Easter Island, edited by Dr. Carl Skottsberg. Vol. II., Botany, Part ii. Uppsala 1922, Almqvist and Wilssells.

of great service to all interested in tropical agriculture and especially to agriculturists and planters in the West Indies, for whose benefit it was chiefly intended. Many will entertain the hope expressed in an editorial article which appears in the final issue of the paper that after a while the new West Indian Agricultural College will undertake the publication of a journal which will efficiently continue the work of that now suspended.

Referring to the West Indian Agricultural College a preliminary announcement is made in the Agricultural News to the effect that the College is expected to be open for the reception of a limited number of students in October next. More definite information will be given to West Indian Governments and educational institutions in due course, and in the meantime inquiries may be addressed to the Chief Clerk and Registrar, Imperial Department of Agriculture, Barbados.

Guayule Rubber in Mexico.—*Parthenium argentatum*, known as the Guayule Rubber Plant, a native of Mexico is of bushy habit and slow growth and unlike other rubber producers the rubber is extracted by mechanical methods. Much has been done during recent years by American scientists in the way of seed selection and hybridisation to select the best producers for cultivation and immense sums of money have been expended in perfecting machinery for handling the plants and extracting the rubber. The industry has been seriously handicapped from its infancy owing to revolutions in Mexico and now that the price of rubber has dropped to such a low figure the prospects of the industry are not encouraging. The American Consul at Torreon, Coahuila, writing under date March 10th last (Commerce Report No. 15, p. 105), gives the following particulars—" Owing to the drop in the price of rubber, the Guayule rubber industry, formerly of considerable importance in the Torreon District, was of little consequence during the year 1921, all four rubber factories being closed and apparently abandoned, except the Continental-Mexican Rubber Co., the largest and most important, which owns a million-dollar plant and spent the year 1921 remodelling it and introducing a cheaper system of extracting rubber from the Guayule plant, which grows abundantly in the mountains of this district. On January 1st, this company again began operations and is still working full force, although, owing to the recent drop in the price of rubber, manufacturing is being carried on at a loss and will continue to operate about two months more, until the stock of Guayule plants on hand is used up. If, at the expiration of this period, the price fails to go up to 20 cents. or more, this plant will be forced to close down indefinitely. The three other plants, in Gomez Palacio, across the river from Torreon, are now closed and with present prices of rubber have no prospects of opening again unless the market for rubber soon changes for the better." Previous notes on Guayule have appeared in *K. B.* 1907, p. 285, 1908, p. 255, and 1910, p. 211.

J. M. H.

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ROYAL BOTANIC GARDENS, KEW.

BULLETIN
OF
MISCELLANEOUS INFORMATION.

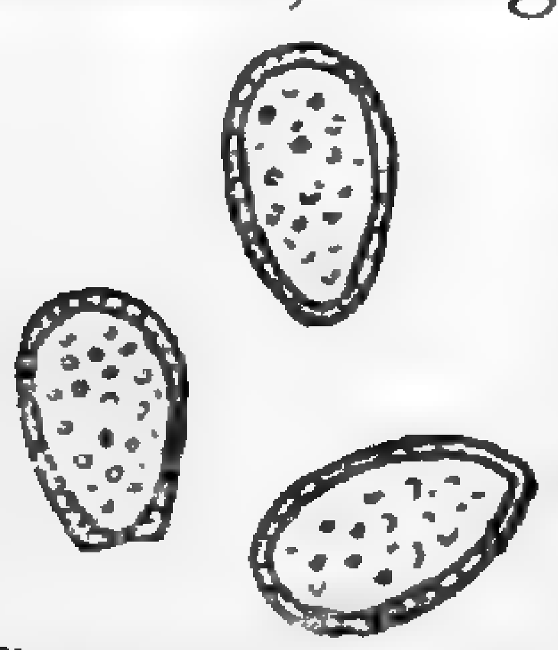
No. 5] [1922

XXV. FUNGI EXOTICI. XXVI.

E. M. WAKEFIELD.

Ganoderma simulans, *Wakef.*

Pileus sessilis vel lateraliter stipitatus, circa 8 × 5–7 cm., 1–1·5 cm. crassus. *Superficies* nigra, nitida, tenuiter incrustata, glabra, radiato-rugulosa, marginem versus plus minus anguste sulcata, margine obtuso, deflexo, undulato, concolore. *Hymenium* applanatum vel concavum. *Contextus* pallidus, lignoso-fibrosus, 2 mm. crassus (raro 3–5 mm.). *Tubuli* pallide brunnei, 5–10 mm. longi. *Pori* minuti, punctiformes, crasse tunicati, albido-grisei vel isabellini. *Sporae* ovoideae, apice demum truncatae, ferruginosae, punctatae, 20–23 × 12·5–13μ.



Ganoderma simulans. Spores × 500.

TROPICAL AFRICA. Mwachi River, Mazeras, growing from the dead roots of trees, *T. D. Maitland*, No. 556, Mar. 1921.

The fungus is said to be fairly plentiful in the locality where found. Sessile, somewhat ungulate forms are found attached to stumps, while the stipitate forms grow up from buried roots, as in the case of *G. lucidum.*

The name *simulans* has been given to the species on account of its remarkable resemblance to *Fomes subresinosus*, Murr. So striking is this that the suspicion remains that they must be connected. Yet careful search has failed to disclose any trace of Ganoderma spores in the specimens of *F. subresinosus* examined, while in this plant they are very abundant. On the other hand it is to be noted that the spores of *F. subresinosus* are not hyaline and globose as described, but large (17–20 × 10–12·5μ), ovoid, and slightly tinged with brown. They are however perfectly smooth, and have no indication of the outer hyaline wall characteristic of Ganoderma. The spores of *F. subresinosus* are in fact like those of the genus Amauroderma.

Hexagonia sericata, *Wakef.*

Pileus applanatus, dimidiato-sessilis. 11–17 cm. latus, 7–9 cm. longus, fusco-umbrinus, unicolor, radiato-sericeus, zonis angustis concentricis notatus, postice vix tomentoso-velatus. *Tubuli* ad 7 mm. longi, rigidi, tenuiter tunicati, intus subglaucescentes.

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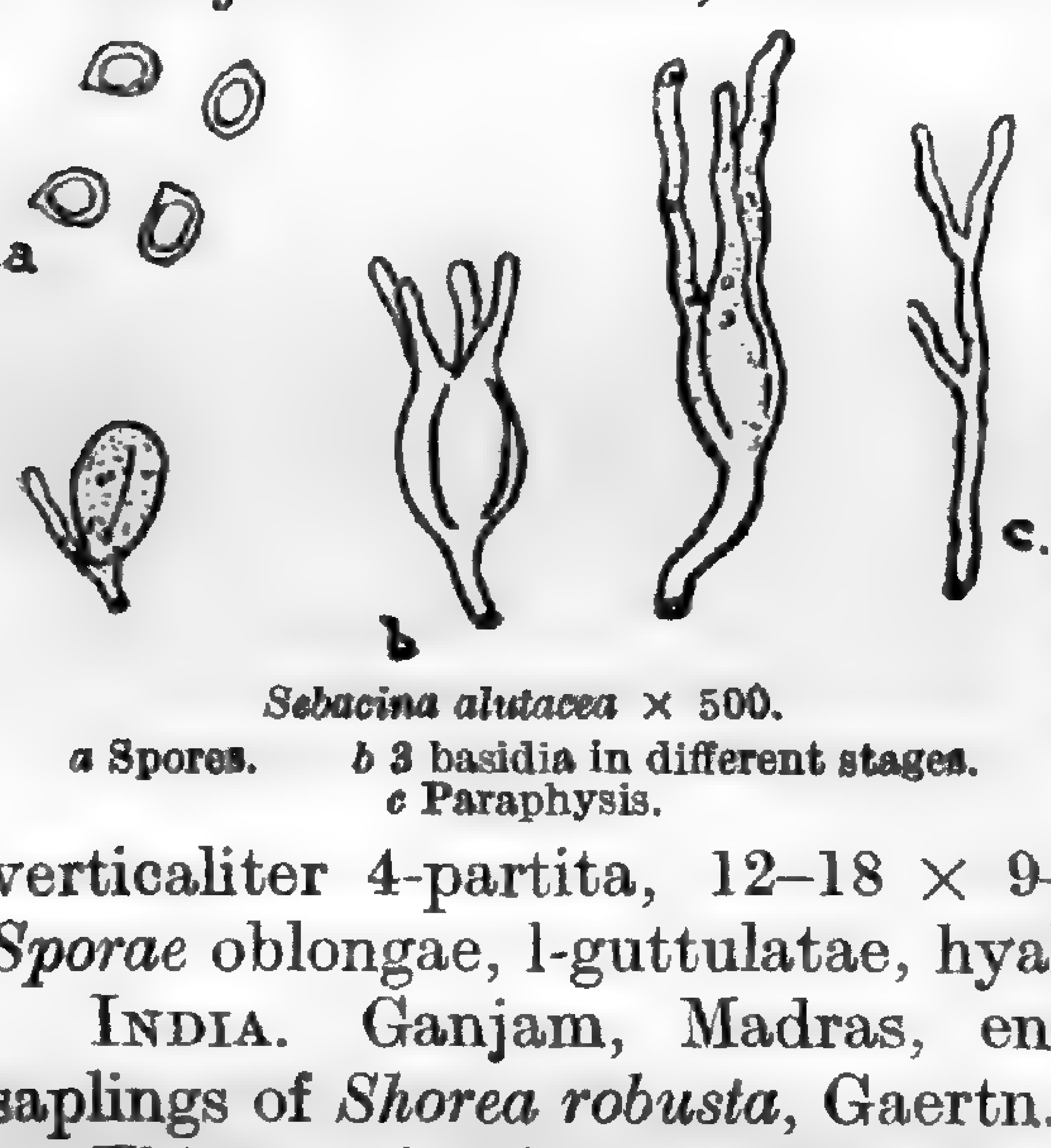
Pori elongato-hexagonales, concolores, 3–4 mm. diametro. *Sporae* non visae.

TROPICAL AFRICA. Nairobi, on dead wood, *Dr. Van Sumerun*, Oct. 1920.

A beautiful species, of a uniform dull brown colour ("Mummy Brown" of Ridgway), with large fairly regular pores. It evidently belongs to the same section as *H. subvelutina* Wakef., but differs from that species in its regular shape, and especially in colour. The silky appearance of the pileus is a marked character. Bearing in mind the very different appearances which *H. Pobeguini* may assume at different stages, it seems just possible that both this plant and *H. subvelutina* may be forms of one species. The three fine specimens in the present collection are however all alike and show no suggestion of transition.

Sebacina alutacea, *Wakef.*

Fungus late effusus, incrustans, in sicco alutaceus, coriaceus. *Hymenium* laeve, alutaceum, margine sterile albido fimbriato. *Subiculum* crassum; stratum basale ex hyphis confertis parallelis, stratum medium ex hyphis tenacibus ramosis laxe intertextis 2 diam. constitutum. *Paraphyses* erectae, flexuosae, filiformes, sursum ramosae, 1·5–2μ diametro. *Basidia* ovoidea, verticaliter 4-partita, 12–18 × 9–12μ, sterigmata 20–30 × 3μ, *Sporae* oblongae, 1-guttulatae, hyalinae, laeves, 6–8 × 5–6μ.



Sebacina alutacea × 500.
a Spores. *b* 3 basidia in different stages. *c* Paraphysis.

INDIA. Ganjam, Madras, encrusting the bases of young saplings of *Shorea robusta*, Gaertn. f., *A. F. Minchin*, Aug. 1918.

This species is very close to *S. incrustans*, Tul., which it resembles in habit, texture, and colour when dry. The specimen sent is almost entirely resupinate, but there is evidence of a tendency to form small columnar or fan-shaped outgrowths such as occur in *S. incrustans.* The present plant differs chiefly in the smaller size of hyphae, basidia, and spores. In structure it shows three very distinct layers, hymenium, a medial layer of loosely woven hyphae, and a basal layer of close parallel hyphae next the substratum.

Ustilago verruculosa, *Wakef.*

Sori ovaria deformantes, fusco-cinnamomei, membrano griseo demum sursum operto tecti. *Sporae* subglobosae, pallidae, crasse denseque verruculosae, cum verrucis 18–22μ diametro, hyphis sporisque majoribus hyalinis intermixtis.

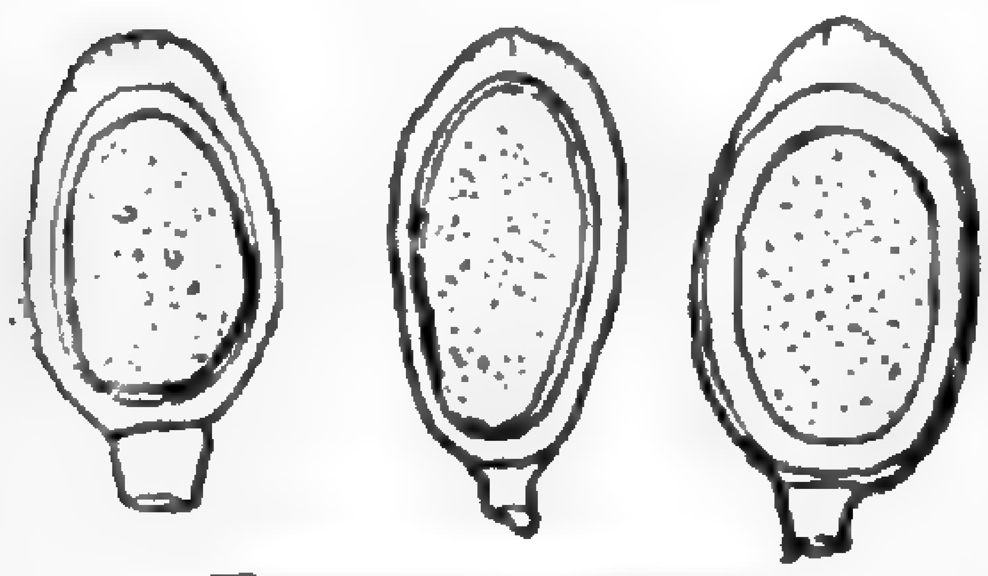
Ustilago verruculosa.
Spores × 500.

TROPICAL AFRICA. Congo, in the ovaries of *Setaria aurea,* A.B., *H. Vanderyst,* No. 5054, Jan. 1914.

The species differs from *U. Setariae-aureae*, P. Henn. and *U. Evansii*, P. Henn., both of which occur on the same host, in the pale colour of the sori, and the larger, very coarsely warted spores. The latter spore-characters distinguish it also from *U. heterospora*, P. Henn., to which it is very closely related.

Uromyces pustulatus, *Wakef.*

Sori teleutosporiferi varii, in ramulis foliisque minuti, rotundati, 1–1·5 mm. diametro, in fructibus elongati, confluentes, pustulas ad 2·5 cm. longas efformantes, primo epidermide tecti, demum erumpentes, castanei, pulverulenti. *Teleutosporae* ovatae, ellipsoideae, pyriformes, vel compressione angulatae, minutissime echinulatae, 22–35 × 19–20μ, apice hyalino incrassato. *Pedicelli* hyalini, decidui, ad 30 × 3μ.



Uromyces pustulatus.
Teleutospores × 500.

TROPICAL AFRICA. Kibos, Mombasa, on leaves, inflorescences, and fruits of *Bauhinia fassoglensis*, Kotschy, *T. D. Maitland*, Feb. 1921.

Among the various species of *Uromyces* found on *Bauhinia* this one is noteworthy for occurring on leaves, peduncles and fruits. On the leaves and stems the pustules are of the usual small round type, but on the pods they become large and confluent, forming eventually very large raised pustules which give a "scabby" appearance to the fruit.

The teleutospores resemble closely those of *U. goyazensis*, P. Henn., both in shape and in the fact that the markings on the epispore are very fine, and only clearly visible when the spore is examined dry or in lactic acid. The markings in *U. pustulatus* are however in the form of very fine warts, not reticulations such as are described for *U. goyazensis*.

When the teleutospore is mounted in water the wall swells up and becomes more distinct. At the same time it loses its markings and becomes perfectly smooth, except at the thickened hyaline apex, where a little fine warting is visible.

Many of the sori in the present gathering are parasitised by *Tuberculina*.

Mycosphaerella Tristaniae, *Wakef.*

Maculae amphigenae, rotundatae, ad 1·2 cm. diametro, rubiginosae, linea fusca delimitatae. *Perithecia* immersa, sparsa, punctiformia, amphigena. *Asci* ovati vel pyriformes, 20–25 × 12μ. *Sporae* subdistichae, oblongae, utrinque rotundatae, circa 7–10 × 2·5–3μ.

FEDERATED MALAY STATES. Penang Hill, on living leaves of *Tristania Griffithsii*, Kurz, *T. F. Chipp*, No. 4694, Aug. 1919.

Diaporthe (Chorostate) curvatispora, *Wakef.*

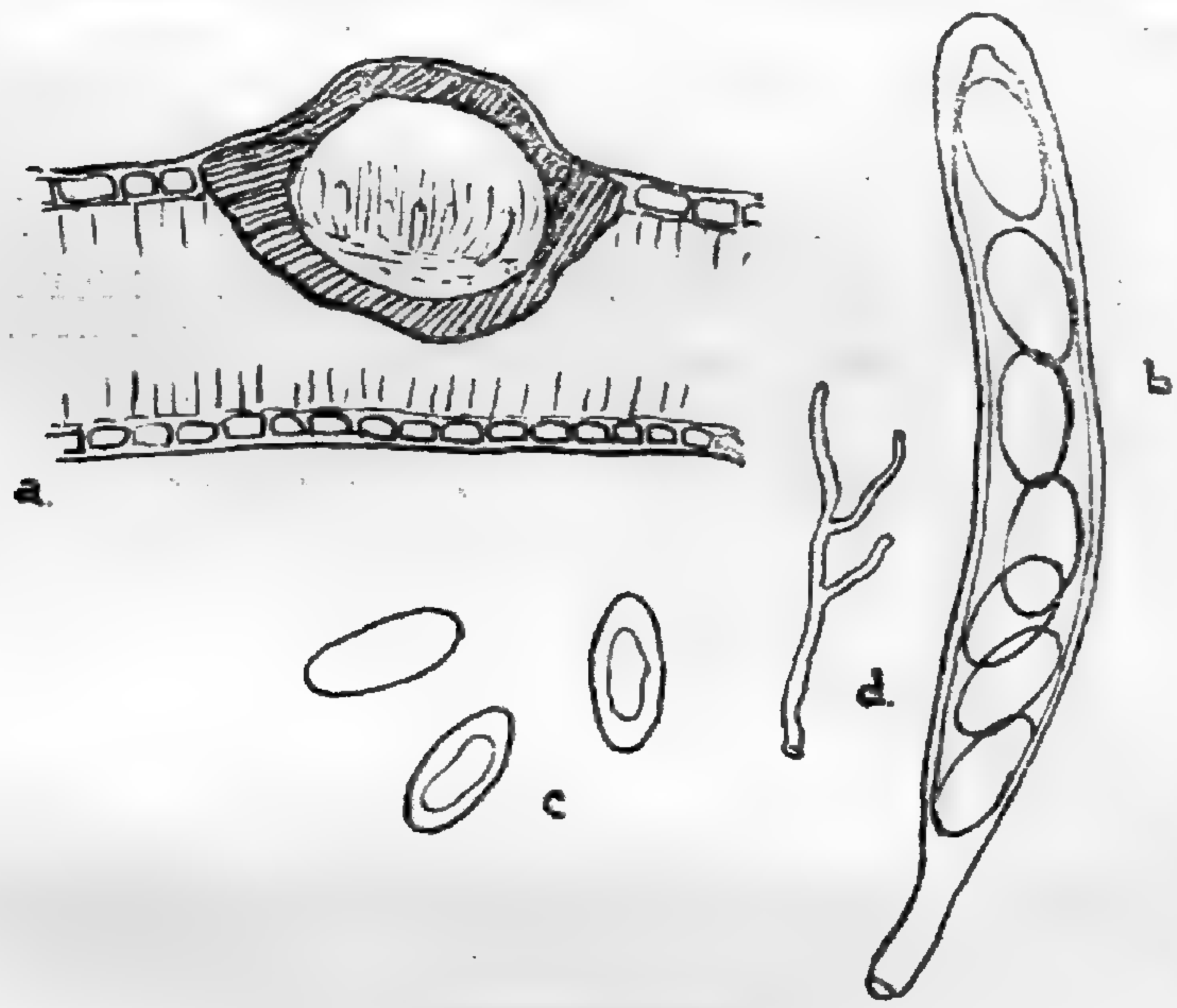
Diaporthe curvatispora.
Ascus and 3 spores × 500.

Stromata sparsa, minuta, valsea, epidermide pustulato-elevata tecta. *Perithecia* in singulo stromate pauca (3–4), subglobosa, ostiolis subconvergentibus. *Asci* cylindracei, apice truncati, sessiles vel brevissime stipitati, 80–90 × 12μ. *Sporae* distichae, hyalinae, fusoideae, inaequilaterales, curvatae, uniseptatae, non constrictae, 28–32 × 4·5–5μ.

INDIA. Sibsagar, on bark of *Mesua ferrea,* Linn., *R. S. Hole,* Nov. 1921.

Phyllachora Proteae, *Wakef.*

Stromata epiphylla, sparsa, minuta, circa 50μ diametro, rotundata, nigra, clypeo epidermali centro elevato tecta. *Loculi* peritheciiformes, solitarii, in mesophyllo immersi, globosi, pariete stromatico atro crasso circumdati. *Asci* paraphysati, cylindracei, brevissime stipitati, 120–150 × 12–15μ. *Paraphyses* ramosae, filiformes, ascos superantes. *Sporae* monostichae, ovatae, utrinque angustatae, 19–22 × 8–9μ.



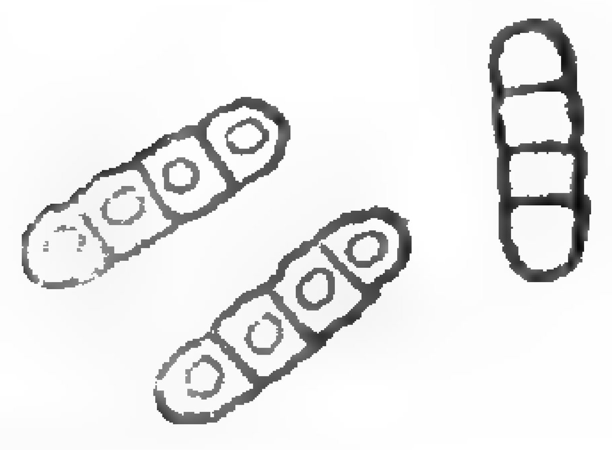
Phyllachora Proteae.
a Stroma vertical section.
b Ascus, *c* Spores, *d* Paraphysis } × 500.

SOUTH AFRICA. Klapmutz, Cape Colony, on leaves of *Protea mellifera,* Thunb. *P. A. Van der Bijl,* No. 357.

The unilocular stromata would suggest the genus *Oligostroma,* Syd., the type species of which also occurs on Protea. The present plant however differs entirely from *O. Proteae* not only in habit but also in microscopic characters. In *O. Proteae* the stromata are aggregated to form conspicuous, raised black spots, whereas in *P. Proteae* they remain as minute solitary spots, sunken except for the central portion where the ostiole occurs. In section the stromatic wall surrounding the loculus is more strongly developed than in *O. Proteae,* and there is a distinct, though very small, epidermal clypeus. Furthermore the spores are those of the genus *Phyllachora,* shorter than those of *Oligostroma* and not septate.

Hendersonia Osteospermi, *Wakef.*

Maculae orbiculares, concentrice zonatae, pallidae, zona obscuriore brunnea circumdatae. *Pycnidia* epiphylla, sparsa, minuta, pariete tenui plectenchymatico. *Conidia* cylindracea fusca, asperulata, 3-septata, non vel vix constricta, 20–23 × 6–7μ.



Hendersonia Osteospermi.
Conidia × 500.

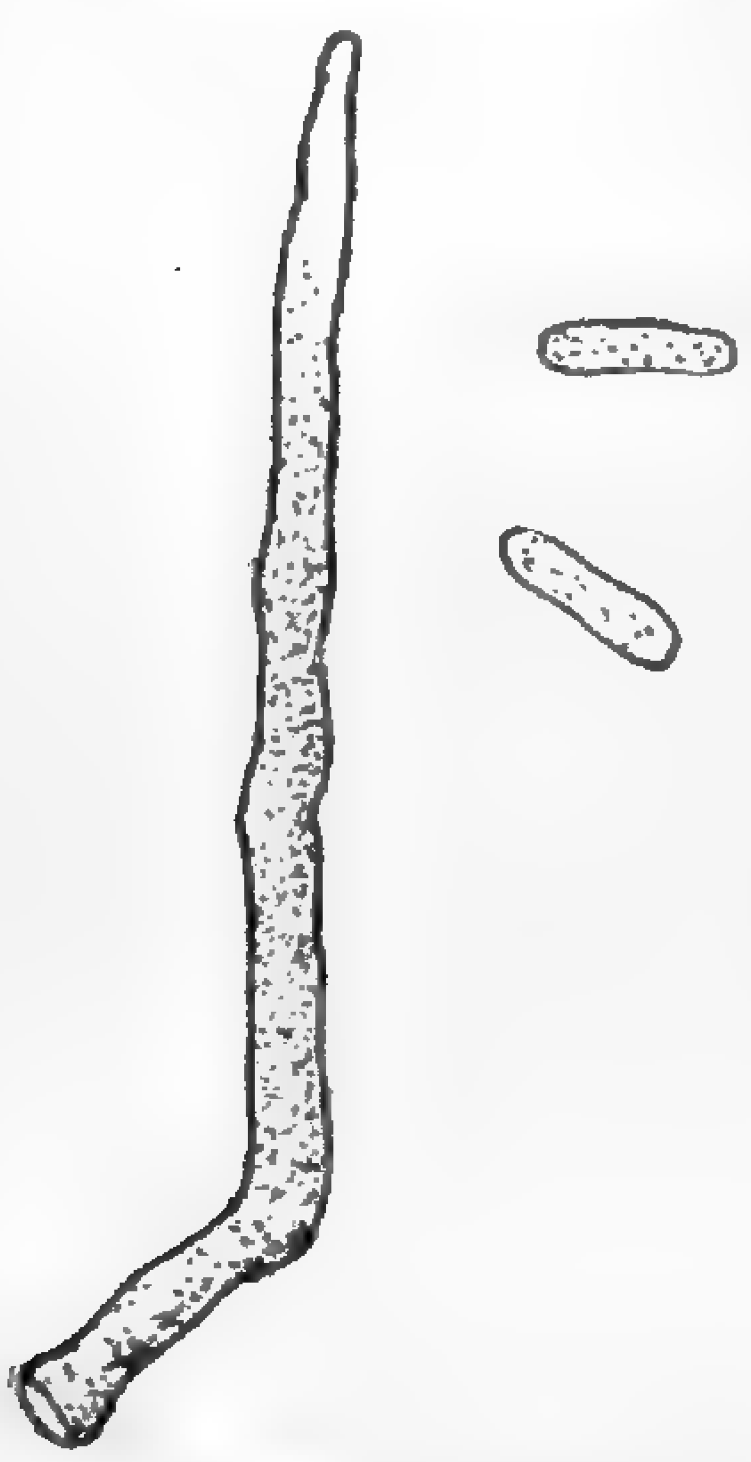
South Africa. Kewboom, Cape Province, on living leaves of *Osteospermum*, *P. A. Van der Bijl*, No. 409.

The species is characterised by the irregular outline of the spores. The wall can scarcely be called verrucose, but apparently a few minute flattened warts are present which give a somewhat wavy appearance when the spore is viewed in optical section.

Colletotrichum Pterocelastri, *Wakef.*

Maculae amphigenae, parvae, 1–1·5 mm. diametro, sparsae vel confluentes, pallidae, purpureo-cinctae. *Acervuli* minutissimi, atri, pauci, in centro macularum insidentes. *Setulae* numerosae, fuscidulae, cylindraceae, apice hyalino rotundatae vel attenuatae. *Conidia* oblonga, hyalina, guttulata, 15–17 × 4μ.

South Africa. Knysna, Cape Province, on living leaves of *Pterocelastrus variabilis*, Sond., *P. A. Van de Bijl*, No. 404.



Colletotrichum Pterocelastri.
Seta and Conidia × 500.

XXVI.—CONTRIBUTIONS TO THE FLORA OF SIAM.

Additamentum XII.

W. G. Craib.

Tetracera Loureiri, *Pierre mss.* nom. nov. *T. fragrans*, Ridley in Journ. Str. Br. Roy. As. Soc., No. 59, p. 62 (1911) *non* Willdem. et Th. Dur. (1899). *T. sarmentosa*, Vahl, var. *Loureiri*, Finet et Gagnep. in Fl. Gén. Indo-Chine, I. p. 16. *T. assa*, DC., var. *Loureiri*, Finet et Gagnep. in Bull. Soc. Bot. Fr., Mém. 4, p. 3.

Bangkok, *Zimmermann* 74, 180, *Kerr* 4357, *Marcan* 325, *Mrs. Williamson* (ex *Ridley*, l.c.), Anghin, *Schomburgk* 261. Srirăcha, *Mrs. D. J. Collins* 243. Muong Pran, *Pierre* 225. Luang, *Pierre* 224. Prachuab, *Winit* 318.

Distr. Perlis, Cambodia, Cochinchina.

Siamese name, Thao orakon (ex *Winit*).

412 **Manglietia Garrettii,** *Craib* [Magnoliaceae-Magnolieae]; a *M. glauca*, Blume, foliis majoribus, pro rata angustioribus, nervulis rete laxius efficientibus, fructu majore recedit.

Arbor ramulis primo adpresse puberulis cito glabrescentibus cinereis pauci-lenticellatis. *Folia* oblanceolato-oblonga vel oblonga, apice obtuse acuminata, basi cuneata lateve cuneata, ad 28 cm. longa et 9·3 cm. lata, rigide chartacea, glabra, subtus pallidiora, nervis lateralibus utrinque 12–16 intra marginem anastomosantibus supra subprominulis subtus prominentibus, nervulis reticulationem pagina utraque subprominulam efficientibus, margine integra; petioli ad 3 cm. longi, supra parum canaliculati; stipulae fugaces, 4 cm. longae, adpresse ferrugineo-puberulae. *Flores* adhuc ignoti. *Fructus* ei *M. glaucae*, Blume, similis sed major.

S.W. of peak Doi Pah Khow, near crest of ridge, 1320 m., *Garrett* 114.

473 **Michelia Kerrii,** *Craib* [Magnoliaceae-Magnolieae]; ab affini *M. Champaca*, Linn., foliis arcte reticulatis subtus saltem juvenilibus glaucis, floribus albis differt.

Arbor circa 10 m. alta (ex *Kerr*); ramuli graciles, juventute molliter adpresse ferrugineo-pubescentes vel subsericei, mox glabrescentes, fusco-corticati, inconspicue pauci-lenticellati. *Folia* lanceolata, oblongo-lanceolata, vel late lanceolata, apice acuminata vel gradatim angustata, summo apice breviter apiculata, basi saepissime inaequilateralia, cuneata, vel saepe latere altero cuneata, altero fere rotundato-cuneata, usque ad 15 cm. longa et 4·3 cm. lata, rigide chartacea, primo supra pilis sericeis sparse instructa, subtus pilis brevibus albis densius instructa, mox glabra vel fere glabra, supra sicco viridia, subtus saltem juvenilia sed saepissime et matura glauca, nervis lateralibus utrinque circa 12 bene intra marginem anastomosantibus pagina superiore subconspicuis inferiore conspicuis, nervulis rete pagina utraque prominulum efficientibus, petiolo ad 1·5 cm. longo supra anguste canaliculato suffulta; stipulae fugaces, circa 1·3 cm. longae, extra adpresse ferrugineo-pubescentes. *Flores* axillares, solitarii, albi, odorati (ex *Kerr*); alabastra anguste ovoidea vel oblongo-ovoidea, acuminata, adpresse ferrugineo-pubescentia; pedicelli breves. *Petala* 12, acutiuscula, 2·5 cm. longa, 4 mm. lata, glabra. *Stamina* 6·5 mm. longa, connectivo excurrente apiculata. *Gynophorum* circa 3 mm. longum. *Carpella* breviter pubescentia, stylo 1·25 mm. longo.

Doi Sutep, c. 1650 m., evergreen jungle, *Kerr* 4679.

Canangium fruticosum, *Craib* [Anonaceae-Unoneae]; *C. odorato* (Hook. f. et Thoms.), simile sed habitu humiliore, foliis basi saepissime cuneatis, pedicellis longioribus differt.

Frutex 3–4-metralis (ex *Kerr*); ramuli graciles, juventute densius breviter griseo-pubescentes, mox puberuli, demum glabri, cortice rubro-brunneo vel fusco-brunneo parcius sed conspicue lenticellato reticulato obtecti. *Folia* late lanceolata, oblongo-lanceolata, vel rarissime elliptica, apice longius acuminata vel fere caudato-acuminata, summo apice acuta, basi cuneata, rarius rotundato-cuneata, ad 13·5 cm. longa et 4·8 cm. lata, chartacea, subtus pallidiora, ad costam nervosque laterales pagina utraque crispatim puberula, nervis lateralibus utrinque 6–8 supra conspicuis subtus prominulis, nervulis inter se sat distantibus subtus subconspicuis, margine integra; petioli graciles ad 1 cm. longi, ut ramuli pubescentes, supra anguste canaliculati. *Flores* ramulis novellis gesti, pedicellis gracilibus usque ad 5 cm. longis densius griseo-puberulis suffulti. *Sepala* 3 (interdum 4), deltoidea, acutiuscula, fere 1 cm. longa, 6 mm. lata, dorso densius griseo- vel fulvo-griseo-puberula, intra medio fere glabra, marginem apicem et basem versus similiter puberula. *Petala* saepissime 6, rarius 8, ad 7 cm. longa et 6 mm. lata, pagina utraque juventute ut sepala puberula, mox sparsius puberula. *Receptaculum* dense breviter pubescens. *Stamina* apiculo puberulo circa 1 mm. longo incluso 2·5 mm. longa. *Carpella* glabra.

Chiengmai, 300 m., cult., *Kerr* 3219. Bangkok, under 5 m., commonly cultivated, *Kerr* 4435.

Lao name, Săbŭn nga kûa (ex *Kerr*).

Goniothalamus Marcanii, *Craib* [Anonaceae-Mitrephoreae]; *G. tamirensi*, Pierre ex Finet et Gagnep., affinis, sed minus pubescens, foliorum paginae inferioris et ramulorum pilis brevioribus, foliorum nervis lateralibus minus patulis, petalis exterioribus minus angustatis.

Fruticulus circa 2 m. altus (ex *Kerr*); ramuli juventute densius ferrugineo-pubescentes, mox puberuli, demum glabri, cortice fusco-brunneo obtecti, lenticellis sparsis. *Folia* oblonga, apice breviter obtuse acuminata, basi cuneata vel rotundato-cuneata, saepe inaequilateralia, 11–17 cm. longa, 4–5·7 cm. lata, chartacea vel rigide chartacea, supra primo parce pubescentia, cito glabra nisi ad costam saepe puberula, subtus ad costam breviter ferrugineo-pubescentia, aliter demum fere glabra, nervis lateralibus utrinque 9–12 intra marginem anastomosantibus supra conspicuis parumve prominulis subtus prominulis, margine integra, petiolo 7–10 mm. longo ut ramulis ferrugineo-pubescente suffulta. *Flores* solitarii, supra-axillares, viridi-lutei (ex *Kerr*). *Sepala* ovata vel elliptico-ovata, acuminata, acutiuscula, 6 mm. longa, 5·5 mm. lata, dorso sparse ferrugineo-hirsuta, intra glabra, ferrugineo-ciliata. *Petala* exteriora ovata, obtusa, ungui lato circa 3 mm. longo incluso 1·4 cm. longa, 9·5 mm. lata, utrinque sparsius adpresse pubescentia, interiora 1·1 cm. alta, extra adpresse pubescentia, inferne ciliolata. *Receptaculum* longius sed haud dense pubescens. *Stamina* 1·5 mm. longa, apice truncata et puberula. *Carpella* 1·25 mm. alta, ovulis duobus subbasilaribus, stylo 2 mm. longo.

Srirăcha, evergreen jungle, *Marcan* 143, *Kerr* 4129.

Goniothalamus desmoides, *Craib* [Anonaceae-Mitrephoreae]; species nova facie *Unonae discoloris*, var. *siamensi*, Scheff., similis, ovario adpresse pubescente, stylo perbrevi, stigmate grandi, ovulo subbasilari solitario distinguenda.

Frutex, ramulis juventute dense plus minusve adpresse ferrugineo-tomentellis. *Folia* oblonga vel oblanceolato-oblonga, apice acuminata, subobtusa, basi rotundata, cuneato-rotundata vel cordatula, ad 15 cm. longa et 5·5 cm. lata, chartacea, supra nisi ad costam ubi pubescentia puberulave matura glabra, juvenilia aliter haud diu albo-pilosa, subtus breviter cupreo- vel rufo-pubescentia, nervis lateralibus utrinque 15–17 supra subconspicuis subtus prominentibus, nervulis subtus conspicuis vel prominulis, margine integra, petiolo 4–5 mm. longo ut ramulis induto suffulta. *Flores* solitarii, conspicue supra-axillares, breviter pedicellati, pallide virides, odorati (ex *Kerr*); bracteola paulo infra calycem sita, late lanceolata, 4 mm. longa. *Sepala* late ovata, obtusa, circa 6 mm. longa, 6 mm. lata, facie utraque adpresse cupreo-pubescentia. *Petala* exteriora anguste oblonga, apice obtusa, 3·4 cm. longa, 1 cm. lata, facie utraque adpresse pubescentia, interiora circa 8 mm. longa, late breviter unguiculata. *Antherae* 1 mm. longae, loculis lateralibus, connectivo apice truncato. *Carpella* adpresse pubescentia, 1 mm. longa, apice constricta; stylus circa 0·5 mm. longus, stigmate truncato circa 0·5 mm. lato; ovula solitaria, subbasilaria.

Chiengmai, 300 m., cult., *Kerr* 3312.

Mitrephora Collinsae, *Craib* [Anonaceae-Mitrephoreae]; ab affini *M. Edwardsii*, Pierre, petiolo longiore, cortice fusciore inter alia distinguenda.

Ramuli primo densius fulvo- vel ferrugineo-pubescentes, mox glabri, fulvo-corticati, lenticellis paucis subconspicuis. *Folia* oblonga vel subelliptica, apice breviter acuminata, rarius rotundata, basi cordatula vel fere truncata ad 8·2 cm. longa et 5 cm. lata, subcoriacea, supra ad costam densius molliter pubescentia, demum glabra, subtus primo dense adpresse fulvo-pubescentia, demum ad costam nervosque laterales breviter pubescentia, aliter puberula vel fere glabra, nervis lateralibus utrinque circa 12 supra parum impressis subtus prominentibus, nervulis subtus subconspicuis, margine integra, petiolo 3–4 mm. longo suffulta. *Flores* in speciminibus visis infeliciter manci. *Alabastra* densius adpresse ferrugineo-pubescentia.

S. Siam, *Mrs. D. J. Collins* 507.

Sphaerocoryne clavipes, *Craib*, comb. nov. *S. siamensis*, Scheff. mss. (ex *Boerl.* in Ic. Bogor. t. LXIX). *Unona Mesnyi*, Pierre, Fl. For. Cochin. t. 17 pro parte (1880). *Polyalthia siamensis*, Boerl., l.c. *Popowia Mesnyi*, Craib in Kew Bull. 1914 p. 5. *P. aberrans*, Pierre ex Finet et Gagnep. in Bull. Soc. Bot. Fr., Mém. 4 p. 109 et in Fl. Gén. Indo-Chine I. p. 83, vix *Polyalthia aberrans*, Maingay. *Melodorum clavipes*, Hance in Journ. Bot. 1877 p. 328.

Sriracha, *Mrs. D. J. Collins* 6, *Marcan* 189. Bangkok Palace Gardens, *Murton* 30. Chiengmai, 300 m., cult. *Kerr* 3525.

Distr. Cambodia, Cochinchina, Java (cult.), [Laos ex Fl. Gén. Indo-Chine].

To this genus also belongs *Popowia diospyrifolia*, Pierre ex Finet et Gagnep. (= *S. diospyrifolia*, comb. nov.).

Melodorum affine, *Craib* [Anonaceae-Xylopieae]; ab affini *M. oblongo*, Craib, pedicellis fructiferis brevioribus, foliis tenuioribus, nervis lateralibus supra haud impressis recedit.

Ramuli volubiles, primo ferrugineo-tomentelli, mox glabri, brunneo- vel fusco-brunneo-corticati, lenticellis subconspicuis. *Folia* oblonga vel cuneato-oblonga, apice rotundata, obtusa, vel interdum breviter acuminata, basi cuneata vel cuneato-rotundata, usque ad 18·5 cm. longa et 6·2 cm. lata, rigide chartacea, supra ad costam tomentella, subtus pallidiora, tomentella praetereaque ad costam nervosque pilis longioribus instructa, nervis lateralibus utrinque 15–18 supra saepissime subconspicuis subtus prominentibus, costa supra impressa; petioli 7–10 mm. longi, sat crassi, supra canaliculati. *Pedicelli* fructiferi terminales, 1 cm. longi, bracteolis persistentibus. *Receptaculum* parum incrassatum. *Carpella* (an omnino matura?) ellipsoideo-orbicularia, 1·8 cm. longa, stipite 2·5 cm. longo suffulta, dense ferrugineo-tomentella.

Doi Sutep, 660 m., mixed jungle, *Kerr* 3259.

Alphonsea lutea, *Hook. f. et Thoms*, var. **longipes,** *Craib* [Anonaceae-Miliuseae]; varietas pedicellis elongatis distincta.

Arbor sempervirens, 50-pedalis, trunco cortice laevi griseo obtecto (ex *Vanpruk*); ramuli primo breviter adpresse fulvo-pubescentes, mox glabri, cortice cinereo reticulato obtecti. *Folia* oblongo-lanceolata, apice subacuminata, basi cuneata vel rotundato-cuneata, ad 14·5 cm. longa et 4 cm. lata, rigide chartacea, supra ad costam primo breviter pubescentia, mox puberula, subtus matura glabra vel subglabra, nervis lateralibus utrinque ad 10 pagina utraque conspicuis sed vix prominulis, nervulis rete gracile efficientibus, petiolo circa 4 mm. longo suffulta. *Flores* in fasciculis e ramulis annotinis ortis dispositi, pedicellis 2 cm. longitudine fere attingentibus infra medium bracteolatis ut alabastris adpresse fulvo-pubescentibus.

Prê, Mê Song, 360 m., *Vanpruk* 444.

This plant, treated here as a variety, in all probability represents quite a valid species. Receipt of more adequate material, both flowering and fruiting, is required for certainty.

Capparis auricans, *Craib*, comb. nov. *C. grandis*, Linn. f., var. *auricans*, Kurz, For. Fl. Br. Burma, vol. I., p. 64.

Mê Chang, deciduous jungle, 300 m., *Kerr* 3177.

Distr. Burma, *Smales*. Frequent in Prome district (fide Kurz, l.c.).

Capparis mekongensis, *Gagnep.*, var. **crispata,** *Craib* [Capparidaceae-Cappareae]; varietas nova foliis angustioribus apice mucronatis brevius petiolatis, maturis pagina superiore medio et ibi praesertim ad costam breviter crispatim pubescentibus cognoscenda.

Muang Sa, Nan, 180 m., dry mixed jungle, evergreen tree c. 9 m. high, *Kerr* 2396.

C. mekongensis is known to the writer from description only. Kerr's plant which differs mainly in the points noted has had to be treated therefore in the meantime as a variety. A very similar plant was collected at Lampun (*Winit* 99), but the specimens forwarded consist of young flower-bearing twigs only. The collector further expresses a doubt as to whether the plant is deciduous or not.

Euonymus auriculatus, *Craib* [Celastraceae-Celastreae]; species nova fructibus echinatis foliis basi cordatis breviter petiolatis distincta.

Arbor sempervirens, circa 10-metralis (ex *Kerr*), ramulis glabris pallide viridibus angulatis, internodiis inferioribus elongatis superioribus brevibus. *Folia* opposita vel subopposita, oblanceolata, apice acuminata, summo apice mucronata, basi auriculato-cordata, ad 19 cm. longa et 5·4 cm. lata, subcoriacea, pagina utraque viridia sed inferiore pallidiora, glabra, nervis lateralibus utrinque 13–16 pagina utraque prominulis, nervis transversis subprominulis, margine integra, petiolo ad 6 mm. longo sat crasso fuscescente supra dense puberulo suffulta. *Pedicelli* ad apices ramulorum novellorum gesti, solitarii, axillares, 2–4 cm. longi, longitudinaliter breviter pubescentes. *Fructus* juvenilis dense echinatus, stylo trifido saepissime coronatus, basi calyce persistente ornatus; calycis segmenta reflexa, circa 5 mm. longa, acuminata, nervosa, intra ima basi puberula.

Mê Ta, 300 m., *Kerr* 3620.

Crotalaria Kerrii, *Craib* [Leguminosae-Genisteae]; ab affini *C. Stocksii*, Hook. f., foliis haud punctatis distinguenda.

Herba basi lignosa, ad 25 cm. alta, copiose graciliter ramosa, caule ramulisque breviter pubescentibus. *Folia* lanceolata, oblongo-lanceolata vel elliptico-oblonga, apice apiculata, rarius acutiuscula, basi cuneata, ad 3·3 cm. longa et 1·3 cm. lata, chartacea, pagina utraque pilis tenuibus albis plus minusve adpressis instructa, subtus parum pallidiora, nervis lateralibus utrinque 5–7 supra vix conspicuis subtus prominulis, costa supra impressa subtus prominente, nervulis haud conspicuis, margine integra; petioli circa 1 mm. longi; stipulae deciduae, foliaceae, dimidio-ovatae, acutae, 2 mm. longae, 1 mm. latae, indumento foliorum instructae, saepe divergentes. *Pedunculi* communes axillares, graciles, saepissime 2-flori, 2 cm. longitudine fere attingentes, pedicellis circa 4 mm. longis, pedunculis pedicellisque pilis iis caulium similibus instructis, bracteolis filiformibus 1·5 mm. longis paulo infra calycem positis persistentibus; flores lutei (ex *Kerr*). *Calyx* extra pubescens, postice 4 mm., antice fere 5 mm. longus; lobi ciliati, acuti, postici 2·5 mm. longi, 0·75 mm. lati, lobo antico 3·5 mm. longo. *Vexillum* 4·5 mm. longum ungui brevi lato ciliato incluso, basi bicallosum, marginibus basi poculiformibus; alae 4 mm. longae, 1·3 mm. latae, vix unguiculatae; carina 3·5 mm. longa, apice 4·25 mm. lata, ungui 0·5 mm. longo. *Ovarium* glabrum, 2·5 mm. altum, stylo 4·25 mm. longo glabro. *Legumen* circa 1·5 cm. longum, styli parte basali persistente apiculatum, basi in stipitem circa 2 mm. longum angustatum; semina sat numerosa, 1·5 mm. longa, viridi-straminea, mox brunnescentia, nitida.

Near Prê, Mê Ta, dry bamboo jungle, 240 m., *Kerr* 2352.

Indigofera changensis, *Craib* [Leguminosae-Galegeae]; ab *I. squalida*, Prain, cui habitu persimilis, squamis paucioribus, pilis et caulium et foliorum costae pagina inferiore divergentibus haud arcte adpressis distinguenda.

Caules ad 24 cm. alti, pallidi, pilis albis brevibus divergentibus instructi, sulcati. *Folia* simplicia, oblanceolata vel oblongo-oblanceolata, apice rotundata, rarius breviter acuminata, costa excurrente apiculata, basi cuneata, ad 5·7 cm. longa et 1·5 cm. vel rarius 2·2 cm. lata, sat rigida, supra pilis brevibus medifixis aspera, subtus pallidiora, pilis iisdem sed ad costam plus minusve divergentibus praetereaque squamis paucis instructa, nervis lateralibus utrinque circa 8 subtus subprominulis, margine integra, petiolo 2 mm. longo suffulta; stipulae persistentes, subulatae, 4 mm. longae. *Racemi* axillares, pedunculo communi incluso circa 8 mm. longi, bracteis angustis alabastris subaequilongis, alabastris extra dense albo-hirsutis, pedicellis brevibus. *Calyx* 2·5 mm. longus, lobis posticis aliis paulo latioribus et brevioribus, omnibus acutis, posticis lanceolatis, aliis lineari-lanceolatis. *Vexillum* ovato-rhomboideum, 4·5 mm. longum, 2 mm. latum. *Ovarium* 1·75 mm. altum, adpresse pubescens.

Mê Chang, deciduous jungle, 300 m., *Kerr* 3607.

Desmodium rufihirsutum, *Craib* [Leguminosae-Hedysareae]; a *D. lasiocarpo*, DC., cui affinis, bracteis elongatis recedit.

Caules circa 4-pedales, pilis rufis divergentibus sat rigidis copiose instructi, cortice brunneo striato obtecti. *Folia* simplicia, ovato-elliptica vel elliptica, apice acuminata, acuta, basi rotundata, ad 16 cm. longa et 9·5 cm. lata, rigide chartacea, supra pilis albis basi tuberculatis sat rigidis hirsuta, subtus pubescentia, nervis lateralibus utrinque 5–7 supra conspicuis subtus prominentibus, margine integra, interdum undulata, densius ciliata, petiolo ad 8 mm. longo dense rufo-pubescente suffulta; stipulae e basi 3–5 mm. lata subulatae, 8 mm. longae. *Racemi* in axillis foliorum inferiorum solitarii, superiorum plures, praetereaque in paniculam fere efoliatam terminalem dispositi, ad 10 cm. longi, breviter pedunculati, densiflori; bracteae alabastra longe superantes, subulatae, circa 1 cm. longae, pilis albis divergentibus sat copiose instructae; pedicelli 2 mm. longi. *Calycis* tubus circa 1 mm. longus; lobi duo postici in unum deltoideum apice breviter bilobum 1 mm. longum connati, laterales antico paululo longiores, antico 1·5 mm. longo angusto. *Vexillum* obovatum, 5 mm. longum, vix unguiculatum; alae 3·5 mm. longae, ungui 1 mm. longo excluso; carina 4·5 mm. longa. *Ovarium* 3·5 mm. altum, adpresse pubescens, stylo 2·5 mm. longo.

Doi Sutep, mixed jungle on edge of old clearing, flowers mauve, 660 m., *Kerr* 2763.

Distr. Burma.

Itea puberula, *Craib* [Saxifragaceae-Escallonieae]; *I. macrophyllae*, Wall., affinis, sed foliorum pagina inferiore et racemis puberulis, foliis basi cuneatis vel late cuneatis distinguenda.

Arbor (ex *Kerr*), ramulis juventute puberulis viridibus mox fuscescentibus glabrescentibus. *Folia* oblanceolato-oblonga vel elliptico-oblonga, apice acuminata, acuta, basi cuneata vel late cuneata, usque ad 32 cm. longa et 11 cm. lata, chartacea, pagina utraque ad costam nervosque laterales puberula, subtus pallidiora, nervis lateralibus utrinque ad 15 supra conspicuis subtus prominentibus, nervulis inter se parallelibus sat approximatis pagina utraque conspicuis, margine basem versus integra vel subintegra, apicem versus serrulata vel denticulata, petiolo ad 3 cm. longo supra canaliculato suffulta. *Racemi* solitarii, gemini, vel tres, rarius quatuor in foliorum axillis positi, pedunculo communi brevi incluso circa 20 cm. longi, rhachi pedicellis et alabastris puberulis; pedicelli 2–2·5 mm. longi; flores albi (ex *Kerr*). *Sepala* deltoideo-lanceolata, acuta, circa 1 mm. longa, erecta vel mox incurva. *Petala* recurva, lineari-lanceolata, acuta, 2·5 mm. longa, 0·75 mm. lata. *Filamenta* 1·25 mm. longa, glabra. *Stylus* circa 1·5 mm. longus, superne gradatim angustatus, glaber, stigmate capitato.

Doi Sutep, 1350 m., evergreen jungle, *Kerr* 2000.

Ehretia Winitii, *Craib* [Boraginaceae-Ehretieae]; ab affini *E. aspera* Roxb., ramulis foliisque haud dense aspero-pubescentibus recedit.

Fruticulus 1–3-pedalis (ex *Winit*), ramulis cito glabris cortice cinereo vel brunneo-cinereo obtectis. *Folia* obovata vel elliptico-obovata, apice rotundata, basi cuneata, ad 5·2 cm. longa et 2·2 cm. lata, sat rigida, supra pilis basi tuberculatis hic et illic instructa, scabrida, subtus pallidiora, parce pubescentia, nervis lateralibus utrinque circa 6 intra marginem anastomosantibus supra vix conspicuis subtus prominentibus, margine integra, petiolo circa 3 mm. longo suffulta. *Inflorescentia* terminalis, circa 2 cm. diametro, pedunculo communi 1·5 cm. longo suffulta. *Calyx* sicco fuscus, fere ad basem in segmenta 5 lanceolata acuta basi 0·75 mm. lata dorso parce pubescentia ciliolata partitus. *Corolla* azurea, demum alba (ex *Winit*); tubus 4 mm. longus; lobi oblongi, 3 mm. longi, 1·75 mm. lati. *Filamenta* paulo infra corollae tubi apicem inserta, 3 mm. longa, glabra; antherae oblongae, 1·5 mm. longae, dorsifixae. *Ovarium* in calyce bene inclusum, stylo 4·5 mm. longo apice breviter 2-ramoso.

Kanburi, near swamp in open jungle, 18 m., *Winit* 532.

Siamese name. Chan Nam.

Chirita tubulosa, *Craib* [Gesneraceae-Cyrtandreae] a *C. barbata*, Sprague, partibus omnibus pallidioribus brevius et sparsius pilosis, foliis basi rotundatis vel subcordatis haud cuneatis, calyce tubuloso lobis lanceolatis erectis, corolla minore, lobo infimo pro rata longiore, antheris multo brevius barbatis, inter alia distinguenda.

Caulis sat crassus, viridis, pilis divergentibus sparse instructus. *Folia* oblonga, basi rotundata vel subcordata, ad 19 cm. longa et 6 cm. lata, supra viridia, pilis breviusculis subadpressis sat rigidis instructa, mox plus minusve glabrescentia, subtus pallidiora, pilis similibus instructa, nervis lateralibus utrinque circa 20 supra conspicuis subtus prominentibus, margine integra, distincte sed breviter petiolata. *Inflorescentia* ei *C. barbatae* similis, pedicellis ad 15 mm. longis. *Calyx* viridis, distincte nervosus, tubo circa 6 mm. longo, lobis lanceolatis acutis haud reflexis circa 4 mm. longis extra pilis subrigidis sparse instructus. *Corolla* e calyce 3 cm. exserta, extra alba, pilis erectis instructa, intra alba nisi e basi lobi infimi luteo-lineata (ut in *C. barbata*) praetereaque e staminum insertione latere utroque linea purpurea multo angustiore brevioreque ornata, lobo infimo 1 cm. longo et lato, lobis lateralibus circa 5 mm. longis quam posticis paulo longioribus. *Stamina* iis *C. barbatae* similia nisi antheris pallidis brevius barbatis et filamentis ad angulos macula atro-purpurea instructis. *Ovarium* viride, ima basi glabrum, superne sparse pubescens, 1 cm. longum, stylo circa 15 mm. longo breviter pubescente albo, stigmate bifido.

Described from living plants grown from seed collected by Dr. A. F. G. Kerr. The plants flowered in October of last year.

Radermachera Pagetii, *Craib* [Bignoniaceae-Tecomeae]; a speciebus aliis calyce tuberculato recedit.

Arbor 30–60-pedalis (ex *Paget* et *Marcan*); ramuli florigeri sat crassi, primo sicco fusci, dein cortice cinereo obtecti, sparse lenticellati, foliorum cicatricibus ellipticis vel late ellipticis parum elevatis copiose notati. *Folia* pinnata, ad 17 cm. longa petiolo 4–5·7 cm. longo excluso; foliola oblongo-lanceolata vel ovato-lanceolata, apice acuminata, acuta obtusave, basi inaequilateralia, saepissime rotundata, ad 6·5 cm. longa et 2·2 cm. lata, chartacea, glabra, subtus parum pallidiora, nervis lateralibus utrinque 7–8 subtus fere prominulis, margine integra, petiolulo circa 5 mm. longo suffulta. *Thyrsi* terminales, breviter pedunculati; pedunculi partiales verticillati, 1–1·5 cm. longi; pedicelli circa 1·5 cm. longi, infra medium bracteolati, bracteolis parvis angustis, et barbati, aliter praesertim superne sparse pilosi. *Calyx* 1·5–1·7 cm. longus, praesertim inferne dense tuberculatus. *Corolla*, lobis inclusis, 6 cm. longa, alba vel pallide lilacina (ex *Marcan*), tubo infra staminum insertionem intra pubescente. *Filamenta* 1 cm. supra corollae tubi basem inserta, circa 1·5 cm. longa, antherarum loculis divaricatis 3 mm. longis. *Ovarium* circa 1 cm. altum, stylo 2·5 cm. longo. *Fructus* 14 cm. longus, fuscus, densius tuberculatus; semina, ala inclusa, 3·5 cm. longa.—*Radermachera sp.n.*, Craib, Contrib Fl. Siam, p. 151.

Bangkok, Legation Garden, *Paget.* Bangkok, cult., *Marcan* 617. Petchabouri, thicket, 50 m., *Marcan* 621 (almost certainly wild).

Siamese name, Kaa kow (ex *Marcan*).

Cinnamomum (Camphora) siamense, *Craib* [Lauraceae-Perseae] a speciebus indicis hujus gregis ramulis gracilibus, foliis minoribus subtus glabris haud glaucis distinctum.

Arbor ramulis gracilibus glabris primo pallide brunneis mox fusco-brunneis pauci-lenticellatis. *Folia* oblongo-elliptica, rarius lanceolata ovatave, apice angustata vel subacuminata, mucronulata, basi cuneata, saepe inaequilateralia, ad 11 cm. longa et 4·5 cm. lata, coriacea vel chartaceo-coriacea, glabra, subtus parum pallidiora, nervis lateralibus utrinque 4–6 supra conspicuis subtus prominentibus intra marginem anastomosantibus, duobus infimis intramarginalibus, nervulis rete gracile subtus prominulum efficientibus, margine integra, petiolo circa 1 cm. longo supra canaliculato suffulta. *Flores* ignoti. *Fructus* immaturus; receptaculum incrassatum, elongato-turbinatum, 1·6 cm. longum, apice 7 mm. diametro, perianthii segmentis delapsis.

N. Siam, *Kerr* 2511.

XXVII.—MISCELLANEOUS NOTES.

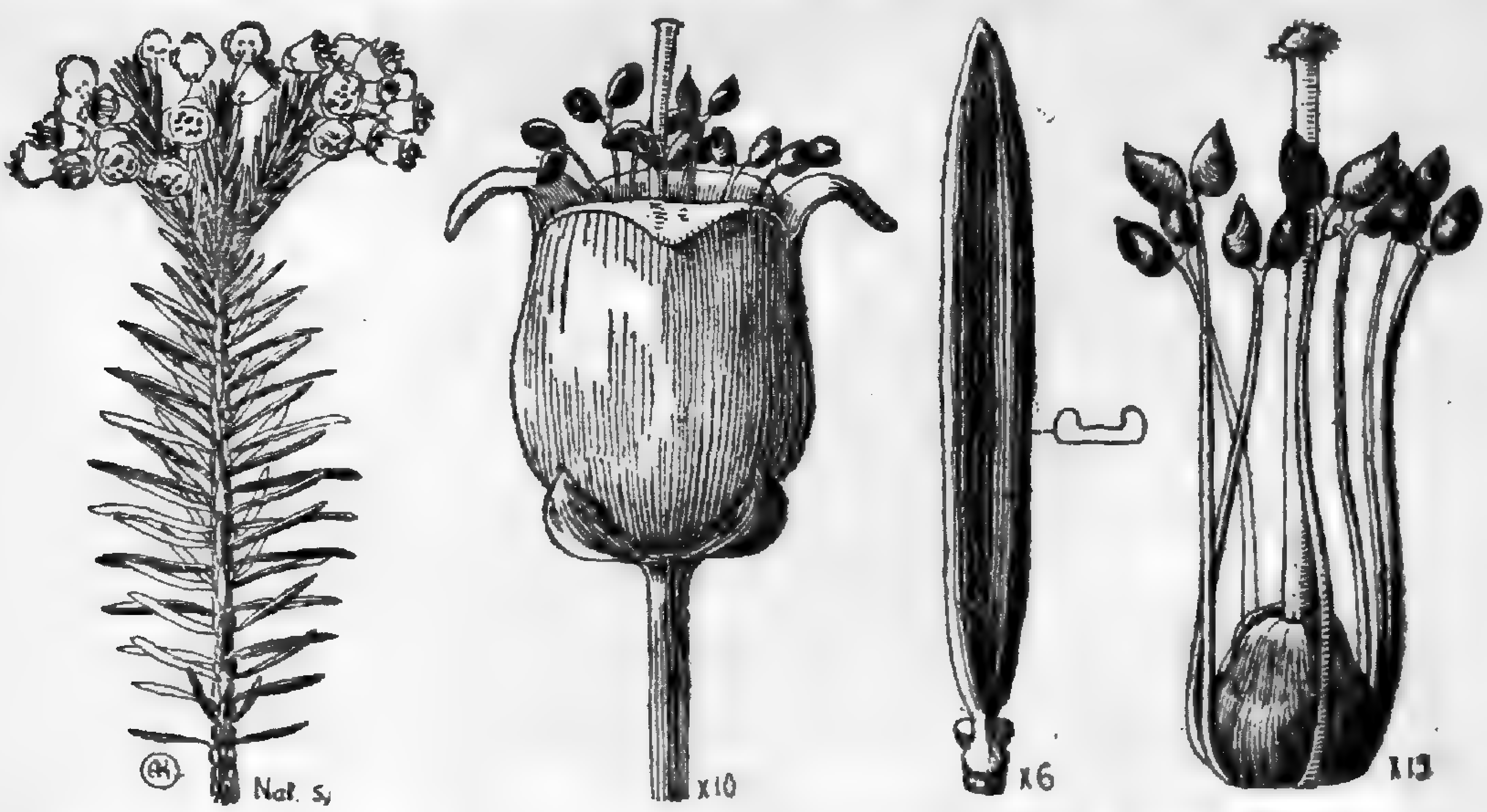
Retirement of Mr. W. Watson.—On June 24th Mr. W. Watson, A.L.S., who has been Curator of the Royal Botanic Gardens, Kew, since August 1st, 1901, retired under the age limit. Mr. Watson entered Kew as Foreman in 1879 and was appointed Assistant Curator in 1886. He is succeeded by Mr. W. J. Bean, who has been Assistant Curator since Feburary 7th, 1900, having entered Kew in 1883 as a young gardener. The post vacated by Mr. Bean is not being filled, but the five Foremen, Messrs. W. Irving, C. P. Raffill, A. Osborn, W. Taylor and J. Coutts, have been given the rank of Assistant Curators.

Mr. Archibald T. Brooks, Agricultural Superintendent, St. Lucia (*K.B.*, 1903, 30), has been appointed by the Secretary of State for the Colonies, on the recommendation of Kew, Director of Agriculture in the Gambia.

Presentation of the Forrest Collection.—The important and valuable collections made by Mr. George Forrest during the period 1916–1919, when he was engaged on his botanical explorations in N.W. Yunnan and S.E. Tibet—chiefly on the ranges which divide the three great rivers, the Yangtze-kiang, the Mekong and the Salween, draining those regions— have been very generously presented to the Royal Botanic Gardens, Kew, by the Syndicate under whose auspices Mr. Forrest carried out his explorations. Out of the 6000 numbers collected during those years an almost complete set has been presented to Kew, all labelled with Forrest's numbers and determined at the Royal Botanic Gardens, Edinburgh. Previous collections by Forrest are already well represented in the Herbarium and the present consignment which keeps up to the former standard in excellent selection and preservation will form a valuable addition to our collections from these mountains.

Erica vagans, *L.*, var. **kevernensis,** *Turrill.—Erica vagans* is well known as one of the characteristic "Lusitanian" plants of the British flora, and it is therefore of additional interest to record the occurrence of an aberrant plant which differs markedly from the common type.

This new plant was discovered and introduced into cultivation by Mr. P. D. Williams, of Lanarth, and he has kindly furnished the following particulars :—"When partridge shooting at Trelanvean farm, St. Keverne, on the north-west corner of a rough moor (2248, Ordnance Survey 1907), I noticed a small plant of this remarkable form of *Erica vagans*. Next day I took cuttings (which fortunately grew) and also layered the plant. The following year the original plant and the layers were trodden into the ground by cattle and destroyed. I have a group of it in my garden and find that in normal years it never seeds, but that it sometimes sports. In 1921 it seeded. It is remarkable that on the same day I found the only recorded plant of a natural hybrid of *Erica vagans* and *E. tetralix* (x *E. Williamsii*, Druce). This plant was about ¾ of a mile to the west on plot 2788, Ordnance Survey 1907." Plants at Kew received from Mr. Williams have flourished and have been propagated so that they now occupy an entire bed between the T-range and the Succulent



House, near beds of typical *Erica vagans* and x *Erica Williamsii* These plants have been kept under observation for about a year and the flower and fruit characters studied in living specimens.

The new plant differs from the usual form of the species in the shape and colour of its corollas, characters which are not easy to make out in dried material. The corollas are broadly campanulate, with a wide open mouth, and well developed, more or less reflexed lobes. The bending back of the corolla lobes varies with the age of the flowers, but in mature, though not faded, examples it is decidedly more marked than in typical *Erica vagans*. In colour the fresh corollas are a charming rose-pink with no tinge of purple. Careful examination of numerous plants, all apparently derived from the one original by vegetative propagation, has failed to detect any constant morphological differences between the leaves, calyx, androecium or gynoecium of the St. Keverne plant and typical *Erica vagans*, though the anthers are paler in the former and the seeds sometimes slightly larger, but their reticulation or shallow pitting is the same in both.

Horticulturally the St. Keverne variety is more desirable than the typical plant since the colour of the corollas is more pleasing. Its propagation by cuttings or layering is easy and it is likely that its cultivation will spread.

It is impossible at present to decide fully the botanical status of this plant. No morphological characters which would suggest a hybrid origin have been found. Mr. Williams records that the plant does not generally seed but sometimes sports. The examples at Kew have carried seed this last year (1921) almost as abundantly as the examples of typical *E. vagans ;* whether or not this seed is viable remains to be seen. If plants are successfully raised from seeds it may be possible to suggest the mode of origin of the single individual originally found. At present its origin by mutation appears to be most likely, and we can only retain the name " St. Keverne " for it as a horticultural designation, or perhaps better still call it var. *kevernensis* with the following differential diagnosis : a planta typica corollis late campanulatis roseis haud purpureis, lobis plus minusve reflexis praecipue differt. Examples of reversion to the parent plant have been noticed at Kew by Dr. Hill and others.

The interesting hybrid between *Erica vagans* and *E. tetralix*, also discovered by Mr. Williams, described in the Kew Bulletin 1911, p. 378, and named x *E. Williamsii* by Dr. G. C. Druce (Gard. Chron. 1911, ii., p. 388), is flourishing at Kew, the numerous plants filling a bed close to that occupied by the St. Keverne plant described above. The same keen observer has also found in Cornwall an abnormal condition of *Erica vagans* in which the floral organs are replaced by small leaves or bracts on an elongated axis and their number at the same time greatly increased. This sport has been described by Worsdell (Plant Teratology II., p. 124), and by Druce (Rep. Bot. Soc. and Exchange Club, 1919, p. 569).—W. B. T.

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BULLETIN

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XXVIII.—A HOST LIST OF THE POLYPOREAE OCCURRING IN THE UNION OF SOUTH AFRICA.

PAUL A. VAN DE BIJL,

Professor of Phytopathology and Mycology, University of Stellenbosch.

INTRODUCTION.

The *Polyporeae* are of considerable economic importance to all concerned either with the care of forests or with the timber trade. Several parasitic and semiparasitic species are responsible for the decay of valuable timber trees, and even those which are purely saprophytic often cause serious loss by inducing the decay of sleepers and posts.

Several of the species of *Polyporeae* are of wide distribution, and one object in publishing this list is to add to our knowledge of the hosts on which they occur.

In taking up the study of these fungi and of the damage they cause it was essential to have them correctly identified, and in this connection I am indebted to Mr. C. G. Lloyd for much kind assistance.

When I started on the subject some five years ago the number of species to be found in any herbarium or mycological institution in South Africa was small, and these were not determined with any degree of certainty. With the cooperation of friends and especially officers of the Forestry Department, who collected for me in various parts of the Union, our knowledge of the species of *Polyporeae* occurring in the Union has been considerably increased. Mr. J. D. Keet, of the Forestry Department, took an especial keen interest in the subject, first in the King William's Town conservancy and subsequently in the Knysna conservancy, and we are indebted to him for bringing to light a large number of species not previously recorded from the Union.

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With regard to the arrangement adopted in this paper, the genera are listed alphabetically and the species alphabetically under their respective genera. The genus *Polystictus* is merged in the genus *Polyporus*. The host-plants are listed alphabetically under the various species. Where no name is given the host-plant was undetermined.

The list contains a few species believed to be new and indicated accordingly. These will be described in a monograph of the South African species to be published later.

In most of the countries where forestry plays an important part ever-increasing attention is being devoted to the causes of the decay of trees and timber for which this group of fungi is largely responsible. A knowledge of their distribution over the globe is for this reason very desirable, and it is hoped that the present list, the first from the Union, will supplement those which have already appeared from America, Ceylon, and other countries.

Daedalea *(Pers.) Fr.*

D. fuscospora, *Lloyd.* Old rotten log.

D. Hobbsii, n. sp. (MS. name). Old log.

Favolus, *Fr.*

Species of this genus were only found on dead logs. The genus appears to occur only in the more subtropical parts of the Union.

F. brasiliensis, *Fr.*

F. dermoporus *(Pers.) Lloyd.*

F. europaeus, *Fr.*

F. Jacobaeus, *Sacc. et Berl.* This is the same as *F. brasiliensis* but with slightly smaller pores. In one collection the surface of the pileus was slightly tessellate and thus tended to connect this species with *F. tessellatus,* Mont.

F. megaloporus *(Mont.) Bres.*

F. spathulatus *(Jungh.) Bres.*

Fomes *(Fr.) Gill.*

F. applanatus *(Pers.) Gill.* On *Acacia mollissima*, *Celtis kraussiana*, *Cunonia capensis*, *Curtisia faginea*, *Olea laurifolia*, *Podocarpus* sp., *Pyrus communis*, *Rhus laevigata*, *Trichocladus* sp. Under *F. applanatus* I include *F. annularis*, Lloyd, *F. leucophaeus* (Mont.) Cooke, *F. vegetus* (Fr.) Cooke, *F. australis* (Fr.) Cooke.

In the "South African Journal of Science," Vol. xiv., p. 465, a rot of *Olea laurifolia* caused by this fungus was described.

F. conchatus (*Pers.*) *Gill.* On living *Melia Azedarach.* Also saprophytic on various undetermined logs and stumps.

F. connatus (*Weinm.*) *Gill.* On living *Curtisea faginea.*

F. geotropus *Cooke.* On living plants of *Ocotea bullata, Podocarpus* sp., and *Virgilia capensis.*

Fomes hornodermus (*Mont.*) *Cooke.* On *Ocotea bullata.*

F. McGregori, *Bres.* On *Rhus laevigata, Scolopia Mundtii,* and *Trichocladus* sp.

F. melanoporus (*Mont.*) *Cooke.* On undetermined logs.

F. oroflavus, *Lloyd.* On *Podocarpus* sp.

F. pectinatus (*Kl.*) *Gill.* On *Acacia melanoxylon*, and *Kiggelaria africana.*

F. rimosus (*Berk.*) *Cooke.* On living plants of *Acacia* sp., *Curtisea faginea, Elaeodendron croceum, Kiggelaria africana, Olea laurifolia, Pleurostyla* sp., *Ptaeroxylon utile, Rhus laevigata, Schotia latifolia, Scolopia Mundtii, Xymalos monospora.*

In Trans. Roy. Soc. South Africa, Vol. vi., p. 215, the "Heart Rot" of *Ptaeroxylon utile* caused by this fungus is described.

F. Robinsoniae (*Murr.*) *Sacc. et Trott.* On *Gymnosporia peduncularis.*

F. robustus, *Karst.* On *Olea laurifolia, Xymalos monospora.*

F. senex (*Nees et Mont.*) *Cooke.* On living *Sizygium* sp., and other undetermined hosts.

F. yucatanensis (*Murr.*) *Sacc. et D. Sacc.* On living plants of *Olea* sp. and *Trema bracteolata.*

Gloeoporus, *Mont.*

G. conchoides, *Mont.* Saprophytic. Host undetermined.

Hexagonia, *Fr.*

In South Africa the genus *Hexagonia* occurs only in the more subtropical regions.

H. albida, *Berk.*

H. Dybowskii, *Pat.*

H. phaeopora, *Pat.*

H. Pobeguinii, *Har.*

H. rigida, *Berk.* On *Persea gratissima* (dead branches). Also saprophytic on other undetermined hosts.

H. speciosa, *Fr.* Saprophytic on old logs in the forests of Zululand.

H. tenuis (*Hook.*) *Fr.* Saprophytic on *Albizzia fastigiata, Hibiscus tiliaceus, Xanthoxylon capense.*

The form known as *H. tricolor*, Fr. is referred to *H. tenuis*, as the stain present on the upper surface of the pileus is not constant.

Laschia, *Fr.*

L. Thwaitesii, *B. et Br.* On dead branches lying on the ground in forests.

Lenzites, *Fr.*

L. aspera (*Kl.*) *Fr.* On *Eucalyptus globulus.*

L. betulina (*Linn.*) *Fr.* (including *L. guineensis*, Fr.) A common saprophyte. Recorded on *Acacia mollissima*, living *Celtis kraussiana, Olea laurifolia, Pinus* sp., *Quercus* sp.

L. repanda (*Pers.*) *Fr.* A common saprophyte. Recorded on *Acacia mollissima, Salix* sp., and undetermined hosts.

Under *L. repanda* are included *Daedalea elegans*, Spreng. and *Lenzites applanata*, Fr.

L. trabea (*Pers.*) Fr. On logs of *Pinus* sp., *Populus* sp.

Polyporus (*Mich.*) *Fr.*

P. adustus (*Willd.*) *Fr.* On *Quercus* sp. (Saprophytic on logs and stumps.)

P. anebus, *Berk.*

P. aratus, *Berk.* (= *P. luteo-olivaceus*, Berk.) a common saprophyte.

P. arcularius (*Batsch*) *Fr.*

P. arenosobasus, *Lloyd.* On the ground.

P. biformis, *Kl.*

P. cinnabarinus (*Jacq.*) *Fr.*

P. Colossus, *Fr.*

P. conchatus, *Lloyd.* On dead stump of *Populus* sp.

P. dichrous, *Fr.*, Saprophytic on *Podocarpus* sp. and *Rhus laevigata.*

P. dictyopus, *Mont.*

P. durbanensis, n.sp. (MS. name).

P. Emerici, *Berk.*

P. flexilis, n.sp. (MS. name).

P. fruticum, *Berk. et Curt.* On living Rubiaceous plant.

P. gallopavonis, *Berk. et Br.*

P. gilvus (*Schw.*) *Fr.* A common saprophyte on *Acacia melanoxylon, Calodendron capense, Rhus laevigata. Scolopia Mundtii, Quercus* sp. and other undetermined hosts.

Under *P. gilvus* I include *P. scruposus*, Fr.

P. hirsutus (*Wulf.*) *Fr.* Saprophytic on *Acacia decurrens* var. *normalis* and on undetermined hosts.

P. hirsutulus, *Schw.*

P. hirtellus, *Fr.*

P. immaculatus, *Berk.* Saprophytic on *Podocarpus* sp.

P. leoninus, *Kl.*

P. lucidus (*Leys*) *Fr.* On living plants of *Acacia* sp., *Acacia mollissima, Albizzia amara, Albizzia fastigiata, Olea laurifolia, Olea verrucosa, Salix* sp., and on dead *Ptaeroxylon utile* and *Zizyphus mucronata.*

Under *P. lucidus* I include *Ganoderma sessile,* Murr., *P. capensis,* Lloyd, and *Ganoderma fulvellum* Bres.

P. luteus (*Bl. et Nees*) *Fr.*

P. mastoporus, *Lév.*

P. mollicarnosus, *Lloyd.*

P. nigrolucidus, *Lloyd.* On the ground in forests.

P. occidentalis, *Kl.* A common saprophyte. Recorded on *Albizzia fastigiata, Persea gratissima.*

P. lanatus, Fr., *P. helvolus,* Fr. and *Trametes devexa,* Berk. are included under this name.

P. ochroleucus, *Berk.* On dead *Curtisea faginea* and *Trichocladus* sp.

P. ochroporus, n.sp. (MS. name). Close to *P. Patouillardii* but with different surface, larger and differently coloured pore mouths and thinner setae.

P. Patouillardii, *Rick.* On living *Scolopia Mundtii.*

P. phocinus, *Berk. et Br.*

P. pinsitus, *Fr.*

P. pocula (*Schw.*) *Berk. et Curt.* On bark of *Eucalyptus* sp.

P. pubescens (*Schum.*) *Fr.*

P. rusticus, *Lloyd.* Saprophytic on stump of *Pinus* sp.

P. sacer, *Fr.* On the ground in forests or in the vicinity of stumps.

P. sanguineus (*Linn.*) *Fr.* A common saprophyte. Found on living *Aloe arborescens, Aloe Marlothii,* as well as on dead *Acacia mollissima, Olea laurifolia, Xymalos monospora,* and undetermined hosts.

P. subpictilis, *Henn.*

P. subradiatus, *Lloyd.* Saprophytic on *Eucalyptus* sp.

P. sulphureus (*Bull.*) *Fr.* On *Quercus* sp. (wound parasite), and on *Eucalyptus* sp. (saprophytic on stump.)

P. tabacinus, *Mont.*

P. Trichiliae, n.sp. (MS. name). On *Trichilia emetica.*

P. undatus, *Pers.*

P. varius, *Fr.* On dead *Curtisea faginea.*

P. velutinus, *Fr.*

P. versicolor (*Linn.*) *Fr.* Common saprophyte on *Acacia mollissima* and various undetermined hosts. On *Prunus persica* it occurs as a wound parasite.

P. versiporus, *Pers.*

P. vinosus, *Berk.*

P. xanthopus, *Fr.*

P. zonatus, *Fr.*

Trametes, *Fr.*

T. albotexta, *Lloyd.* On dead *Podocarpus* sp.

T. cingulata, *Berk.* Common on dead *Acacia mollissima* and indigenous *Acacia* spp.

T. griseo-lilacina, n.sp. (MS. name).

T. Hystrix, *Cooke.*

T. incondita, *Fr.* On living *Ptaeroxylon utile.*

T. Keetii, n.sp. (MS. name).

T. lactinea, *Berk.* Saprophytic on *Acacia mollissima* and *Schotia latifolia.*

T. moesta, *Kalchbr.*

T. obstinatus, *Cooke.* Common in South Africa on living *Acacia mollissima,* indigenous *Acacia* sp., *Citrus,* and a number of undetermined hosts.

T. ochrolignea, *Lloyd.*

T. protea (*Berk.*) *Fr.* A common saprophyte on species of *Pinus, Populus, Salix,* and undetermined hosts.

T. robiniophila, *Murr.*

T. Sepium, *Berk.*

T. Sycomori, *Henn.*

T. subflava, *Lloyd.* On living *Celtis kraussiana.*

T. tomentosa, n.sp. (MS. name).

T. violacea, *Lloyd.*

T. Zimmermannii, *Bres.*

XXIX.—DECADES KEWENSES

PLANTARUM NOVARUM IN HERBARIO HORTI REGII CONSERVATARUM.

DECAS CVI.

1051. **Vochysia hondurensis,** *Sprague* [Vochysiaceae]; affinis *V. guatemalensi*, Donn. Smith, a qua foliis obovato-oblongis vel oblanceolatis haud acuminatis et floribus minoribus recedit.

Arbor magna trunco recto cylindrico (fide *Hummel*). *Ramuli* validi, subquadrati costa a quaque stipula usque ad nodum inferiorem decurrente, fulvi vel atrobrunnei, glaberrimi, densiuscule sed inconspicue lenticellati. *Folia* quaternatim verticillata, obovato-oblonga vel oblanceolata, apice rotundata vel obtusissima, basi obtusa vel subcuneata, 6–14 cm. longa, 2·5–5 cm. lata, coriacea, brunnescentia, inconspicue crebre reticulata, glaberrima, subdiscolora, supra via nitidula nervo medio leviter impresso nervis lateralibus primum inconspicuis tandem leviter impressis magis obviis, subtus nervo medio prominente lateralibus prominulis; nervi laterales utrinque 10–13, patuli, arcuato-ascendentes, 4–7 mm. intra marginem anastomosantes; petioli 1·5–2·5 cm. longi, graciles; stipulae e basi lata subulatae, 2–3 mm. longae, pilosulae. *Thyrsi* 15–20 cm. longi, minute pilosuli, rhachi angulata profunde canaliculata subtiliter striata; cincinni circiter 5-flori; pedunculi 4–8 mm. longi; pedicelli 5–8 mm. longi. *Flores* calcare excluso 1–1·3 cm longi. *Calycis* segmenta antica ovata, obtusa, 3 mm. longa, 2 mm. lata, glabra vel sparse ciliolata; segmenta lateralia deltoideo-ovata, 1·5 mm. longa, 1·5–1·8 mm. lata, ciliolata; segmentum posticum 9 mm. longum, (explanatum) 5·5 mm. latum, calcare descendente 6–6·5 mm. longo. *Petala* elliptico-ovata; petalum medium 5 mm. longum, 4 mm. latum; lateralia paullo minora. *Filamentum* 3 mm. longum; anthera 6 mm. longa, 1·5 mm. lata. *Ovarium* glabrum, 1·3 mm. longum; stylus 2·5 mm. supra basin sigmoideo-curvatus, deinde erectus sensim ampliatus, parte superiore 8 mm. longa.

BRITISH HONDURAS. Belize, *E. F. J. Campbell* 10 (type); Punta Gorda, *C. Hummel.*

According to Mr. Campbell, *V. hondurensis* is a timber tree with soft wood used extensively for making small boats. Mr. Hummel states that it is a tree of large size, straight and cylindric, yields a good wood for boards, and is common in the South of the Colony. The vernacular name of the species is "Yemeri."

1052. **Vochysia tabascana,** *Sprague* [Vochysiaceae]; affinis *V. guatemalensi*, Donn. Smith, a qua foliis oppositis brevioribus pro rata latioribus apice vix cuspidatis, rete venularum valido, calcare floris descendente recedit.

Ramuli laeves, purpureo-brunnei, glaberrimi, profunde canaliculati. *Folia* opposita, elliptico-oblonga, apice brevissime latissime subcuspidata, basi obtusa vel subcuneata, 5–10·5 cm. longa, 2·5–5 cm. lata, coriacea, lutescentia, utrinque valde reticulata, glaberrima, supra nitida nervo medio et lateralibus prominulis, subtus opaca nervo medio prominente lateralibus prominulis; nervi laterales utrinque 9–10, basi patuli, arcuato-ascendentes, 2·5–5 mm. intra marginem anastomosantes; petioli 1–2 cm. longi, graciles; stipulae e basi deltoidea subulatae, usque ad 2 mm. longae. *Thyrsi* circiter 15 cm. longi, minute puberuli, rhachi angulata profunde canaliculata subtiliter striata; cincinni 2–5-flori; pedunculi 5–7 mm. longi; pedicelli 5–6 mm. longi. *Flores* calcare excluso 1·1–1·4 cm. longi. *Calycis* segmenta antica late ovata, rotundata, 2–2·2 mm. longa, 2·5 mm. lata, ciliolata; segmenta lateralia 1 mm. longa, 1.5 mm. lata; segmentum posticum 9–13 mm. longum (explanatum) 6 mm. latum, calcare descendente crasso 7·5 mm. longo. *Petala* ciliata; medium 4–5 mm. longum, lateralia minora. *Filamentum* 3 mm. longum; anthera 5·5–6·5 mm. longa, 1·3–1·5 mm. lata. *Ovarium* glabrum, 1·2 mm. longum; stylus rectus, 8·5 mm. longus, superne vix ampliatus.

MEXICO. Tabasco; between Atasta and La Tejeria, *Rovirosa* 792.

1053. **Rhus costaricensis,** *Riley* [Anacardiaceae-Anacardieae]; affinis *R. terebinthifoliae,* Cham. et Schlecht., a qua indumento formaque foliolorum differt.

Rami dense fulvo-tomentosi, striati, lenticellis magnis conspicuis. *Folia* imparipinnata, 3–4–juga, 9–13·5 cm. longa, rhachi dense fulvo-tomentosa, flexuosa. *Foliola* satis remota, circiter 1·5–2 cm. distantia, obliqua, integra, ovato-oblonga, submucronato-acuminata, basi valde inaequalia, latere superiori rotundato, inferiori acuto, brevissime petiolulata, 4–5 cm. longa 1·5–2·5 cm. lata, supra praecipue secundum costam nervosque laterales insculptos pilosa, subtus dense fulvotomentosa, costa nervisque lateralibus valde prominentibus. *Paniculae* magnae, ramis folia longe superantibus, ubique dense fulvo-tomentosae, ramis ramulisque flexuosis. *Bracteae* vix 1 mm. longae, triangulares, obtusae, utrinque pilosae, marginibus ciliatis. *Sepala* 5, ovata, obtusa, dimidium petalorum aequantia, marginibus ciliatis exceptis glabra. *Petala* 5, ovata, basi plus minusve cordata, apice rotundata, 1·5 mm. longa, 1 mm. lata, extra glabra, intus sparse sericea, marginibus ciliatis. *Stamina* 5, petalis multo breviora. *Ovarium* ovoideum, pubescens; styli connati, breves, stigmatibus capitatis. *Drupae* circiter 6 mm. diametro, longe pilosae.

COSTA RICA. Prov. San José: Rio Virilla, 1100 m., fl. and fr. Dec., *Tonduz in Donn. Smith* 6999 (*Herb. Inst. Nac. Costaric.* 9823) (type); Prov. Cartago, near Cartago, 1275 m., fr. March, *Cooper in Donn. Smith* 5729.

A specimen collected by Heyde and Lux at Carrizal, Dep. Santa Rosa, Guatemala, alt. 1500 m. (*Donn. Smith* 4330) probably belongs to *R. costaricensis*, but the leaflets have longer petiolules, and are larger and thinner.

1054. **Acacia pseudo-eburnea,** *J. R. Drumm. MS. ex Dunn* [Leguminosae-Mimoseae]; ab *A. Campbellii*, Arn., pinnis 3–4-paribus, petiolis eglandulosis, corollis calyce sesquilongioribus differt.

Frutex parvus, ramulis ut aculeis rhachibusque foliorum et pinnarum pubescentibus, aculeis stipularibus binis 1-1·5 cm. longis rectis tenuibus *Folia* 3–4-juga, 3–4 cm longa, glandulis infra jugum supremum et saepe infra juga alia instructa, petiolo eglanduloso; pinnae 1·5–2 cm longae; foliola 8–10-paria, oblonga, obtusa, mucronata, 3 mm. longa, glabra. *Capitula* axillaria, solitaria vel bina, sub anthesi lutea, 1·5–2 cm. diametro; pedunculi 3–4 cm. longi, pubescentes, bracteis parvis 2–3 medio cincti. *Flores* sessiles, ∞. *Calyx* 1·5 mm. longus, glaber, dentibus minutis. *Corolla* 2·5 mm longa, glabra dentibus triangularibus 1 mm. longis. *Stamina* ∞. *Legumen* 5–10 cm. longum, 5–6 mm. latum, breviter stipitatum, glabrum, suturis paullo incrassatis, inter semina leviter constrictum. *Semina* oblonga, compressa, 6 mm. longa.

N.W. India. Kumaon, *Stewart* 96; The Bhabar at 500 m., 1852, *Strachey* and *Winterbottom* 3; Hardwar 330 m., Jan. (flower) 1845, *Thomson* 893, *Major Madden*, 1852; Mohan Rau, Saharanpur, Siwaliks at 500 m., 11.2.1922 (flower) *Parker* 55.

1055. **Vaccinium glaucescens,** *Riley* [Vacciniaceae-Vaccinieae]; affinis *V. angustifolio*, Benth., glabritie et glaucitie, pedicellis longioribus et positu bracteolarum differt. *Fruticulus* ramis angulatis glabris, novellis glaucis. *Folia* brevissime petiolata, oblongo-lanceolata, 2–4 cm. longa, valde acuminata, coriacea, utrinque glabra et glauca, conspicue nervosa, minute et remote dentata. *Racemi* 6–8 cm. longi, foliati, a basi ramulorum ad apicem florentes. *Pedicelli* axillares solitarii, recurvi, glauci, circiter 8 mm longi. *Bracteolae* lineari-lanceolatae, acuminatae, vel angustiores subulatae, 3–6 mm. longae, medio pedicelli vel superius insertae, glaucae. *Calycis* lobi triangulares, acuti vel acute acuminati, glabri. *Corolla* 4 mm. longa. *Antherae* longissime aristatae, glabrae.—*V. angustifolium* var *glaucescens*, Benth. Pl. Hartw. p. 45 (1840).

Mexico. Tepic; Bolaños, *Hartweg* 342 β (type).

1056. **Clethra tomentella,** *Rolfe MS. ex Dunn* [Clethraceae]; affinis *C. luzonicae*, Merrill, sed foliis basi attenuatis et racemis laxis differt.

Arbor parva, cortice ramulorum brunneo striato instructa. *Folia* alterna, apicibus ramulorum aggregata, oblanceolata, apice acuminata, basi attenuata, 6–11 cm. longa, sparse serrata sed fere integra, chartacea, subtus tomentella, supra glabra; venae 12–15-pares, subtus prominentes; petioli 5–12 mm. longi.

Paniculae terminales, 20 cm. longae, racemis multis elongatis angustis laxis divergentibus; bracteae lineares, 5 mm. longae, caducae, ut calyces, pedicelli pedunculique tomento brevi rufo vestitae. *Calyx* 2 mm. longus, e sepalis 5 imbricatis lanceolatis basi paullo unitis compositus. *Petala* obovata, basi breviter coalita, 3 mm. longa. *Stamina* inclusa. *Ovarium* ovatum, 1 mm. longum; stylo brevi bilobo.

PHILIPPINE ISLANDS. Benguet; Tonglou, *A. Loher* 3790; *Elmer* 6283 (May 1904): Rizal, *A. Loher* 6193 (Aug. 1905); 6177 (19 Sept. 1905).

1057. **Veronica rigida,** *Turrill* [Scrophulariaceae-Digitaleae]; affinis *V. Chamaedrys*, L., sed caulibus rigidioribus ramosioribus, foliis petiolatis, infructescentiis saepe longioribus, pedicellis brevioribus, corollis minoribus differt.

Planta perennis (vel interdum biennis), caulibus cylindricis adscendentibus ramosis rigidis inferne pilis in lineis duabus dispositis instructis superne undique hirsutis. *Folia* oblongo-ovata vel ovata, apice subobtusa, basi subcordata deinde in petiolum angustata, usque ad 3·8 cm. longa et 2·7 cm. lata (petiolo excluso), saepissime minora et circiter 2 cm. longa et 1·5 cm. lata, margine inciso-dentata, in pagina superiore leviter hispida vel glabra nervis impressis, in pagina inferiore nervis prominentibus valde hispidis; petiolus 6–7 mm. longus, hispido-hirsutus. *Inflorescentia* 3–12 cm. longa, glanduloso-hirsuta; bracteae lineari-lanceolatae, 4–5 mm. longae, 1 mm. latae, glanduloso-hirsutae; pedicelli floriferi 2 mm. longi. *Infructescentia* usque ad 3·4 dm. longa; pedicelli fructiferi 4 mm. longi. *Calyx* 5 mm. longus, sepalis costis extra prominentibus instructis. *Corolla* 8–10 mm. diametro, intense caerulea, lobis lateralibus adaxialique 3–5 mm. latis, abaxiali circiter 2 mm. lato. *Stamina* 3 mm. longa, caerulea. *Ovarium* biconvexum, ambitu circulare, 0·75 mm. altum, marginibus apiceque albo-hirsutum; stylus 3·5 mm. longus, inferne albus, medio purpureus, superne intense caeruleus. *Capsula* obcordata, 3·5 mm. longa, 4 mm. lata, margine albo-hirsuta, saepissime pubescens; semina oblongo-orbicularia, pallide flava.

GREEK MACEDONIA. Southern slopes of Krusa Balkan; north of Karamudli, *Turrill* (seed-number) 49, seeds collected 18·6.'17, in flower and fruit at Kew from May to September.

This plant was originally described (in *Kew Bull.* 1920, p. 192) as a variety of *Veronica Chamaedrys*, L. After cultivating it for five successive years and finding that its important differential characters remain constant it has been thought advisable to raise it to specific rank. In cultivation it has behaved both as a biennial and as a perennial, flowering the second and succeeding years after being sown.

A specimen collected by A. Baldacci, Iter Albanicum Septimum, in silvaticis Greĉa sub m. Kunj Kostíc, distr. Kuĉi, 24 Julio 1900, No. 350, is probably specifically identical with the plant here described. It has, however, more deeply and irregularly incised leaves.

1058. **Beloperone flaviflora,** *Turrill* [Acanthaceae-Justicieae]; affinis *B. tenerae,* Turrill, sed planta fulvo-hirsuta, foliis multo majoribus, floribus flavis valde distincta.

Herba (vel suffrutex) erecta, caulibus subteretibus junioribus dense fulvo-hirsutis deinde subglabris. *Folia* oblongo-elliptica vel elliptica, usque ad 2·75 dm. longa (petiolo excluso) et 1·1 dm. lata, apice acute acuminata basi cuneata vel acuta, costa nervisque in pagina utraque conspicuis pilis fulvis in juventute praecipue instructis, nervis lateralibus utrinsecus circiter 12; petiolus usque ad 6 cm. longus, fulvo-hirsutus. *Inflorescentiae* axillares vel terminales; bracteae lineari-lanceolatae, 3 mm. longae, extra dense glanduloso-puberulae, caducae; bracteolae lineares, 2·5 mm. longae, dense glanduloso-puberulae. *Calycis* segmenta lanceolato-linearia, acuta, 5 mm. longa, 1 mm. lata, puberula. *Corolla* anguste cylindrica, superne leviter ampliata, 2·8 cm. longa, flava, extra glanduloso-puberula, labio adaxiali 1·2 cm. longo apice emarginato, abaxiali 1·2 cm. longo leviter aequaliterque trilobato. *Stamina* 2, leviter exserta, filamentis 1·8 cm. longis inferne pilis brevibus reflexis instructis, antheris dithecis, thecis superpositis utrisque vix 2 mm. longis calcaratis; pollinis granula ellipsoideo-oblonga, 55–58 μ longa, 32–33 μ diametro. *Ovarium* cylindrico-conoideum, 3 mm. altum, basi 1·25 mm. diametro, puberulum; stylus 2·2 cm. longus, inferne puberulus.

West Indies. Trinidad: heights of Aripo; Jan. 13, 1922, *R. O. Williams.*

This is a very distinct species of *Beloperone.* It is related to a plant collected by C. G. Pringle at Las Canoas, State of San Luis Potosi, Mexico, 1891, No. 3933, and described by B. L. Robinson in Proc. Amer. Acad. xxvii. p. 183, 1892 as *Beloperone fragilis,* Rob. Unfortunately this name cannot stand, since the same combination had been used long previously by Martius in Flor. Bras. ix. p. 140, 1847, to designate a plant, which, from the description, is a quite distinct species, from Prov. Bahia, Brazil. For the Mexican plant it is proposed that the name *Beloperone tenera,* Turrill, should be substituted for *Beloperone fragilis,* Robinson.

1059. **Isotheca,** *Turrill* [Acanthaceae-Justicieae]; genus novum affinis *Herpetacantho,* Nees, sed floribus in thyrsum terminalem dispositis, staminum abaxialium thecis aequalibus parallelis, pollinis granulis ad typum " Stachelpollen " pertinentibus distincta.

Calyx 5-partitus, segmentis angustis acutis subaequalibus. *Corollae* tubus elongatus, superne parum ampliatus; limbus 2-labiatus, labio adaxialo ex segmentis 2 lateralibus composito, abaxiali breviter trilobo. *Stamina* 4, didynama, filamentis basi per paria lateralia connatis; antherae staminum adaxialium monothecae, abaxialium dithecae, thecis oblongis aequalibus parallelis muticis. *Pollinis* granula sphaeroidea, typi " Stachelpollen." *Discus* annularis, brevis. *Stylus* filiformis, apice minute 2-dentatus; ovula in quoque loculo 2. *Capsula* (fere matura) oblongo-clavata, basi in stipitem longum solidum contracta.—*Herba* vel suffrutex, erecta. *Folia* integerrima. *Flores* pedicellati, flavi, fasciculati vel solitarii, in axillis bractearum parvarum in thyrsum terminalem dispositi.

I. alba, *Turrill*, species unica. *Caules* erecti, glabri. *Folia* elliptica, apice acute angustata vel acuminata, basi in petiolum cuneato-angustata, usque ad 2·2 dm. longa (petiolo excluso), costa nervisque in pagina superiore subimpressis, in pagina inferiore conspicuis, lateralibus utrinsecus circiter 12 marginem versus anastomosantibus, glaberrima; petiolus usque ad 5 cm. longus, glaber. *Inflorescentia* thyrsoidea, terminalis, cum pedunculo 3 cm. longo 2 dm. longa, glabra. *Calycis* segmenti 5, lanceolato-aciculares, subaequales, apice acuminati, 7 mm. longi. *Corolla* alba (ex *Williams*), tubo 4 cm. longo fauce 8 mm. diametro glabro; labii adaxialis segmenta 2, lateralia, 7 mm. longa, 2·5 mm. lata, labio abaxiali trilobo, lobis subaequalibus 1·5 mm. longis. *Stamina* leviter exserta; antherae thecis 4 mm. longis, filamentis circiter 4·5 cm. longis; pollinis granula circiter 65 μ diametro. *Ovarium* cylindricum, 3 mm. altum, 1·5 mm. diametro, glabrum, loculis 2 biovulatis; stylus 5·5 mm. longus.

West Indies. Trinidad; heights of Aripo, Jan. 13, 1912, *R. O. Williams*.

1060. **Leucas helicterifolia,** *Haines* [Labiatae-Stachydeae]; *L. lanatae*, Benth. affinis, sed indumento et foliis lanceolatis acutis serratis nec crenatis differt.

Herba caulibus pluribus subdiffusis 30–50 cm. longis vix ramosis quadrangulatis, pilis suberectis longis brevioribusque dense obtectis. *Folia* lanceolata vel anguste oblongo-lanceolata acuta 4–6 cm. longa, 0·8–1·5 cm. lata, serrata, supra pilosa, pilis basibus tumidis, subtus dense villosa praecipue in nervis; nervi laterales 3–5 obliqui; petioli inferiores ad 5 mm. longi. *Flores* albi, sessiles, in verticillastris multifloris axillaribus dispositi, bracteis setaceis 2–4 mm. longis, pilosis. *Calyx* tubulosus, 7–9 mm. longus; tubus rectus vel leviter incurvus, intra parce sericeus, nervis 10 fortibus pilosis, ore aequali, dentibus triangularibus acutissimis minutis erectis ciliatis. *Corollae tubus* 9–10 mm. longus, pubescens; labium superum 4 mm., labium inferum 6 mm. longum subtus pubescens.

India. Bihar & Orissa: Ramnagar Hills; 300–600 m., *Haines* 4995.

XXX.—ADDITIONS TO THE WILD FAUNA AND FLORA OF THE ROYAL BOTANIC GARDENS, KEW: XVI.

Bark Beetles (Coleoptera).

W. Dallimore and J. W. Munro.

Phloeosinus thujae, *Perris* (The Thuya Bark Beetle). The abnormal drought of 1921 seriously affected the health of many trees at Kew and those that were unduly weakened have been carefully watched during the present year for signs of improved health or further deterioration.

Amongst the enfeebled trees were two specimens, at least 40 to 50 years old, of *Thuya orientalis* near the Cumberland gate. In the autumn of 1921 they had an unhealthy appearance and the winter rains effected little improvement. During late spring a number of branches died and by the end of June the bark had begun to separate from the wood. On examination the presence of a bark beetle was detected. This was submitted to Dr. J. W. Munro, Entomologist to the Forestry Commission, who identified it as *Phloeosinus thujae*, Perris, a beetle that had not hitherto been found in Britain although it is known to occur on the Continent on species of *Thuya*, *Cupressus*, and *Sequoia*, and also on *Juniperus communis* and *J. Sabina*, attacking sound healthy trees, its attack beginning on the uppermost twigs and spreading downwards. Towards the end of July the beetle was found on *Cupressus pisifera* in another part of the gardens, half a mile from the original locality.

Dr. Munro has kindly contributed the following particulars respecting this beetle together with highly magnified drawings of the insect and its main and secondary galleries.

" *Phloeosinus thujae* belongs to the Hylesininae group of the bark beetles and is allied to the genus *Hylesinus* or ash-bark beetles. It is very dark brown or almost black in colour, about $\frac{1}{12}$ in. long. and differs from the ash-bark beetles in several important characters, of which, the absence of tubercles on the thorax, the deeply indented margin of the eyes, and the structure of the antennal club are the chief.

" The brood galleries of *Phloeosinus* are typical for the genus. Like those of the ash-bark beetles the mother galleries are two-armed but unlike these last they are cut parallel to the stem axis and not across it.

" It is at present difficult to determine whence these beetles came to Kew. They may have been imported on *Thuya* or they may yet prove to be indigenous in England. The first surmise is probably the correct one."

However interesting the discovery of an injurious insect new to Britain may be to the entomologist it is disquieting to the cultivator and emphasises the danger of importing insect and other pests with nursery stock. It is probable that in the present instance the beetle may have been present at Kew in small numbers for many years and escaped detection until the sudden enfeeblement of the host plants from another cause, made it possible for the beetles to increase rapidly in numbers and kill the branches. It is well known that the elm-bark beetles may be present on healthy trees for many years causing little harm, whereas, after the weakening of the trees by other agencies, the beetles rapidly increase in numbers and kill the trees.

The rapidity with which a disease is able to spread on closely cropped ground emphasises the necessity for gardeners, foresters, and farmers, to be constantly on the alert. Diseases, whether of fungus or insect agency, usually appear in the first instance on single plants or on limited areas and the application of a wash or burning a few plants at the outset may prevent an epidemic that would do incalculable harm at a later date were they neglected. The supply of clean nursery stock is also of vital importance in the control of disease and care should be taken to clean any infected stock before it leaves the nursery.

The appearance of the thuya bark beetle at Kew affords a good opportunity of directing attention to other bark beetles found in the gardens and on the invitation of the Director, Dr. Munro has prepared the following list, with drawings of the galleries of some of the principal genera found in the sap-wood and bark.

The discovery of the bark beetle *Phloeosinus thujae*, Perris, in the Royal Botanic Gardens, by Mr. Dallimore, has called attention to the Kew bark beetles generally. No list of these has so far been published and except for an exotic species, *Xyleborus morigerus*, Bland., recorded by Pearson in *K. B.* Additional Series V, there is no mention of bark beetles in the Kew fauna lists. The following list therefore, based on observations made by the writer during the last two years and on material collected by Mr. Dallimore, has been prepared at the Director's request.

Scolytus destructor, Ol., (Large Elm Bark Beetle).—This species is abundant in Kew on elms. It increased in numbers during 1921 probably owing to the favourable conditions produced by the drought.

Scolytus multistriatus, Marsh, (Small Elm Bark Beetle).—This species is found together with *S. destructor* but is less common. Both these species are accompanied by the Elm Bark Weevil (*Magdalis armigera*, F.).

Scolytus pruni, Ratz., (Large Fruit-tree Bark Beetle).—A few specimens have occurred in the Director's Orchard and one brood was reared on cherry laurel (*Prunus Laurocerasus*), in Cambridge Cottage Garden in 1921, in a hawthorn log in Queen's Cottage Grounds, 1922, and on *Prunus Padus* in the Upper Nursery, 1922.

Scolytus intricatus, Ratz., (Oak Bark Beetle).—This species is common throughout the gardens on various oaks and on sweet chestnut.

Scolytus rugulosus, Ratz., (Small Fruit-tree Bark Beetle).—Common on various fruit trees in the Director's Orchard, and on *Prunus Padus* in the Upper Nursery, 1922.

Hylesinus fraxini, Panz., (Ash Bark Beetle).—Probably common on *Fraxinus* in Queen's Cottage Grounds and on lilac (*Syringa vulgaris*), 1922.

Hylesinus vittatus, F., (Elm Hylesinus).—On elm along with *Magdalis armigera.*

Phloeosinus thujae, Perris, (Thuya Bark Beetle).—Found on *Thuya orientalis* near the Cumberland Gate, July 1922. Not previously recorded for Britain, and on *Cypsressus pisifera,* July 1922.

Myelophilus piniperda, L., (Pine-shoot Beetle).—Not uncommon in the Pinetum.

Hylurgops palliatus, Gyll., (Brown Pine Beetle).—On pine and spruce logs in the Stable Yard.

Hylastes ater, Payk., (Black Pine Beetle).—On pine logs in the Stable Yard.

Dryocaetes villosus, F.—On oak and sweet chestnut in Queen's Cottage Grounds.

Cryphalus (Ernoporus) fagi, F., (Beech Bark Beetle).—On beech twigs and branches throughout the gardens. Until recently this species was considered rare in England. Mr. Chrystal finds it abundant in Epping Forest and the writer has recently found it near Wotton in Surrey.

Cryphalus abietis, Ratz., (Fir Bark Beetle).—Its galleries have been found on *Abies* spp.

Pityogenes bidentatus, Hbst.—On *Pinus* spp. in the Pinetum and Stable Yard.

Pityogenes chalcographus, L.—On scaffold-poles in the Stable Yard. Undoubtedly an importation. Not established in the Gardens.

Pityophthorus pubescens, Marsh.—On pine twigs in the Pinetum.

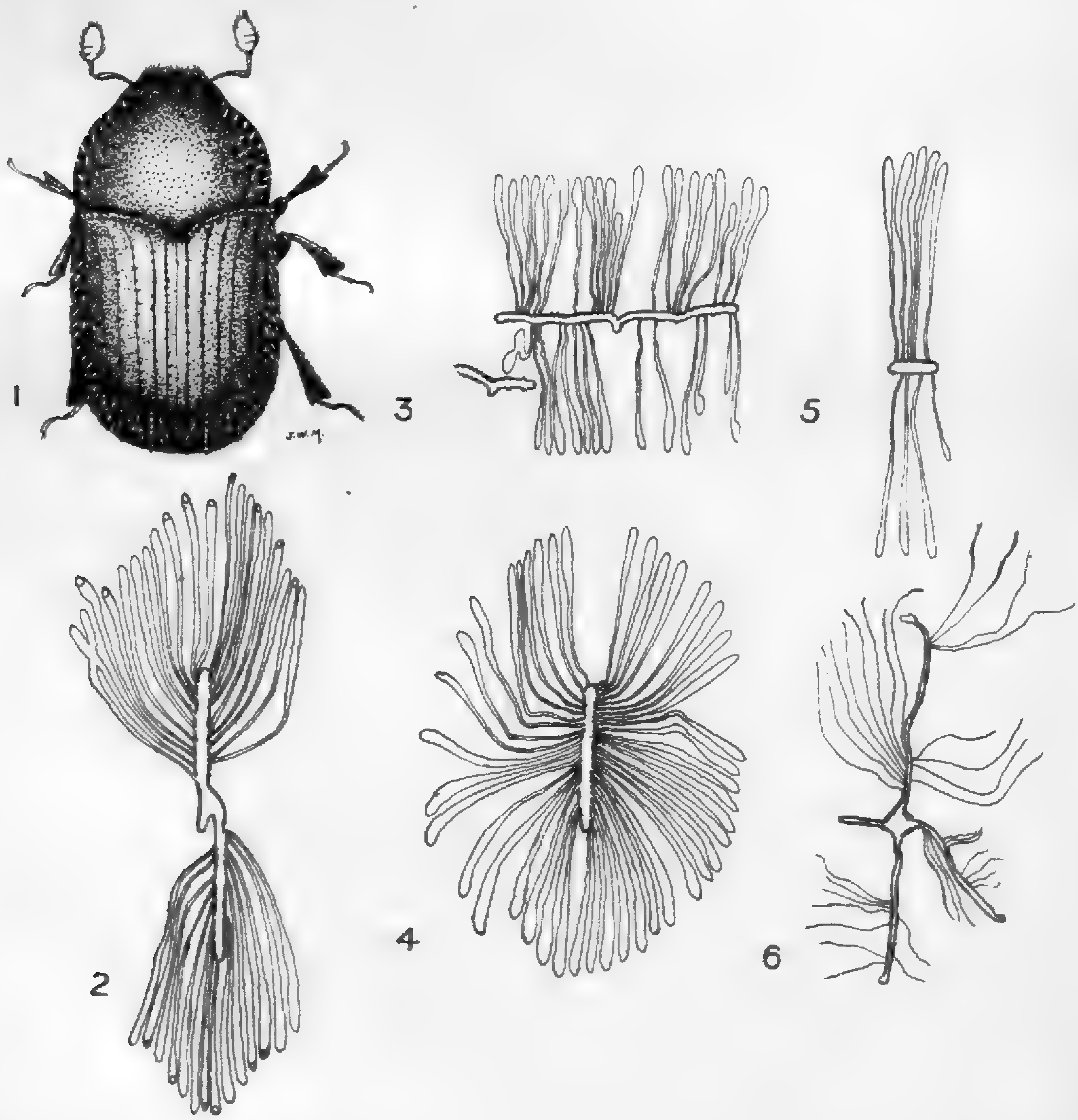
Xyleborus saxeseni, Ratz.—On cherry trees in the Director's Orchard, on oak, sweet chestnut and beech in Queen's Cottage Grounds and on a *Catalpa* log from the Gardens.

Trypodendron domesticum, L.—On oak and beech logs in the Stable Yard.

This list is probably incomplete but it is interesting in that with the exception of *Pityogenes chalcographus* and the possible exception of *Phloeosinus thujae* it contains no exotic species and no peculiarly northern species. All the above bark beetles except for the two species named are more or less common in Surrey and the South of England generally. As might be expected some of the host trees recorded for certain species are unusual. Thus lilac is not a usual host in Britain for *Hylesinus* *fraxini* although it is cited by various authors for that species in Central Europe. The occurrences of *Scolytus pruni* on cherry laurel and of *Xyleborus saxeseni* on *Catalpa* are also unusual and are due to the rich flora present in the gardens affording a wide range of hosts.

Another feature of the list is the small number of pine-dwelling species recorded. This is probably due to the early removal of trees that are not thriving and of all felled stems and broken branches. While this applies to the pine dwellers it is obviously not applicable to the hard-wood dwelling bark beetles, for many elms in particular support a number of *Scolytus* broods which readily increase under favourable conditions—a phenomenon that deserves to be recognised and studied by all interested in Arboriculture.

A further interesting feature of the bark beetle conditions in Kew is the very important part played by the woodpeckers and tits in keeping these insects within bounds. Two species of woodpecker occur, the green and the lesser spotted woodpeckers, and of these the latter accounts for more than half of the bark beetle broods reared. The tits, blue tit, great tit and others, are chiefly enemies of the smaller bark beetles, especially the twig dwelling species.



Descriptions of Figures.

The galleries found in the sap-wood and inner bark are as a rule of generic significance.

Fig. 1. *Phloeosinus thujae* much enlarged. Natural length, $\frac{1}{12}$ in.

Fig. 2. *Phloeosinus thujae.*—Mother gallery long and perpendicular, running in both directions from the centre; larval galleries long inclining from the centre towards each end.

Fig. 3. *Hylisinus fraxini.*—The mother gallery is horizontal, running in both directions from the centre with long right-angled larval galleries.

Fig. 4. *Scolytus destructor.*—Mother gallery long and perpendicular; larval galleries long, close together, inclining from the centre towards each end.

Fig. 5. *Scolytus intricatus.*—Mother gallery short, horizontal; larval galleries at right angles, long.

Fig. 6. *Pityogenes bidentatus.*—Mother galleries star-shaped (beetles polygamous); larval galleries long, slender and irregular.

XXXI.—DIAGNOSES AFRICANAE: LXXVI.

1671. **Xylotheca Kotzei,** *Phillips* [Flacourtiaceae—Oncobeae]; affinis *X. lasiopetalae*, Gilg. et *X. Kraussianae*, Hochst.; ab hac foliis longioribus coriaceis, nervis subtus prominentibus, ab illa foliis longioribus glabris recedit.

Frutex ramis glabris in sicco sulcatis. *Folia* petiolata; lamina lanceolata vel lanceolato-elliptica, nonnunquam breviter acuminata, obtusa, basi leviter angustata, 4–11·5 cm. longa, 1·5–3·3 cm. lata, integra, glabra, venatione distincta, costa et nervis subtus prominentibus; petioli 0·4–1·5 cm. longi, puberuli. *Racemi* terminales vel axillares, pauciflori. *Flores masculi:* pedicelli 2·8 cm. longi, breviter hirsuti. *Sepala* 3, oblonga, apice rotundata, 1·5 cm. longa, 7 mm. lata, extus sparse glandulosa et pubescentia marginum partibus tectis glabris, ciliata. *Petala* circiter 9, apice rotundata, in basin angustata, 2·2 cm. longa, superne 1 cm. lata, extus breviter villosa. *Stamina* numerosa; filamenta 5 mm. longa; antherae lineares, obtusae, basi subsagittatae, 5·5–6 mm. longae. *Flores feminei* non visi. *Fructus* ellipsoideus, 2·2 cm. longus, 1·5 cm. diametro, unilocularis placentis parietalibus, aliquantum pustulatus, minute pubescens, costis 6 longitudinalibus.

South Africa. Zululand: Empangeni Forest Plantation, *P. C. Kotze in National Herbarium, Pretoria,* 1478, 1652, *and in Herb. Forest Dept.* 3537, 3747. Port Durnford Plantation, *Prior in National Herbarium, Pretoria,* 1479 (type), *and in Herb. Forest Dep.* 3632.

1672. **Rhinopteryx angustifolia,** *Sprague* [Malpighiaceae-Banisterieae]; ab *Rh. spectabili*, Niedenzu, unica specie hactenus cognita, ramulis inflorescentiaeque rhachi gracilioribus, foliis anguste oblongo-oblanceolatis breviter acuminatis, antheris subtruncatis, fructu majore differt.

Arbor parva. *Ramuli* castanei, exsiccando costulati, mox glabrescentes, 2 dm. infra inflorescentiam 5 mm. diametro: internodia 2·5–5 cm. longa. *Folia* anguste oblanceolata, apice breviter subacute acuminata, versus basin longe angustata, 14–18 cm. longa, 3·5–4·5 cm. lata, coriacea, supra juventute molliter pilosa, nervo medio excepto mox glabrata, subtus breviter molliter pilosa vel glabrata, nervo medio et lateralibus necnon rete venularum promientibus; petioli circiter 5 mm. longi, supra breviter villosi. *Racemus* terminalis, sub fructu ad 3·5 dm. longus. *Bracteae* subulatae, 4–5 mm. longae; bracteolae iis conformes, 2·5–3 mm. longae; pedicelli 1·5–2 cm. longi (sub fructu). *Calyx* extus basi glandulis 3 circularibus brunneis unilateraliter ornatus; sepala extus breviter brunneo-villosa, difformia; sepalum impar, quod a glandulis maxime remotum est, 5·5 mm. longum, 3·5 mm. latum, subrhomboideum, nempe inferne suboblongum, in basin per 3 mm. leviter angustatum, superne depresso-deltoideum; sepala duo intermedia (nempe interiora et non-glandulifera) elliptica, 5 mm. longa, 3·5 mm. lata; sepala duo glandulifera oblonga, subcuspidata, 4 mm. longa, 2·5–3 mm. lata. *Flores* albi (*McLeod*). *Petala* non visa. *Filamenta* 2 mm. longa; antherae 4–4·5 mm. longae, subtruncatae, interdum minute biapiculatae. *Mericarpia* alis 5·5–6 cm. longis 3–4 cm. latis.

Tropical Africa. Gold Coast: Northern Territory; savannah between Sambu and Pabia Lorha, *N. C. McLeod in Gold Coast Forest Herb.* 815.

An interesting addition to the genus *Rhinopteryx*, which has hitherto been supposed to be monotypic. The type-species *Rh. spectabilis*, Niedenzu, is a native of the Gambia Protectorate, and has obovate-oblong or elliptic leaves, up to 8 cm. broad, strongly apiculate anthers and smaller fruits.

1673. **Dialium Simii,** *Phillips* [Leguminosae-Cassieae]; inter species africanas foliolis ovato-lanceolatis breviter acuminatis emarginatis, petalis et staminibus 5, fructibus complanatis dense papilloso-glandulosis valde distincta.

Arbor 6–10 m. alta. *Folia* 7–9 cm. longa; foliola 3·5–6 cm. longa, 0·8–2·5 cm. lata, lanceolata vel ovato-lanceolata, breviter acuminata, apice emarginata, glabra, infra costis prominentibus. *Inflorescentia* diffusa. *Sepala* 5, 4·5–5·5 mm. longa, 2·5 mm. lata, oblonga, apice obtusa, pubescentia. *Petala* 5, 2 mm. longa, elliptica, basi unguiculata. *Stamina* 5; filamenta 1·5 mm. longa; antherae 2·5–3 mm. longae, ovato-lineares, breviter hispidae. *Ovarium* setosum; stylus 2–3 mm. longus; stigma discoideum. *Fructus* complanatus, late ellipticus, 2·5 cm. longus 1·5–1·8 cm. latus, dense papilloso-glandulosus.

TROPICAL AFRICA. Rhodesia : near Railway Station. Victoria Falls; a tree 20–30 ft. high, evergreen, with flowers and fruits both present, July 1920, *T. R. Sim* 19004; *F. A. Rogers* 5307 [Herb. Kew].

Sim's specimen was submitted to the Director of Kew who reported on it as follows :—" We find it matches fruiting specimens from the same spot, these were placed in *Dialium*. The fruit and basifixed anthers agree with those of this genus. You will note that both petals and stamens of your specimen number 5, while the generic description of *Dialium* gives " petals 1–2 or 0; stamens 2." The latter state is, however, obviously one of reduction, and as it can be linked with the perfect condition of your specimen by such a species of *D. Englerianum*, Henriques (Bol. Soc. Brot. 1899, 48) which has " petals 4, stamens 4–5," we should advocate the placing of Sim 19004 into *Dialium*, note being made of the extension of generic characters involved."

1674. **Brunia albiflora,** *Phillips* [Bruniaceae]; species foliis linearibus laxe pilosis 1 cm. longis capitulis corymbosis floribus albis distincta.

Rami juniores villosi. *Folia* conferta, ascendentia, linearia, obtuse nigro-mucronata, 1·2–1·4 cm. longa, 0·5–1 mm. lata, supra plana et canaliculata, infra convexa, junioribus pilosis demum glabris. *Capitula* alba, terminalia, corymbosa, sphaerica; pedunculi 3 cm. longi, pilosi, bracteis linearibus carinatis rubro-brunneis, dense induti; axis inflorescentiae clavata, 8 mm. longa, 3 mm. crassa. *Bracteae* lineari-spathulatae, basi angustatae, apiculatae, 5 mm. longae, 1 mm. latae, virides, extra dense villosae. *Sepala* linearia, apiculata, 3·5 mm. longa, villosa. *Petala* linearia, obtusa, basi angustata, 5·5 mm. longa, superne 1 mm. lata. *Filamenta* 4 mm. longa, linearia, glabra; antherae 1 mm. longae, lineares. *Ovarium* semi-inferum, 1·5 mm. longum, 0·75 mm. diametro, glabrum, 2-loculare, loculis 1–ovulatis; styli 2, basi liberi, teretes, 4·5 mm. longi; stigma simplex.

SOUTH AFRICA. Caledon Division: Hottentots Holland Mountains, Apr. 1922, *T. P. Stokoe in S. Afr. Nat. Herb.* 1669.

1675. **Brunia Stokoei,** *Phillips* [Bruniaceae]; affinis *B. macrocephalae*, Willd., sed foliis brevioribus et angustioribus glabrescentibus, bracteis latioribus et brevioribus differt.

Rami glabri, basibus foliorum delapsorum verrucosi. *Folia* patula vel recurva, trigona, supra fere plana, costa elevata, infra carinata, obtusa, apice nigro-mucronata, 7–8 mm. longa, 1 mm. lata, glabra. *Capitula* depresso-globosa, conferta, circiter 3 cm. diametro; pedunculi 2–3 cm. longi, 5–7 mm. crassi, bracteis imbricatis lanceolatis obtusis 3 mm. longis 1 mm. latis infra carinatis glabris induti; axis 1·2–1·5 cm. longa, 7–9 mm. crassa, ovoidea; bracteae obovato-spathulatae, subacuminatae, nigro-mucronatae, 7 mm. longae, superne fere angulo recto curvatae.

dorso in parte media dense villosae. *Sepala* 4, anguste linearia vel oblanceolata, 4·5 mm. longa, extra dense villosa. *Petala* triloba, linearia, 5·5 mm. longa, 0·75 mm. lata. *Filamenta* 5 mm. longa, teretia; antherae lineares, 1·25 mm. longae. *Ovarium* 2 mm. longum, 1 mm. diametro, ellipsoideum, superne dense villosum, 2-loculare, ovulis solitariis pendulis; styli 1–2, 4 mm. longi, teretes, a basi liberi, stigmate simplici. *Fructus* immaturi 3·5 mm. longi, 1·5 mm. diametro, ellipsoidei.

South Africa. Caledon Division: Hottentots Holland Mountains, near Hang Klip, April 1922, *T. P. Stokoe in S. Afr. Nat. Herb.* 1668.

1676. **Mussaenda Dawei,** *Hutchinson* [Rubiaceae-Mussaendeae]; affinis *M. angolensi*, Wernham, sed nervis lateralibus numerosioribus, pedunculis multo longioribus corollae pilis omnibus ascendentibus, calycis lobo petaloideo multo majore differt.

Frutex speciosus; rami laxe foliati, teretes, brunnei, rufo-hispido-pubescentes, internodiis 2·5–3·5 cm. longis. *Folia* late elliptica, breviter acuminata, basi brevissime cuneata, 9–14 cm. longa, 5–6 cm. lata, chartacea, integra, utrinque sparse hispida; costa supra dense hispida, infra prominens et setulosa et minute puberula; nervi laterales utrinsecus 15–16, infra conspicui, a costa sub angulo 65° abeuntes; petioli 1 cm. longi, rufo-pubescentes; stipulae parvae, triangulares, dense villosae. *Cymae* terminales, laxiflorae; cymulae pedunculatae, circiter 9-florae, pedunculis circiter 3 cm. longis rufo-hirsutis. *Flores* subsessiles. *Receptaculum* oblongo-obconicum, dense tomentosum. *Calycis* dentes triangulares, 1·75 mm. longi, tomentosi, uno magno petaloideo ovato-orbiculari breviter acute acuminato albo circiter 8 cm. longo et 6·5–9 cm. lato. *Corolla* 3·5–4 cm. longa; tubus subcylindricus, utrinque dense rufo-tomentosus, superne circiter 2·5 mm. diametro; lobi 5, ovati, acute acuminati, 6 mm. longi, 3·5 mm. lati, intra strigilloso-pubescentes. *Fructus* non visus.

Tropical Africa. Angola: Portuguese Congo; handsome shrub on the shores of the Quissanga Islands, Lower Congo River, 1921, *M. T. Dawe* 41.

1677. **Pteronia intermedia,** *Hutchinson et Phillips* [Compositae–Asteroideae]; affinis *P. onobromoidi*, DC., et *P. punctatae*, Phillips, ab illa foliis et capitulis multo minoribus, ab hac foliis alternis ramulis glabris differt.

Frutex circiter 30 cm. altus; rami breves, glabri. *Folia* alterna, carnosa, lineari-oblonga, apice rotundata, 0·4-1 cm. longa, 1·5–2 mm. lata, breviter setuloso-ciliata, glabra. *Capitula* solitaria, terminalia, plus minusve urceolata, circiter 1·5 cm. longa, fere 1 cm. diametro, circiter 30-flora. *Involucri bracteae* 5–6-seriatae, superne incrassatae, marginibus anguste lacerato-membranaceis, exterioribus oblongo-ellipticis apice rotundatis 6–7 mm. longis 5·5 mm. latis, interioribus 1–1·2 cm. longis, 3 mm. latis obtusis. *Receptaculum* 5 mm. diametro, foveolatum. *Corollae tubus* 7 mm. longus, superne leviter ampliatus, lobis

3 mm. longis 1·25 mm. latis lanceolatis subobtusis. *Antherae* 3·5 mm. longae, appendice lanceolato-ovato. *Pappus* 7 mm. longus, setis basi connatis inaequalibus fere laevibus. *Achaenium* 2·5 mm. longum, obovoideum, longe dense pilosum.

South Africa. Flats near the Matjesfontein-Sutherland Road, and on the slopes of Ngaap Kop at Matjesfontein, shrub 1 ft. high with yellow flowers, Oct.–Nov., 1921, *W. J. Foley, in S. Afr. Nat. Herb.* 1517. Duplicate in *Herb. Kew.*

1678. **Brachystelma floribundum,** *Turrill* [Asclepiadaceae-Ceropegieae]; affinis *B. lineari*, A. Rich., sed tubere multo majore, foliis longioribus et latioribus, floribus numerosioribus majoribus, coronae segmentis trilobatis lobis linearibus facile distinguitur.

Tuber ambitu orbiculare, 1·15 dm. diametro, 2·7 cm. crassum, leviter depresso-concavum, laeve, pallide stramineum. *Caules* 2–3, usque ad 6 cm. alti, cylindrici, puberuli, purpurei. *Folia* sessilia, lineari-lanceolata, acuta, usque ad 6·5 cm. longa et 9 mm. lata, costa nervisque in pagina superiore leviter impressis, in pagina inferiore prominentibus, nervis lateralibus marginem versus anastomosantibus, duobus infimis margini fere parallelis, supra glabra, infra ad costam puberula, margine et marginem versus pilis brevibus a basibus bulbosis purpureis orientibus instructa. *Flores* usque ad 12, ad nodos sublaterales, horizontales; pedicelli 1·2–1·5 cm. longi, puberuli. *Sepala* lanceolata, acuta, 4 mm. longa, basi 1·5 mm. lata, puberula. *Corollae tubus* late breviterque campanulatus, 7 mm. longus, 1 cm. diametro, extra pallide viridis maculis purpureis parvis instructus, intus pallide viridis lineis transversis et maculis purpureis instructus; lobi lineares e basibus triangularibus 2·8 cm. longae, patentes, supra nigro-purpurei, glaberrimi; plicae 5, 1 mm. longae, inter corollae lobis positae. *Coronae segmenta* 5, late ovata, purpureo-maculata, apice trilobata, lobis linearibus duobus lateralibus 1·7 mm. longis dense puberulis arcuato-erectis, lobo medio antherifero glabro incumbente; pollinia 0·5 mm. longa. *Carpella* cylindrica, 2 mm. longa, viridia, purpureo-maculata; styli apex discoideus, leviter convexus.

Tropical Africa. Rhodesia: grown in the Royal Botanic Gardens, Kew, from a tuber received from Mr. A. Hislop, Rhodesia, and described from the living plant, in flower 27.6.1922.

1679. **Brachystelma lanceolatum,** *Turrill* [Asclepiadaceae–Ceropegieae]; affinis *B. Johnstonii*, N.E. Br., sed foliis lanceolatis, corollae lobis minus dense albo-villosis differt.

Planta perennis, caule solitario e centro tuberis oriente. *Tuber* disciforme, apice impressum, 3·5 cm. diametro, cinereum, glabrum. *Caulis* simplex, 1·5 dm. altus, teres, puberulus. *Folia* lanceolata, apice acuta, basi in petiolum circiter 0·5 cm. longum gradatim angustata, usque ad 6·5 cm. longa (petiolo excluso) et 1·1 cm. lata, costa in pagina superiore impressa, in inferiore prominente, nervis lateralibus pagina utraque inconspicuis, glabra vel fere glabra. *Flores* circiter 7, in caulis apicem conferti, sessiles. *Corolla* fere 11 cm. diametro, lobis 5 cm. longis basi 5 mm. latis in caudas lineari-filiformes gradatim attenuatis extra glabris viridibus intus albo-villosis viridibus basi purpureo-maculatis, reticulatis, tubo campanulato 5 mm. longo 4 mm. diametro extra glabro purpureo intus fauce purpureo-lineato. *Corona* cupularis, viridis, dentibus 10 intus ad apicem leviter retrorsum barbatis praedita, et quinquelobata, lobis 1·25 mm. longis lineari-oblongis apice rotundatis incumbentibus.

TROPICAL AFRICA. Uganda: grown in the Royal Botanic Gardens, Kew, from a tuber received from Entebbe, and described from the living plant, in flower 6.6.1919.

1680. **Mimetes Stokoei,** *Phillips et Hutchinson* [Proteaceae-Proteeae;] M. *saxatili*, Phillips, affinis, sed perianthii lobis villosis et stigmatibus multo majoribus differt.

Rami villosi, densissime foliati. *Folia* ovata vel ovato-elliptica 6–6·5 cm. longa, 3–3·5 cm. lata, apice inaequaliter 3-dentata, raro integra, basi piloso-villosa, utrinque pilis sericeis appressis dense induta. *Capitula* sessilia 7 cm. longa, 10–12-flora, ad apices ramorum dense conferta. *Involucri bracteae* 3–4-seriatae, ovatae, oblongae vel lineares, obtusae, 1·3–2 cm. longae, 4–9 mm. latae, supra villosae, ciliatae. *Perianthii lobi* 4 cm. longi, basi lati, villosi; limbus 9 mm. longus, linearis, villosus. *Antherae* 5 mm. longae, lineares, apice glandulis 0·5 mm. longis ovatis subobtusis instructae. *Squamae hypogynae* 2 mm. longae, lineares. *Ovarium* 1 mm. longum, villosum; stylus 5·5 cm. longus, flavus, glaber; stigma 3 mm. longum, nigrum, apice ovoideo-globosum, rostratum, glabrum, basi paullo verrucosum.

SOUTH AFRICA. Caledon Division: Hottentots Holland Mountains; near Hangklip, Feb. 1922, *T. P. Stokoe in S. Afr. Nat. Herb.* 1642.

An exceptionally handsome species; in the living plant the styles are bright yellow and stigmas black; the leaves are very erect and hide the branches.

XXXII.—MISCELLANEOUS NOTES.

MAJOR T. F. CHIPP, M.C., B.Sc., Deputy Conservator of Forests, Gold Coast, since 1921, and formerly Assistant Director of the Botanic Gardens, Singapore (*K. B.* 1914, 227), has been appointed Assistant Director of the Royal Botanic Gardens, Kew. (See also *K.B.* 1909, 424; 1910, 132).

MR. M. T. DAWE, F.L.S., has been appointed by the Secretary of State for the Colonies, on the recommendation of Kew, Commissioner of Lands and Forests, Sierra Leone. (See also *K.B.* 1902, 24; 1911, 65; 1915, 306.)

Mr. L. Lewton Brain.—We learn with regret that Mr. L. Lewton Brain died at Kuala Lampur on June 24th of heart failure after an attack of malaria. Mr. Lewton Brain was educated at St. John's College, Cambridge, and was subsequently appointed Junior Demonstrator of Botany in the University. In 1903 he was appointed Mycologist and Lecturer in Agriculture to the Imperial Department of Agriculture for the West Indies (*K.B.* 1903, 30), and later held the post of Assistant Director in the Division of Physiology and Pathology in the experiment station of the Hawaiian Sugar Planters' Association. When the post of Director of Agriculture in the Federated Malay States fell vacant in 1910, Mr. Lewton Brain was appointed to fill the position (*K.B.* 1910, 253), and on the abolition of this post last year he was appointed Technical Adviser in Agriculture to the Government of the Federated Malay States (*K.B.* 1922, 94). During the eleven years of his tenure of the Directorship the Agricultural Department of the Federated Malay States has been reorganised and greatly strengthened and is now one of the best equipped Agricultural Departments in the Colonies.

The Chinese Form of Cornus Kousa.—The Chinese form of this cornel, which was introduced from Western China in 1907, has flowered very beautifully this year at Kew and promises to be one of the best and most attractive of the new shrubs from that country. The species has, of course, long been known in gardens, but previous to the introduction of the Chinese plants, all those in cultivation were of Japanese origin. The floral beauty of *Cornus Kousa* is due solely to its bracts, of which four subtend the true flowers—small and inconspicuous—clustered in a head $\frac{3}{8}$ inch wide. The bracts are ovate-lanceolate, slender-pointed, and in the Chinese plants the largest of them are 2 to 3 inches long and 1 to $1\frac{1}{2}$ inches wide, creamy white, suffused with pink before they fade. On the Japanese plants previously in cultivation the floral bracts are smaller and narrower, but judging by specimens preserved in the Herbarium at Kew there do appear to exist in Japan forms of this species with bracts as large as those of Wilson's plants, although they have not been introduced. The garden value of the species is enhanced by the length of time the bracts remain in good condition; this year, in spite of the heat and drought in May and early June they were in beauty five or six weeks. Mr. Wilson found it as a shrub and as a small tree varying from 15 to 30 feet in height. It can be increased by cuttings, and in favourable seasons good seed no doubt will ripen. A figure of a Japanese form of *Cornus Kousa* appeared in the *Kew Bulletin* for 1915, page 179.

W. J. B.

The Big Tree of Tule.—Unless the comparatively few regions of the globe as yet botanically unexplored have some unsuspected wonders to reveal in the way of ancient trees, it is not likely that any tree, or indeed any living organism exists that is older than the Big Tree of Tule. This tree is a near relative of *Taxodium distichum*, the well known "Deciduous" or "Swamp" Cypress of the Southern United States. It is known to botanists as *Taxodium mucronatum*, Tenore, and is a native of Mexico, where it is widely spread. The Big Tree of Tule grows in the churchyard of Santa Maria de Tule, which is about 18 miles south-east of Oaxaca and 250 miles from the City of Mexico. Its height is about 150 feet and the diameter of the trunk 50 feet; therefore, although of much shorter stature than the Sequoias or Mammoth trees of California, its trunk is considerably wider than that of the largest of them. There seems to be little doubt, too, that it is considerably older.

Although a calculation of the age of such a tree as this must be largely conjectural, there are data on which an estimate can be based. On other and younger trees of *Taxodium mucronatum* the annual rings have been counted and found to number about two hundred in a section twelve inches wide. The annual rings on young trees are normally thicker than on very old ones of the same species. It seems safe, therefore, in the case of the Taxodium of Tule, with its diameter of 50 feet (that is 25 feet from centre to circumference), to calculate its annual rings at 200 to the foot and to put its age at 5000 years. In spite of its age it appears to be still in perfect health. Mr. C. J. Chamberlain of the University of Chicago, who gives an interesting account of this tree in "School Science and Mathematics," Nov. 1921, states that in 1908, when he saw it, there was not a dead twig in sight. He goes on to say :—' Resting under the shade of the Big Tree and remembering its great age, one can hardly avoid thinking of events which have occurred during its lifetime. Before the Pyramids of Egypt were built it was a sturdy tree; and before Moses led the children of Israel out of the wilderness, it must have reached the usual size of the species; when Rome was founded, it must have been known as a big tree; in the days of King Arthur and his table round, its reputation as a giant among its kind must have been established; and ever since there have been Mexican traditions, Indians have made pious pilgrimages to the Big Tree of Tule. It must have been a familiar object to the pre-historic men who built the Pyramids on the nearby Monte Alban, and who erected the wonderful buildings now known as the Ruins of Mitla."

Taxodium mucronatum is represented at Kew at present by three trees, one of which is in the Temperate House, a second is growing at the edge of the Water-lily pond, and the third on the margin of the Lake. These trees were presented by Mr. H. J. Elwes in 1908 and are now 7 feet to 9 feet high. Although they grow slowly they are quite healthy and the two planted out-of-doors have not suffered very much through winter cold as yet. In habit and foliage they strongly resemble *T. distichum* but at

Kew retain some of their leaves, whilst *T. distichum* is quite deciduous. In Mexico, *T. mucronatum* is evergreen. There are two good photographs of the tree at Tule in Museum No. III., taken in 1898 and presented to Kew two years later by the late Hon. Charles Ellis. W. J. B.

Hooker's Icones Plantarum.—Since the last note on " Hooker's Icones Plantarum " appeared in the *Kew Bulletin*, 1913, p. 280, a complete volume (vol. xxxi = vol. i of the fifth series), containing plates 3001 to 3100, has been published, as well as a general index to volumes i–xxx, which was issued in 1919.

In the first part, published in January 1915, there are plates with descriptive text of plants belonging to 19 families. *Pareugenia* (t. 3004) is a new genus of Myrtaceae from the Fiji Islands. It is nearest allied to the section Syzygium of *Eugenia. Antherothamnus* (t. 3007) is a new monotypic genus of Scrophulariaceae, allied to *Freylinia. A. Pearsonii,* discovered by the late Prof. H. H. W. Pearson in South-West Africa, is described by him as " a charming shrub with flowers delightfully scented at night." Five plates are given to the Euphoriaceae. *Plectaneia elastica* (t. 3024) a climbing shrub belonging to the Apocynaceae, and native of Madagascar, is said to yield a rubber of good quality.

Part 2, published in August 1915, contains figures and descriptions of representatives of 16 families. Five South African species of *Thesium* are included. The Leguminosae are represented by one species each of *Leptoderris, Millettia* and *Lonchocarpus. Leptoderris brachyptera* (t. 3028), from Senegambia and Angola, has " fragrant pink flowers produced so copiously in the dense forests of Cungulungulo (Angola) as to hide completely the tree on which the creeper grows." *Homozeugos* (t. 3033) is a new genus of Gramineae belonging to the tribe Andropogoneae of which two species, both Angolan, are known. Three species of *Meconopsis* are figured. *M. venusta* (t. 3036), collected by Mr. George Forrest in Yunnan, has deep red-purple flowers, and appears to be a particularly attractive plant.

Part 3, which appeared in June 1916, contains representatives of 14 families. Three species of Compositae are figured. *Pappobolus macranthus* (t. 3057) is the only known species of a new genus of Compositae (tribe Helianthoideae) from Bolivia. *Neowollastonia* (t. 3060) is a new genus of Apocynaceae allied to *Ervatamia.* The only species (*N. tabernaemontanoides*) is a native of New Guinea. The Asclepiadaceae are represented by the new genus *Dalzielia* of which the single species (*D. oblanceolata*) is from Sierra Leone. A figure of a new genus of Zingiberaceae (*Eriolopha*), from New Guinea, occurs on t. 3067. Plates 3068 to 3075 are given to grasses, among them being three new genera : *Chloachne, Uranthoecium* and *Danthoniopsis.*

Part 4, completing the volume, was issued at the end of last June. It consists entirely of plates of grasses, with text by

Dr. Stapf. These grasses with few exceptions are Tropical African species which Dr. Stapf had investigated in the course of his elaboration of the family for the "Flora of Tropical Africa" and descriptions of which have appeared in volume ix of that work. Two new genera are published: *Diheteropogon* (t. 3093) and *Odyssea* (t. 3100). *Diheteropogon* was treated by Hackel as a section of *Andropogon*, and *Odyssea* is nearest allied to *Diplachne*. S. A. S.

The Useful Plants of Nigeria.—With the publication of *Kew Bulletin*, Additional Series IX, Part IV, Mr. Holland's compilation of "The Useful Plants of Nigeria," is brought to a close. The first Part published in 1908, and of which a notice was given in *K.B.*, 1909, p. 427, gave a general introduction to the subject and detailed information of the plants comprised in the Natural Families *Ranunculacae* to *Anacardiaceae*. The second part, published in 1911, continued with the *Anacardiaceae* and concluded with the *Araliaceae*, The third Part, published in 1915, dealt with the Natural Familes *Rubiaceae* to *Labiatae*, whilst the present Part concludes the Dicotyledons, and covers the Monocotyledons, Filices, and Fungi. As an appendix to the last Part a list of books and papers dealing with West African subjects is given, and there is a complete index to all four Parts.

With the fourth Part is bound an Introduction and Preface. In the Introduction Sir David Prain, under whose auspices the work was planned and carried through so successfully, gives the reasons which called for this publication. The Flora of Tropical Africa "which has occupied much of the attention of the Herbarium Staff at Kew for more than half a century, and the completion of which at last appears in sight," provides a floristic study. In West Africa no attempt had hitherto been made at an economic survey of the vegetation and it was to supply this much-needed want that the present work was undertaken in the Museums at Kew. Mr. Holland's Nigerian service has rendered him eminently suitable for this task, and although the work is primarily intended to cover Nigerian plants, it will be found equally useful for all West African countries.

Mr. Holland in a brief Preface outlines the scheme followed in "The Useful Plants of Nigeria," to which he has devoted the greater part of his non-official work for the past sixteen years. The Parts have gradually increased in size, but it is chiefly the present greatly enhanced cost of production that has necessitated the very high price of the last Part. The published prices of the Parts are :—No. I, 2*s.*; No. II, 2*s.* 6*d.*; No. III, 3*s.* 6*d.*; No. IV, 1*l.*; or the complete volume, 1*l.* 8*s.* T. F. C.

Gambia Plants.—Mr. M. T. Dawe, whilst on an official mission in the Gambia Colony on behalf of the Colonial Office early in

1921, made a collection of dried plants, a list of which has just been published.*

The specimens were determined at the Herbarium of the Royal Botanic Gardens, Kew, and were selected by Mr. Dawe mainly on account of their economic importance, as his visit to the colony was made in the season when few plants were in flower. About 115 species are enumerated with economic notes and native names. As the indigenous flora of the Gambian hinterland is not particularly well known, it is hoped that Mr. Dawe's wish will be realised that his collections should be added to by officials and others who travel in the colony, particularly with respect to the native names and uses of the plants.

Babington's Manual of British Botany.†—The appearance of a new edition of this well known work is a matter of some importance to all interested in the British flora. The chief impression gained by an examination of the work as now re-issued is that the present editor has been seriously handicapped by limitations placed on him by those whose desires he had perforce to respect. It is a matter of considerable regret that the whole work could not have been re-written for this edition and especially that the matter contained in Appendix II. could not have been incorporated in the body of the work. Appendix II. is undoubtedly the most valuable and interesting part of the present edition. In it Mr. Wilmott has brought together many of the recent results of the continued critical examination of British plants. Much has evidently been accomplished since the last edition of the Manual was published. Amongst other studies those of Pugsley on *Fumaria*, of Gregory and Drabble on *Viola*, of Lindberg and Salmon on *Alchemilla*, of Moss on *Salicornia* and *Ulmus*, of Druce on *Orchis* and other genera, are included in a summarised form.

The Preface is dated 24th April 1922, but it would appear, from internal evidence, that at least the name changes in the body of the book were made, irrevocably for this edition, several years ago. On the other hand, quite recent discoveries are recorded in Appendix II., though complaints about omissions will no doubt reach the Editor.

The convenient size of the new edition will appeal to field-workers, but the paper and binding will not withstand the long continuous wear to which a field reference book has of necessity to be subjected.

W. B. T.

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* List of Plants collected in the Gambia, by M. T. Dawe, F.L.S., F.R.G.S., 11 pp. Bathurst: Gov. Printer, 1922.

† Manual of British Botany, by Charles Cardale Babington, Tenth Edition, edited by A. J. Wilmott, B.A., F.L.S. Gurney and Jackson, 33, Paternoster Row, London, E.C., 1922. Price 16s. net.

Presentation of Mr. William Hancock's Herbarium.—Mr. W. Hancock, F.L.S., the well-known collector of Chinese plants and for many years a regular correspondent of Kew, was born at Lurgan in Ulster in 1847. His taste for botany dates from his childhood when he was taught by his mother how to know, collect and preserve the wild flowers of Northern Ireland. He was sent fortunately to a private school at Lancaster where botanical study was encouraged. After further education at Queen's College, Belfast, and a short period of business experience in that town, he obtained an introduction to Sir Robert Hart and went out to China as a member of his staff in the Chinese Imperial Maritime Customs.

This appointment gave him ample opportunity in his spare time to pursue his chosen hobby. He originally got help as to the naming of his collections from Hance of Canton, and from Maximowicz of St. Petersburg, but soon became acquainted with Sir Joseph Hooker, then Director of Kew.

Impressed by Hancock's keenness and by his excellent preparation of specimens, Sir Joseph encouraged him to become a correspondent of Kew, and to number and label his future specimens in a methodical way. From that time a succession of packets of plants arrived at Kew containing sets of all that he collected. His chief fields were, of course, China and Formosa, but in his periods of leave he also visited Japan, Java, Sumatra and later Central America and the West Indies.

All this time Hancock was amassing a large private herbarium, and as it was labelled throughout with numbers corresponding with Kew determinations, it was one of considerable value. When he retired from the Chinese Imperial Service he settled with his sister at Bristol, where he died in 1914.

A large number of new flowering plants and ferns discovered by Hancock were named after him, and a new genus of orchids *Hancockia*, Rolfe, was published in 1903.

In accordance with his wishes his whole herbarium of about 10,000 specimens was after his death placed by Miss Hancock at the disposal of Kew, with the condition that the part not required for the Kew Herbarium should be given to the University of Bristol.

Abnormal Pine Stems.—A short time ago Mr. J. S. Gamble directed attention to the abnormal development of young pine trees in his plantations at Highfield, East Liss, Hants. The trees had normal trunks for a distance of several feet above the ground, they then suddenly became bent at right angles with the trunk, extending outwards for a distance of 5–7 inches, then by means of a curve and another sharp turn regained approximately the original vertical plane 12 inches or so above the lower bend.

The condition is common in some parts of the country and follows an injury to the young leading shoot. The injury may be due to a variety of causes, but frequently follows an attack by the "Pine-shoot Tortrix Moth" (*Retinia buoliana*, Schiff.). The female deposits an egg at the extreme point of a shoot, near the base of the terminal bud, in July. A caterpillar appears in the course of a few weeks and gnaws a small wound at the base of the bud. This causes a flow of resin in which the caterpillar passes the winter. When growth begins in spring the caterpillar bores into the shoot and eats its way upwards along the pith. In many cases the leading shoot is killed. This results in the upward growth of a whorl of side branches, and eventually several leaders, all appearing at a sharp angle with the main stem. But at other times the leading shoot is less seriously injured, probably through some tragedy overtaking the caterpillar. It is so weakened, however, that it cannot maintain an erect position and bends over sometimes at right angles with the trunk and sometimes lower still. In the case of very considerable weakening the shoot may eventually break off by reason of its own weight but in other instances, once the caterpillar disappears, the natural vigour of the tree enables it to set about repairing the injury. The wound heals and the point of the shoot turns upwards. Instead, however, of turning upwards at right angles in a new vertical plane it takes a distinct curve until it is approximately over the centre of the lower part of the trunk, then by a sharp turn quickly assumes a vertical position. This all occurs in the course of a few weeks and probably passes unnoticed. The curve, however, develops with the growth of the tree and becomes very noticeable a few years later. As time goes on there is a distinct tendency for deformed trunks to straighten, for growth is much more rapid on the inside than on the outside of a curve. Numerous deformed trunks are doubtless removed in the course of thinning, but some probably remain until the crop is mature and this may be one of the reasons for irregularities of structure that are sometimes found in planks.

It has been suggested that the curve in the trunk is due to the removal of the natural leader and by a side branch turning upwards to take its place. There is, however, plenty of evidence to prove that in healthy young pines which lose their leaders, there is a distinct tendency for not one but a number of side branches to turn upwards at a sharp angle and in some cases it becomes necessary to thin them out in order to preserve a single trunk. Moreover, the curve often occurs midway along the annual growth, a point at which it would be very unlikely that a side shoot would appear. In order to make sure that there had been no interruption in the original leading shoot of the specimens in question, a longitudinal section was cut through a curved trunk from a point six inches below the curve to a similar distance above. The pith was then traced and found to be continuous, but at the lower bend it had been injured to some extent. A whorl of branches occurred at the lower bend and the next whorl was immediately above the higher bend. The lower part of the trunk had 14 annual rings and the upper part 12 annual rings.

The accompanying photographs show the outer and inner surfaces of one of the sections.

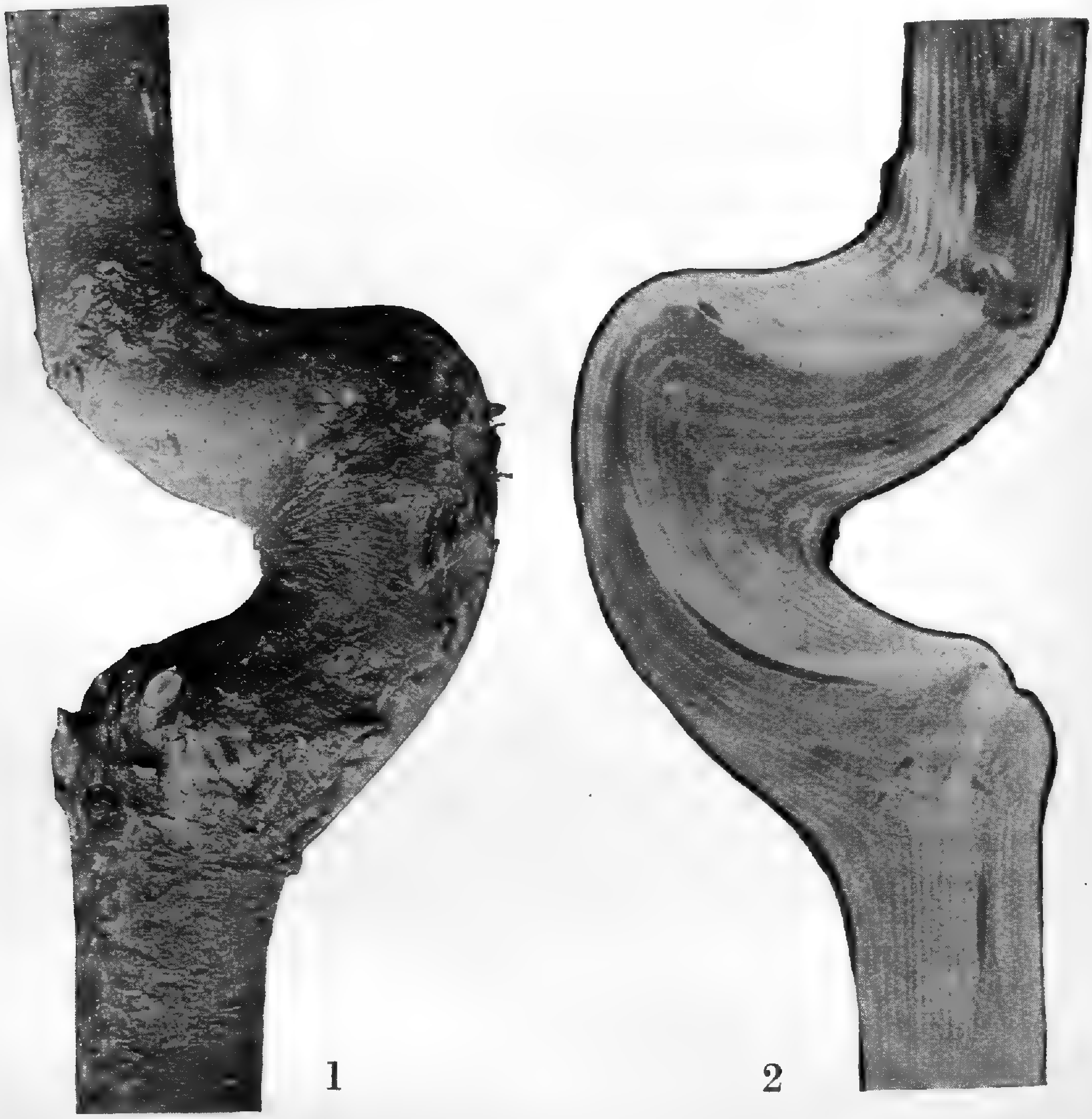

Fig. 1. External view of a curved stem of *Pinus sylvestris*.
Fig. 2. Internal view of the same stem.

A single attack by this moth is capable of causing considerable injury to a tree and repeated attacks effectually prevent normal development, the head assuming a bushy, stunted character. Several such trees are to be seen at Kew, notably *Pinus muricata*. Many species of *Pinus* are attacked, even those introduced recently from China. The five-leaved pines, however, appear to be less susceptible to attack than the two- and three-leaved kinds. From Mr. Gamble we have received injured trunks of *P. sylvestris*, *P. Pinaster*, *P. radiata*, and *P. montana* var.

An illustration of a curved pine stem following an attack by *Retinia buoliana* is given by A. Barbey in Traité d'Entomologie Forestière (1913), p. 235.

An article on the injury to young woods by this moth, written by Mr. W. P. Greenfield, appeared in the Quarterly Journal of Forestry for January, 1914, pp. 25–30. W. D.

The Royal Botanic Gardens, Ceylon.—To mark the centenary of the Royal Botanic Gardens, Peradeniya, which falls this year, a brochure tracing its history and illustrating the many-sided activities of the Institution has been published as the joint work of Mr. Stockdale, Director of Agriculture, Mr. Petch, Botanist and Mycologist, and Mr. Macmillan, Superintendent of Botanic Gardens. The review is grouped under six sections, the first three dealing chiefly with the history and development of the Gardens and its various branches, the last three summarising the botanical and agricultural work carried out.

In the first section, which is headed "History," it is recorded that the Royal Botanic Gardens, Ceylon, like other well-known tropical stations, was not originally established on the site where it is found to-day. The dates of founding the first garden are suggested as 1810, 1811, and 1812, the latter date being the one most favoured. The site too is a matter for conjecture and there were probably two stations, Caltura Garden and the Garden at Colombo until in 1821 when a site, selected by Alexander Moon at Peradeniya, was finally approved and the Botanic Garden instituted there in 1822, where it now covers an area of 147 acres.

During the first period attention was chiefly devoted to growing coffee and vegetables, the actual development of the Gardens being considered to date from the appointment of George Gardner in 1844. "Landscape Development and Acclimatisation" is dealt with in the second section, where the gradual evolution of the Garden is traced and a record of the construction of the principal features given. The main outline of the Garden was traced by Thwaites who was in charge first as Superintendent and later as the first Director from 1849 to 1880, and this work was completed by Trimen, the second Director, from 1880–1896.

The third section deals with the "Establishment of Branch Gardens." In all five branch gardens have been established in different climatic zones of Ceylon, but only two—Hakgala and Henaratgoda—are still retained under the Department. Henaratgoda Garden has the distinction of having been opened for the accommodation of the then recently introduced rubber plants from South America, and the original plantation of *Hevea brasiliensis* is still to be seen there. A brief account of the various attempts to introduce plants raised at Kew from South American seed is given, and the success that attended a consignment of nearly 2000 seedlings which had been raised at Kew and sent to Ceylon in 1876 marked the establishment of Para rubber in the East.

The section dealing with "Botanical Research" is perhaps the most interesting. Many well-known names are here recorded with reference to work carried out at Peradeniya. The most noteworthy feature of the early period of Ceylon botany was Linnaeus' work published in 1747 as the "Flora Zeylanica," which constitutes one of the earliest floras based on the Linnean system and written by Linnaeus himself.

This was followed later by Thwaites' work and Trimen's "Handbook of the Flora of Ceylon," which enabled Ceylon to possess at the close of the last century a more complete knowledge of its flora than any other tropical country. Later workers were able to avail themselves of the laboratory and quarters specially constructed for the use of visitors, amongst whom are many names well known in the botanical world.

The section on "Economic Botany and Agriculture" treats with the experiments of such economic crops as coffee, which as an industry was ruined by *Hemileia* in 1880—cinchona, cocoa, tea, rubber, spices, camphor, and most recently sisal and oil palm. The success attendant on the introduction and acclimatisation of these plants as established in Ceylon is traced individually.

The last section deals with the latest phase in the development of a Department of Agriculture from the original Botanic Gardens, and concludes with a complete list of Staff Officers associated with Peradeniya since its commencement.

The history of the development of the Gardens traced in this interesting review gives an excellent idea of the establishment and shows clearly the value of a Botanic Garden. This record of one of the Empire's most famous Botanic Gardens may well be summed up in the concluding words of the authors, "Paradeniya may look back to its past with pride and forward to its future with confidence."

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ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 7] [1922

XXXIII.—A REVISION OF THE SOUTH AFRICAN SPECIES OF DIANTHUS.

J. BURTT DAVY.

The genus *Dianthus*, as represented in South Africa, has long been a source of trouble to systematists. The characters on which we have to depend for specific delimitation are less amenable to precise definition than is the case in many other genera.

To indicate the difficulty which has been experienced by authors in dealing with them, it may be pointed out that at least ten names have been assigned by botanists at various times to specimens of what is obviously one and the same species, seven of the ten being due to wrong identification with the descriptions of other species, while on the other hand the name *Dianthus scaber*, Thunb., has been assigned at various times to specimens of twelve distinct species, owing to a misconception of the species described by Thunberg.

The only effective way to clear up this confusion was to ascertain precisely what plants Thunberg had in mind when he described his four South African *Dianthi*. By the courtesy of Professor Juel of Upsala (through the Director of the Royal Botanic Gardens, Kew) I have now had the opportunity to study these Thunberg types, and I wish to record my great indebtedness to him for this valuable assistance.

Three of the Thunberg sheets have been matched with material at Kew and the British Museum. But the Thunberg sheet of *D. incurvus* does not agree with any South African material available, nor with his description, and I can only conclude that it is not the type on which the original description was based. I consulted Professor Juel on this point during his recent visit to England; he has kindly looked into the matter since his return to Sweden and has furnished the following note, dated Botaniska Institutionen, Upsala, July 12, 1922 :—" As mentioned in 'Plantae Thunbergianae' (p. 15), Thunberg published a

x (78)18356 Wt 122—P3 1000 9/22 E & S A

catalogue of his herbarium, which appeared in 61 different parts between 1791 and 1827. The main list of the herbarium was published in 1791–1797, and the part treating with the class Decandria is of the year 1793. This part enumerates only three of his Dianthi from the Cape (*crenatus*, *cespitosus*, *scaber*). It is only in an Appendix of the year 1806 that we find *Dianthus albens*. The name *D. incurvus* is to be found nowhere in his catalogues.

"These facts are corroborated by consulting his manuscript catalogue, which essentially corresponds to his printed catalogue of 1791–97, and in which Thunberg has added in the margin the species enumerated in his Appendix of 1806 mentioned above. Here the name "*albens*" is to be found among the species in the margin.

"From these facts it seems probable that Thunberg at the time of his Prodromus disposed of no specimen identified by him with *D. incurvus*. The description in the Prodromus might have been made in S. Africa. But later he seems to have found among his undetermined plants a specimen which he identified with his *D. incurvus*, although he named it *albens*, seeing that the species had been described under that name before his Prodromus, according to Willdenow's Spec. Plant. He therefore wrote "*Dianthus albens*, Wild." and added as a synonym "*D. incurvus*, Prod. cap."

In the Flora Capensis, Sonder recognised nine species of *Dianthus*. Of these *D. incurvus*, Thunb., and *D. holopetalus*, Turcz., prove inseparable, as also do *D. prostratus*, Jacq., and *D. pectinatus*, E. Mey., thus leaving seven valid species in the Flora Capensis. To these must be added :—

D. micropetalus, Ser. (1824), placed by Sonder under *D. scaber*, Thunb.

D. Burchellii, Ser. (1824), placed by Sonder under *D. incurvus*, Thunb.

D. namaensis, Schinz (1897).

D. mooiensis, Williams (1889).

In the present paper six additional species and three varieties are described for the first time, bringing the total number of South African *Dianthi* up to seventeen species and three varieties.

The rich material now available at Kew, shows that the simple or branched habit of the flowering-stem, used by Sonder to group the South African forms, cannot be relied upon, even as a specific character, many individuals bearing both simple and branched flowering stems.

Much of the difficulty experienced by authors in placing some of the material with certainty, has been due to poor preparation by collectors. In this genus the cutting of the petal margins is of some diagnostic value, yet many specimens have been dried in such a way that this character cannot be distinguished. The relative size of the basal and intermediate cauline leaves, the relative length of the internodes on the barren shoots, and the character of the perennial vegetative stem, are also of importance for correct classification. It is hoped that future collectors of *Dianthus* will try to make their specimens more complete in regard to these characters.

Geographical Distribution.

Dianthus is a typically Northern Hemisphere genus, not being known (except as introduced) in South America, Australia or New Zealand. Therefore the occurrence of seventeen species in South Africa, is of peculiar interest. All of these are strictly endemic, as far as known, though some of the Transvaal species may be expected to occur in Southern Rhodesia. Four species (*D. Pearsonii*, *D. kamisbergensis*, D. *namaensis* and *D. junceus*), are restricted to Namaqualand and the South-west Protectorate. One (*D. micropetalus*), extends from the South-west Protectorate, across the Kalahari and Karoo to the Eastern Cape. Another species (*D. Burchellii*), is endemic to Griqualand West, on the eastern edge of the Kalahari. Four species and one variety (*D. incurvus*, *D. Bolusii* and its var. *luteus*, *D. caespitosus* and *D. prostratus*), occur in the winter rainfall belt of the South West Cape region, (some of them extending eastward toward the Sundays River). One (*D. scaber*), appears to be peculiar to the Eastern Cape. Three species and one variety (*D. basuticus*, *D. crenatus*, *D. mooiensis* and *D. micropetalus* var. *Galpini*), extend from the Eastern Cape through Basutoland, Natal and the Orange Free State to the Transvaal. The remaining three species and one variety (*D. transvaalensis*, *D. Kirkii*, *D. Zeyheri*, and *D. mooiensis* var. *dentatus*), are known only from the Transvaal.

As in the case of *Salix**, the genus appears to have reached South Africa by way of the high mountain ranges of Eastern Tropical Africa.

Tropical African Species.—Only three species (*D. longiglumis*, Del., *D. leptoloma*, Steud., and *D. angolensis*, Hiern), are known to occur in Tropical Africa, and these three show close affinity with the South African species. They are found in Angola and Abyssinia respectively; the Abyssinian forms, or connecting links between them and the South African forms, should be sought in the high mountains of Eastern Tropical Africa.

D. leptoloma, Steud., of the mountains of Abyssinia, is a close ally of *D. basuticus*, differing chiefly in the less exserted calyx-tube.

D. longiglumis, Del., of Abyssinia, shows affinity with *D. Bolusii* and *D. basuticus* in stem and foliage, and to *D. caespitosus* in length of calyx-tube and size of petals, which, however, greatly exceed even those of *D. caespitosus*, and have very long-exserted

* Burtt Davy, J.—The Distribution and Origin of Salix in South Africa: Journal of Ecology, vol. x. pp. 62–86, 1922.

claws. It produces a large and handsome flower and might be found useful for crossing with other species.

D. angolensis, Hiern, of Angola, is allied to *D. kamisbergensis* and *D. albens*, by the short calyx-tube, but differs in foliage and petals; to *D. Bolusii* it is allied by the calycine bracts, the petals, the branching and the lower cauline leaves, but differs in the shorter calyx-tube.

Key to the Species.

* Leaves mostly basal: stem-leaves mostly shorter than the basal leaves (0·5–2 cm. long), often scale-like.

† Basal leaves short, 0·5–6 (rarely 10) cm. long, narrow and grass-like, usually forming rosettes at the apex of very short branches of the main (perennial) stem: flowering (annual) stems simple or sparingly branched, slender, erect:

‡ Calyx 1·5–3 cm. long over all

Basal leaves very short, usually 0·5–1·5, (rarely up to 4) cm. long

Petals exserted 2·5–4 mm., dentate or narrowly fimbriate (Kalahari-Karoo species) 1. *micropetalus*.

Petals exserted 0·5–1 cm., narrowly fimbriate or dentate (Eastern Cape-Basutoland form). . . . . . var. *Galpini*.

Petals exserted 1–1·5 cm., lacerate-fimbriate (Western Karoo and Namaqualand species). . . . . . . 2. *Pearsonii*.

Basal leaves longer, 2–5·5–10 (rarely only 1·5) cm. long: petals exserted 0·7–1 cm., dentate (not lacerate–fimbriate): plants 15–30 cm. high:

Calyx 2·5–3 cm. long: bracts 3 pairs, acute, the mucro under 1 mm. long: leaf-margins scabrid: petals exserted 7–10 mm., rosy?: basal leaves 1–2 mm. broad, flat: (Eastern Cape species) . . . . . . 3. *scaber*.

Calyx 1·5–2·5 cm. long: bracts 2 pairs, abruptly mucronate, the mucro about 1·5 mm. long: leaf-margins quite smooth: petals exserted 1 cm., white or creamy: basal leaves 0·5 mm. broad or narrower, filiform or channelled above . . . . . . 4. *transvaalensis*.

‡‡ Calyx very short (1–1·5 cm. long): bracts 2 pairs, ovate, abruptly mucronate: petals exserted 5–7 mm., toothed: flowering (annual) stems very weak, erect or ascending, simple or branched, 10–30 cm. long: basal leaves 2–4·5 cm. long, rather rigid, microscopically pubescent; cauline leaves 0·5–1 cm. long . . . . . . 5. *kamisbergensis*.

†† Basal leaves longer, 10–20 (rarely only 4) cm. long, forming tufts (but not rosettes).

§ Leaves below the crown more or less persistent (or sometimes none in 9. *D. Bolusii*; see also 14. *D. basuticus*).

Basal leaves 3·5–10 cm. long :

Calyx 2·5–3 cm. long : petals exserted 1 cm. or more, lacerately fimbriate : flowering stems mostly simple . . . . . . 6. *namaensis.*

Calyx 2 cm. long : petals exserted 5 mm. or less, dentate : flowering stems branched above . . . . . . 7. *Burchellii.*

Calyx 1·5 cm. long : petals exserted 0·75–1·25 cm., entire, emarginate or denticulate : calyx-teeth and bracts finely ciliolate : leaf-margins scabrid : basal leaves 1 mm. broad or less, channelled above : stems usually incurved above . . . . . . 8. *incurvus.*

Basal leaves 12–20 cm. long : calyx 2·5–2·75 cm. long : petals lacerately fimbriate : stems 1–8-flowered (South-West Cape species) . . . . . . 9. *Bolusii.*

§§ Leaves below the crown deciduous, or none (see also 9. *D. Bolusii*).

Basal leaves 4–20 cm. long, 2–3·5 mm. broad, prominently 7-nerved below, channelled above, scabrous on the margins, rigid, erect, forming a more or less dense basal tuft at the apex of the numerous underground branches : calyx stout, 2–2·3 cm. long : petals dentate, exserted 0·5–1·3 cm. : stems 1–4-flowered (Eastern species) . . . . . . 14. *basuticus.*

Basal leaves 2–4 cm. long : calyx 3·5–5 cm. long.

Bracts acute or with a minute apiculus, their margins broadly scarious up to and including the apex . . . . . . 10. *junceus.*

Bracts long-acuminate, subulate pointed, their margins (but not the apex) narrowly scarious : petals deeply lacerate, exserted up to 1·5 cm. and up to 2 cm. broad . . . . . . 11. *caespitosus.*

** Leaves mostly cauline, the basal often shorter than the intermediate cauline :

Leaves narrow (about 1 mm. broad), not rigid : barren shoots elongated, their internodes 1·5–3 cm. long

Calyx 3·5 cm. long : bracts acuminate, bristle-pointed : petals exserted about 1·5 cm., fimbriate : stems slender, terete, often axillary on elongated leafy shoots . . . . . . 12. *prostratus.*

Calyx 1·75–2·5 cm. long : bracts acute : petals exserted 0·75–1 cm., laciniately fimbriate, white . . . . . . 13. *Kirkii.*

Leaves broader, usually 3–5 (rarely 1·5 to 2) mm. broad and rigid : stems leafy

Calyx stout, 2·5 cm. long : petals exserted 1·5–2 cm., 1–1·5 cm. broad, variously dentate to sub-entire : intermediate cauline leaves about 5 cm. long, not rigid . . . . . . 15. *crenatus.*

Calyx 1·5–1·75 cm. long : petals exserted 5 mm., fimbriate, the claw not exserted : intermediate cauline leaves 2·5–3 rarely 6 cm. long, rigid . . . . . . 16. *mooiensis.*

Calyx 3·5 cm. long : petals exserted 1·5 cm., lacerate-fimbriate, the claw long-exserted : intermediate cauline leaves 2·5–5 cm. long, rigid . . . . . . 17. *Zeyheri.*

1. **D. micropetalus,** *Ser.* in DC. Prod. i. 359 (1824) !

Range : from the Karoo near Cradock, across the Kalahari to the South West Protectorate.

Cape Province : Hay Div., Griquatown *Burchell* 1851 ! *type*, 1935 ! ; Barkly Div., Hebron (now Windsorton) *W. Nelson* 191 ! ; Colesberg Div., Colesberg *Shaw* ! ; (Middelburg Div. ?), " Snowy Mt. " (Sneeuwberg) *Burke* ! ; Cradock Div., Great Fish River near Cradock *Burke* ! ; Fort Beaufort Div., and " British Kaffraria " without precise locality *Cooper* 451 pro parte !, 395 pro parte !

Orange Free State : Without precise locality *Cooper* 1935 ! ; Bloemfontein Distr., Brandfort *Haagner in herb. Conrath* 1225 ! ; Kroonstad Distr., Kroonstad *Miss Chennel* 79 !

Transvaal : Heidelberg Distr., Burttholm near Vereeniging *Burtt Davy* 17133 ! ; Lichtenburg Distr., Korannafontein *Rogers* 20626 !

South West Protectorate : Great Namaqualand, sandy plains north of Areb *Pearson* 9476 !

The very shortly exserted petals at once distinguish this from any of its allies, including *D. scaber* with which it has been confused. In the type specimen, which is depauperate, the flowering stems are simple, but other specimens show both simple and branched stems on the same plant.

A manuscript note by Mr. N. E. Brown, states that *Burchell* 1935 is " identical with *Rehmann* No. 3380 ; from Hünernestkloof, Griqualand West, named by Dr. Szyszylowicz *D. scaber* var. *graminifolia*, Fenzl. *in Herb. Schinz* at Zurich, compared Aug. 7, 1891."

var. **Galpini,** *Burtt Davy*, var. nov., a forma typica petalis majoribus, calycem 0·5–1 cm. excedentibus, differt.

Range : more easterly than that of the typical form.

Basutoland : grassy slopes above Buffels River Waterfall, 2500 m. alt. *Galpin* 6582 !, *type* ; without precise locality *Cooper* 1934 !

Cape Province: without precise locality *Dr. Pappe* in *herb. Hook*, ! ; Barkly East Div., Wittebergen Range, summit of Ben McDhui, 3000 m. alt. *Galpin* 6581 ! ; Queenstown Div., mts. near Queenstown, 1200 m. alt. *Galpin* 1671 !, Shiloh *Baur* 954 !, without precise locality *Drège* b. ! sub nom. *D. micropetalus*, Sering * ; Fort Beaufort Div., and " British Kaffraria " without precise locality *Cooper* 451 pro parte !, 395 pro parte ! ; Uitenhage Div., Winterhoek Mts. *Zeyher* 80 !, between Coega and Sundays River *Drège* c. ! sub nom. *D. albus*, Ait. (non Sering.)

Baur no. 141 from Grasrug, Kaffraria, may belong here, but the calyx is only 1·3–1·5 cm. long; it does not match any other plant at Kew, and the specimen is too scrappy for precise determination.

2. **D. Pearsonii,** *Burtt Davy*, sp. nov., *D. caespitoso*, Thunb., affinis sed calycibus petiolisque brevioribus, petalorum fimbriis brevioribus, bracteis breviter acuminatis nec subulato-acuminatis, differt.

Stems woody, usually with short, woody branches above: flowering stems 5–20 cm. high, very slender, simple or branched above. *Basal leaves* forming rosettes, 0·5–3 cm. long, 0·5–1 mm. broad, flat, with a prominent midrib beneath; margins scaberulous. *Cauline leaves* 0·3–2·5 cm. long. *Bracts* 0·4–1·2 cm. long, ovate, acute; margins scarious. *Calyx* 3 cm. long over all. *Petals* exserted 1–1·5 cm., lacerate fimbriate, pink ?.

Range: South West Protectorate, through Little Namaqualand to Sutherland Div.

South West Protectorate: Great Karasberg *Pearson* 7856 ! *type*, river bed near K'ai Kluft, in crevices in sandstone, 1650 m. alt. *Pearson* 7854 !.

Cape Province: Little Namaqualand, hills at Karoechas, 3000 m. *Schlechter* 11392 ! ; Little Namaqualand ? *Drège*, " *a* " sub nom. *D. micropetalus* var. *β subimbricatus*, E.M. ! ; Sutherland Div., Great Riet River *Burchell* 1375 ? (incomplete, and of doubtful identity).

3. **D. scaber,** *Thunb.*, Prod. 81 (1794) !

Range: Eastern Cape Province, between the Bashee and Gauritz Rivers.

Cape Province: Without precise locality, " e Cap. b. Spei " Thunberg, *type* ! ; " Cafferland " *Dr. Gill* ! ; Transkei, between the Gekau and Bashee Rivers ? *Drège* ! ; Bathurst Div., between Blaauwkrantz and Kaffir's Drift *Burchell* 3683 ! ; Albany Div., flats near Grahamstown *R. W. Read* ! ; Uitenhage Div., Zwartkops Riv. *Dr. Pappe* ! ; Riversdale Div., Gauritz River *Dr. Pappe* !.

4. **D. transvaalensis,** *Burtt Davy* sp. nov.; *D. micropetalo* var. *Galpinio*, Burtt Davy, affinis, sed foliis longioribus glabris

* A mss. note by Mr. Brown states that this equals *Rehmann* 457 from Belvedere, Knysna Div., which I have not seen, but which Szyszylowicz referred to *D. scaber*, Thunb.

(nec scabris), bracteis aristatis, et petalis longioribus albidis, differt.

Rhizome shortly branched above ground, bearing several crowns. *Leaves* forming basal tufts, 5–10 cm. long, 0·5 mm. broad or less, filiform or channelled above, quite smooth; flowering stems 20–40 cm. high, slender, branched above; cauline leaves 1–2 cm. long. *Bracts* 2 pairs, acute, with an awn up to 2 mm. long. *Calyx* 1·5–2·5 cm. long. *Petals* exserted about 1 cm., white, dentate.

RANGE: Transvaal High-veld.

TRANSVAAL: Ermelo *Burtt Davy* 17387! *type, in herb. Cantab.*; Carolina *Rogers* 11553!; Heidelberg Distr., Vereeniging, farm Burttholm *Burtt Davy* 15016!

5. **D. kamisbergensis,** *Sond.* in Fl. Cap. i. 124 (1860)!

RANGE: from the Tulbagh Div., to Little Namaqualand.

CAPE PROVINCE: Without precise locality *Mund*!; Little Namaqualand, Kamiesberg *Ecklon & Zeyher* 244! *type*; Calvinia Div., Roggeveld at the Blaauwkrantz Pass, 900 m. alt. *Pearson* 4984!; Ceres Div., Leeuwfontein, common on burnt veld *Pearson* 3180!, 3189!; Tulbagh Div., Nieuwe Kloof 500 m. *Schlechter* 9026!.

6. **D. namaensis,** *Schinz* in Bull. Herb. Boiss. v, App. 3, 84 (1897)!

RANGE: Great Namaqualand to Clanwilliam Div.

SOUTH WEST PROTECTORATE: Great Namaqualand, Tsirub *Schinz* 553!, *type*; kopjes about 30 km. south of Gründoorn, 1200 m. alt., in shallow soil in rock-crevices *Pearson* 4553!; between Dabaigabis and Gründoorn, 1250 m. alt., in fissures of granite rock on kopje *Pearson* 3151!; near Alewyn's Fontein (15 miles north) *Pearson* 3486!; Great Karasberg at Naruda Nord, in crevices of sandstone in river bed *Pearson* 7855!

CAPE PROVINCE: Nardouw Kloof, in sand, in crevices of rock, Olifants River bed *Pearson* 5334!

7. **D. Burchellii,** *Ser.* in DC Prod. i. 359 (1824)!

RANGE: British Bechuanaland.

BRITISH BECHUANALAND: Kuruman Div., source of Kuruman River *Burchell* 2456! *type in herb. Kew.*; near the Pass in Kamhanin Mt. *Burchell* 2178!.

8. **D. incurvus,** *Thunb.*, Prodr. 81 (1794)!; *D. albens*, Ait., Hort. Kew. Ed. 1. ii. 90 (1789)!; *D. holopetalus*, Turcz. in Bull. Soc. Imp. Nat. Mosc. xxvii (1854) 369!

RANGE: S.W. Cape from Clanwilliam Div. south to Table Mt. and east to the Sundays River.

CAPE PROVINCE: Without precise locality *Roxburgh*!, *Admiral Sir F. Grey*!, *Harvey* 234!, 502!,*, *Pappe*!; Malmesbury

* These may be Zeyher's numbers.

Div., Zwartland, Riebeekskasteel and Paardeberg *Zeyher* 78 ! and Clanwilliam Div., Karreebergen *Ecklon & Zeyher* " 247 " (246 at Kew !) both types of *D. holopetalus*, Turcz. ; Cape Div., Cape Flats *Pappe* !, *Burchell* 723 !, Simons Bay and Chapman Bay *MacGillivray* Herald Voy. Nos., 663 ! 664 ! ; Table Mt. *Saunders* ! ; Muizenberg *MacOwan et Bolus* 91 ! ; Vygeskraal Farm and Lions Head *Wolley Dod* 124 !, 2317 ! ; Caledon Div., Hottentots-holland Berg *Ecklon & Zeyher* 242 ! ; Riversdale Div., Hills near Zoetmelks River *Burchell* 6776 ! ; Mossel Bay Div. (?), between Duyker River and Gauritz River *Burchell* 6382 ! ; Uitenhage Div., Sandfontein, Winterhoeks Berg *Zeyher* 80 !, between Coega and Sundays River *Drège* c !, Uitenhage *Zeyher* 1129 !

Sonder quite correctly followed Willdenow (1799) in uniting *D. incurvus*, Thunb. (1794) with *D. albens*, Ait. (1789), but in doing so he should not have restored Thunberg's name, rightly treated as a synonym by Willdenow. Thunberg himself accepted Aiton's name in preference to his own in his herbarium, where he has written " D. albens, Wild." in the lower right-hand corner where he usually labelled his specimens, while in the lower left-hand corner is written, also in his own handwriting, the synonym " D. incurvus, Prod. cap. "† But as the name *Dianthus incurvus*, Thunb. has been familiar to students of South African botany for over sixty years, through the pages of the *Flora Capensis*, no good purpose would be served by restoring Aiton's name.

There is but one specimen labelled *D. incurvus*, in the Thunberg herbarium, and it does not agree with Thunberg's description of that species, for the petals are lacerate, not " integris "‡, and the cauline leaves are linear, up to 4·5 mm. broad, not at all " lineari-setacea ". At the back of the sheet is written in the upper left-hand corner (the place where he usually noted the localities of his specimens) " e Cap. b. Spei. Thunberg " ; but the specimen does not match any South African material at Kew or the British Museum ; it appears to be somewhat abnormal, suggesting a cultivated plant, and may be a garden specimen of some extra-South African species. It is clear that the sheet was labelled later than the publication of Thunberg's Prodromus, for he cites Willdenow for the name *albens*, and the second volume of Willdenow's edition of the Species Plantarum, in which Aiton's name *D. albens* is used, was not published until 1799.

We must conclude therefore, that the specimen labelled *D. incurvus* in the Thunberg herbarium, is not the original type from which Thunberg drew his description.

Prof. Juel's suggestion that the description of *D. incurvus* may have been made while Thunberg was in South Africa, and therefore from living material, seems a probable explanation, especially

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† *See also* note by Prof. Juel, on p. 210, preceding.

‡ The petals of the Cape Peninsula plant vary from entire or emarginate to crenate or dentate, but are not lacerate.

as he gives with such precision the locality where he found the plant, a detail omitted entirely in the case of many of his specimens; he says: "crescit in collibus infra Taffelberg latere orientali. Floret Majo, Junio."

There is abundance of herbarium material of *D. albens*, Ait., from Table Mt. and vicinity, and no other species of *Dianthus* is known to occur there.

The type of *D. albens* was grown at Kew from seed collected by Masson somewhere in the Cape Province; Thunberg travelled with Masson on one, at least, of his journeys, and Masson's seeds may have been collected at the same place as Thunberg's type of *D. incurvus*.

Aiton's type of *D. albens*, in the British Museum herbarium, agrees sufficiently (allowing for slight variatiou due to growth under English conditions) with Table Mt. specimens (*e.g.*, *Wolley Dod* 124) to show that they represent one and the same species.

In describing *D. holopetalus* as distinct from *D. albens*, Turczaninow was clearly under a misconception as to the type of the latter species, for he cites as the true *D. albens*, Ait., a Transvaal plant (*Zeyher* 79) unknown to Aiton and which is the type of *D. Zeyheri*, Sond. Turczaninow cites as the types of his *D. holopetalus*, Zeyher's No. 78 and Ecklon & Zeyher's No. 247 (distributed by them as *D. albens*, Ait.); we may conclude therefore, that Turczaninow's specimens of these two numbers represented one and the same species. *Zeyher* 78 is *D. albens*, Ait.; but the Kew specimen of *Ecklon & Zeyher* 247 does not match *Zeyher* 78 (and belongs to *D. Bolusii*), while *Ecklon & Zeyher* 246 (labelled *D. crenatus*, Thunb.), compares well with *Zeyher* 78, and is referrable to *D. albens* (not to *D. crenatus*). It would appear, therefore, that the labels of these two Ecklon and Zeyher numbers were transposed, and I have acted on this assumption in assigning the localities to the two plants.

9. **D. Bolusii,** *Burtt Davy,* sp. nov., *D. basutico,* Burtt Davy, affinis, sed pedunculis saepe multifloris, petalis lacerato-fimbriatis differt; a *D. caespitoso,* Thunb. caulibus foliosis, pedunculis multifloris et foliis latioribus differt.

Basal leaves tufted at the crown of a somewhat woody or more or less slender underground stem, 10–17 cm. long, 1·5–3 mm. broad; cauline leaves 1–5 mm. long. *Stems* slender, about 3 cm. high, much branched above (rarely simple), usually 4–8-flowered. *Bracts* 3–5 pairs, broad, acute, bristle-pointed, scarious-margined, chartaceous. *Calyx* 2·5 cm. long. *Petals* exserted 1 cm., lacerately fimbriate, dark purple.

RANGE: George to Piquetberg.

CAPE PROVINCE: Without precise locality *Ecklon ? in herb. Hook.* !, *Drège* b. sub nom. *D. micropetalus β sub-imbricatus*, E.M.!; Swellendam Div.; Zondereinde River *Burchell* 7497!; between Buffeljagts River and Swellendam *Burchell* 7295!; Cannaland, Swellendam or Gauritz River *Ecklon & Zeyher*

243 !; Puspas Valley *Ecklon & Zeyher* 246 ? (No. 247 at Kew !); George Div. ?, George Mts. *Bowie* !; Tulbagh Div., mountains above Tulbagh Waterfall, 350 m. alt. *Bolus* 5126 ! *type in herb. Kew.*; Nieuwe Kloof 500 m. alt. *Schlechter* 9033 !, Tulbagh *Pappe* !; Ceres Div., Michels Pass *Rehmann* 2332 !; Malmesbury and Piquetberg Divisions, Skurfdeberg, Twenty-four Rivers and Riebeeks-Kasteel *Drège* a !, (sub nom. *D. scaber*, Thunb.), *Zeyher* 76 !, 77 !

var. **luteus,** *Burtt Davy,* var. nov., a forma typica petalis minoribus luteo-viridisque, differt.

Cape Province: Paarl Div., Groot Drakenstein *Rogers* 17329 ! *type.*

Petals exserted 4 mm., greenish-yellow, fimbriate: calyx 2·5 cm. long. Plant approaching *D. Burchellii*, Ser., in length of petals, but these are more fimbriate, and the leaves are much longer.

10. **D. junceus,** *Burtt Davy,* sp. nov., *D. caespitoso*, Thunb., affinis sed bracteis acutis vel minute apiculatis, marginibus apicibusque late scariosis, differt.

Stems tufted, much branched below from a woody crown. *Flowering stems* 30–35 cm. high, 1 mm. diam., very numerous, erect, simple, wiry. *Leaves* mostly basal, 2–3 cm. long; cauline leaves about 1 cm. long, appressed, not rigid, the uppermost scale-like, 5 mm. long. *Calycine bracts* about 4 pairs, 0·6–1·2 cm. long, with a very broad, scarious margin to the apex, acute or with a minute apiculus. *Calyx* 4 cm. long, the teeth with broad scarious margins. *Petals* exserted about 2 cm. beyond the calyx, dentate (or laciniate ?) "pale lilac."

Range: Little Namaqualand.

Cape Province: Little Namaqualand: Khamiesberg, summit of kopje South-west of Leliefontein *Pearson* 6312 ! *type*; lower South-east slope of Vogelklip, among bushes in dry stream-bed *Pearson & Pillans* 5904 !; roadside and cornlands, Brakdam *Pearson & Pillans* 5604 !.

11. **D. caespitosus,** *Thunb.*, Prod. 81 (1794) !

Stems 12–38 cm. high, simple. *Basal leaves* 2–6 cm. long, setaceous to flat and up to 1 mm. broad; cauline leaves 0·5–1·5 cm. long, the uppermost scale-like and approaching or overlapping the calycine bracts. *Calycine bracts* 3–4 pairs, up to 1·7 cm. long, long-acuminate, setaceous pointed, not or scarcely scarious-margined. *Calyx* very long (4–5 cm.). *Petals* exceeding the calyx by 1–2 cm., deeply lacerate.

Range: Known only from the Caledon and Riversdale Divisions.

Cape Province: "e. Cap. b. Spei," without precise locality *Thunberg* ! *type*; Caledon Div., Genadendal, 600 m. alt. *Schlechter* 9803 !; Riversdale Div., Gauritz River *Pappe* !

Of the numerous specimens so named, only these two Kew sheets can be considered conspecific wth the Thunberg type.

12. **D. prostratus,** *Jacq.*, Hort. Schoenb. iii. 11., t. 271 (1798) !; Bot. Reg. t. 256 sub nom. *D. crenatus*; *D. pectinatus* E. Mey. ex Sond. in Fl. Cap. i. 124 (1859–60) !

RANGE: Calvinia and Caledon Divisions.

CAPE PROVINCE: Without precise locality *Masson* (seeds, from which the type specimen was grown); Calvinia Div., Uien Vlei, Bokkeveld Mts. *Drège* ! type of *D. pectinatus*, E. Mey.; Caledon Div., Genadendal *Pappe* !

This appears to be closely allied to *D. caespitosus*, Thunb., and I have some hesitation in placing the plant from Genadendal (whence comes also *D. caespitosus*) in *D. prostratus*. Jacquin's figure shows a plant with distinct underground stolons and elongated leafy shoots sometimes bearing peduncles in the lower leaf axils, and the two specimens here cited match it well. The specimens referred to *D. caespitosus*, are distinctly caespitose, and do not suggest the possibility of developing elongated leafy shoots. Comparative field study of the habits of the two plants is desirable.

13. **D. Kirkii,** *Burtt Davy*, sp. nov., species, caulum foliis intermediis quam foliis basalibus et foliis superioribus multo longioribus, petalis brevibus laciniato-fimbriatis, bene distincta.

Stems slender, ascending, 23–30 cm. high, simple or branched, especially above, leafy, the lowest and uppermost cauline leaves much shorter than the intermediate leaves, the latter 2–3·5 cm. long, 1–1·5 mm. broad, not rigid. *Bracts* 3 pairs, short, broad, acute, scarious-margined to the apex with a short mucro. *Calyx* 2 cm. long. *Petals* exserted about 7 mm., white, laciniately fimbriate.

RANGE: Transvaal and Natal High-veld.

TRANSVAAL: Pretoria District, near Pretoria, on kopjes, in dry sand among rocks, Nov. 1901 *J. W. C. Kirk* 5 !, *type*, Magaliesberg *Zeyher* 81 !, Pretoria and Wonderboompoort *Rehmann* 4706 !, 4579 !; Rustenburg Distr., Magaliesberg *Nation* 312 ?; Witwatersrand, Johannesburg *Ommanney* 64 !; Elsburg *Rogers* 12140 ? (material incomplete).

NATAL: near Newcastle *Wilms* 1864 !

14. **D. basuticus,** *Burtt Davy*, sp. nov., affinis *D. leptolomae*, Steud., et *D. crenato*, Thunb., ab illo tubo calycis breviore, ab hoc foliis basalibus caespitosis ad 5–15 cm. longis, 1·5–4 mm. latis, differt.

Basal leaves 5–15 cm. long, 1·5–4 mm. broad, tufted at the apices of the underground branches, arising from a thick (8–10 mm. diam.) woody crown; cauline leaves gradually diminishing from 25 to 5 mm. long. *Flowering stems* slender, erect, simple or branched above, 1–4-flowered, 8–43 cm. long. *Bracts* 2–3 pairs, chartaceous, yellowish, acutely pointed, mucronulate, margins narrowly scarious. *Calyx* 2·5 cm. long, rather stout. *Petals* exserted 0·5–1·3 cm., dentate, " deep pink."

RANGE : Eastern Cape Province (Albert Division) north to the Transvaal and Natal.

BASUTOLAND : without precise locality *Surenger* 3 !; Leribe, 1500–1800 m. *Mrs. Dieterlen* 184 !, *type* ; below Mont-aux-Sources 2750–3000 m. alt. *Maurice S. Evans* 746 !.

CAPE PROVINCE : Albert Div., without precise locality *Cooper* 613.

NATAL : Without precise locality *Gerrard* 1436 !, Tintern 1500–1800 m. alt. *Maurice S. Evans* 354 !, Newcastle *Wilms* 1865 ! 1866 ! Insizwa *Krook in Pl. Penth.* sub nom. *D. micropetalus* var. *graminifolius*, Fenzl.

GRIQUALAND EAST. : Vaal Bank near Kokstad *Haygarth in herb. Wood* 4178 !, near Kokstad *Tyson* 531 !

ORANGE FREE STATE : Harrismith Distr., Besters Vlei, 1650 m. *Bolus* 8124 !, Harrismith *Sankey* 13 !; without precise locality (probably Harrismith) *Cooper* 996 !; Ficksburg Distr., near Clocolan *C. M. Stockdale* !.

TRANSVAAL : Lydenburg Distr., Belfast *Leendertz* 2700 !, Pilgrims Rest *Greenstock* !

15. **D. crenatus**, *Thunb.*, Prod. 81 (1794).

RANGE : from Swellendam round the coast to Natal.

CAPE PROVINCE : Swellendam Div., " crescit in collibus inter Swellendam et Hout-hoek. Floret Decembri " *Thunberg* ! *type*; Uitenhage Div., without precise locality *Zeyher* 499 ! Dr. *Pappe* !, sandy places in grass-veld at the Zwartkops River *Ecklon & Zeyher* 245 !; Albany Div., Witte River Station and Bushman's River *Dr. Gill* !, *Cooper* 1936 !, *Bowie* 4 ! (compares with type), grassy places, Brookhuisens *MacOwan* ! (agrees well with type), near Grahamstown *MacOwan* 701 !; Transkei, Bazeia 600–750 m. alt. *Baur* 14; East Griqualand, around Clydesdale, 600 m. alt. *Tyson* 2115 !

NATAL : Without precise locality *Gerrard* 737 !, *Gueinzius* !, *Dr. Sutherland* !; Alexandra County, Dumisa *Rudatis* 229 !; Durban *Krauss* 57 !, *Wood* 203 (typical) !, *D. W. B. Grant* !, *R. W. Plant* 75 !, *Rudatis* 1512 !; Claremont *Schlechter* 3047 !; Inanda *Wood* 747 !; Ixopo *Mrs. Clarke* 15 ! (a form approaching *D. basuticus* Burtt Davy).

TRANSVAAL : Lydenburg Distr., near Lydenburg *Wilms* 57 ! *Atherstone* !; Devils Knuckles near Spitzkop *Wilms* 59 !; Barberton Distr., Bosch's near Barberton 1200 m. *Galpin* 1269 !; Middelburg Distr., between Middelburg and the Crocodile River *Wilms* 56 !, Bronkhorstspruit *Wilms* 60 !

There is no material of *D. crenatus* at Kew, from the type locality, and until it is re-collected there, some doubt may be felt as to the identity of the eastern and western forms, though the Albany plant seems to be a good match with the type. The flowers are described as " rosy."

The Transvaal material is somewhat off type, approaching *D. basuticus*, Burtt Davy, in some of its characters.

16. **D. mooiensis,** *Williams* in Journ. Bot. xxvii. p. 199 (1889) !; *D. Nelsoni*, Williams, in Journ. Bot. 1889, p. 200 !

RANGE : High-veld of the Transvaal.

TRANSVAAL : Potchefstroom Distr., Mooi River *Nelson* 334 ! *type*, Wonderfontein on the Mooi River, *Nelson* 554 ! type of *D. Nelsoni*, Williams; Witwatersrand, Orange Grove *Rogers* 22386 !; Pretoria Distr., near Pretoria *Burtt Davy* 724 !, *Janse in T.M.H.* 2808 ?; Heidelberg Distr., Heidelberg *Leendertz* 1020 !; Standerton ? *Rogers* 18777 !.

GRIQUALAND EAST : Near Kokstad, 1100 m. *Tyson* 1119 !

NATAL : Between Greytown and Newcastle *Wilms* 1863 !

I can find no specific difference between the two plants named as above by Williams, though he places them in separate sections. The accepted name was originally published by the author as "moviensis" from the "Movi River," obviously a mistake for Mooi River, due to a badly written label, and therefore open to correction.

This species is the High-veld ally of *D. Zeyheri*, Sond.

var. **dentatus,** *Burtt Davy*, var. nov., a forma typica petalis dentatis roseis albidisve, calycis brevioribus et foliis basalibus longioribus, differt.

TRANSVAAL : Pretoria Distr., Rayton *Rogers* 12915 !, *type*.

17. **D. Zeyheri,** *Sond.* in Fl. Cap. i. 124 (1860) !; *D. Colensoi*, Williams in Journ. Bot. xxiii, 344 (1885) !; *D. mecistocalyx*, Williams in Journ. Bot. xxvii, 199 (1889) !.

RANGE : Bush-veld of the Transvaal.

TRANSVAAL : Pretoria Distr., Magaliesberg *Zeyher* 79 !, *Burke* 264 !, *types*; Wonderboompoort *Rehmann* 4581 !; Brits *Stent* in *T.D.A.H.* 6117 !; near Pretoria *McLea in herb. Bolus* 5587 !; Aapjes River *W. Nelson* 555 ! (type of both *D. Colensoi* and *D. mecistocalyx*); Premier Mine *Rogers* 25216 !; Rustenburg Distr., Kloof of Magaliesberg *Nation* 282 !, *Collins* 132 !; Middelburg Distr., Wilge River *Schlechter* 3743 !; Waterberg Distr., between Klippan and Elands River *Rehmann* 5015 !; Pietersburg Distr., Pietersburg *Bolus* 11042 !; Lydenburg Distr., Elandspruitbergen *Schlechter* 3856 !, Lydenburg *Wilms* in *T.M.H.* 6464 !, Pilgrims Rest *Greenstock* !.

Nelson notes: "Rare"; "flowers purest white, 2½ in. diameter, much fimbriated." Williams cites Nelson's plant as the type of his *D. Colensoi*, but erroneously gives "coast of Natal" as the type locality. He correctly described the flowers as white, but included the plant in the Section *Barbulatum*, which he defined as having flowers "rosei purpureive".

A specimen collected by Rogers (No. 22325 !) in the Kloof at Rustenburg, Transvaal, has been referred to the S.W. Cape

PLATE II.

PLATE 1.

FIG. 1.

FIG. 2.

D. prostratus, Jacq. (*D. pectinatus*, E. Mey.), but differs from that species in the terminal inflorescence, broader leaves and shorter, acute, not acuminate, involucral bracts; it appears to be a shade-grown form of *D. Zeyheri*, Sond.

Explanation of Plates.

The figures are reproduced from photographs by Miss E. Brown, of three of the five sheets in the Thunberg Herbarium.

Pl. I., Fig. 1. *D. scaber*, Thunb.: type. Between the two specimens of *D. scaber*, there has been mounted (evidently at a later date) a specimen of another species, numbered 2, from "Helvetia" as indicated on the back of the sheet. To prevent confusion this has been cut out from the print.

Fig. 2. *D. caespitosus*, Thunb.; type.

Pl. II.—*D. crenatus*, Thunb., β; type.

XXXIV.—MISCELLANEOUS NOTES.

Mr. R. E. Holttum, B.A., Junior Demonstrator in Botany in the University of Cambridge, has been appointed by the Secretary of State for the Colonies, on the recommendation of Kew, Assistant Director of Gardens, Straits Settlements.

Mr. H. K. Hewison has been appointed by the Secretary of State for the Colonies, on the recommendation of Kew, Assistant Superintendent, Agricultural Department, Gold Coast, and Captain J. W. D. Fisher, Assistant in the Agricultural Department, Sierra Leone.

The Royal Botanic Gardens, Trinidad.—When any good work has been kept going for a century without a break, it is invariably a matter for congratulation. It shows that the continuity of action of those in authority—who whether from motives of economy or indifference are in a position by a stroke of the pen, as it were, to destroy the results of years of labour and foresight—has been of the right sort. The establishment here recorded as occupying this congratulatory position has a world-wide fame, and the establishment of a College of Tropical Agriculture to which the Gardens will no doubt prove a valuable asset, is a mark befitting its centenary. Founded in 1818 the Garden completed a century in 1919. It is not the oldest in its original foundation—this distinction belongs to St. Vincent (1766) which, it is reported, was drawn upon when more than 50 years old, to supply the Trinidad Garden with its first plants; but Trinidad comes first in the West Indies for an unbroken period of existence.

The following particulars are quoted from a paper by the present Director (Mr. W. G. Freeman) in "The Trinidad Christmas Guardian" 1919.

"The Gardens were established in the year 1818, in the time of Sir Ralph Woodward, under the direction of Mr. Lockhart. Many of the plants were imported from Caracas and St. Vincent. Mr. Lockhart was Assistant Botanist attached to the ill-fated expedition of Captain Tuckey up the River Congo in 1816 during which he suffered severely and was long a patient in the hospital at Bahia. He visited Venezuela and the countries of the Orinoco, discovering the "Cow Tree" (*Brosimum utile*) and the "Saman" or "Zaman" (*Pithecolobium Saman*) which with many kinds of orchids he introduced to Trinidad and during his incumbency special attention was given to the introduction and cultivation of the various spice trees. Under the fostering care of Lord Harris, for many years Governor, the Gardens flourished and their area was considerably extended. It is said that he annually expended from his private purse a large sum towards their development. Mr. Lockhart was succeeded by Mr. Purdie on the recommendation of Sir William Hooker in 1846 and afterwards the Gardens were successively under the care of Dr. Crueger 1857, Henry Prestoe 1864; J. H. Hart 1887 and J. B. Carruthers 1909–1910 during which many notable trees were introduced including the "Saman" (as before stated by Lockhart)—the oldest tree to the wes of Government House having now a spread of branches of 180 feet and a height of 147 feet; "Nutmegs" (*Myristica fragrans*) from the St. Vincent Garden in 1824; the "Mango" (*Mangifera indica*—good varieties) from India and Martiniquê in 1859 and many others from all parts of the world. The distribution of plants was also effected on a large scale and the article concudes with: "I think we may safely say that much has been done and that during the past century the Royal Botanic Garden has been the means of introducing and distributing many of the plants on which the welfare of the Colony is based, and others which are of value for the sake of their fruits and flowers."—J. H. H.

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ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 8] [1922

XXXV.—CONTRIBUTIONS TO THE FLORA OF SIAM.

ADDITAMENTUM XIII.

W. G. CRAIB.

Michelia Rajaniana, *Craib* [Magnoliaceae-Magnolieae]; a *M. lanuginosa*, Wall., cui maxime affinis, petiolo longiore, foliis latioribus supra haud glabris, carpellis maturis approximatis differt.

Arbor circa 20 m. alta (ex *Kerr*); ramuli iuventute crassiusculi, dense fulvo- vel subferrugineo-pubescentes, plus minusve glabrescentes, cortice fusco obtecti, conspicue lenticellati. *Folia* late lanceolata, oblongo-elliptica vel elliptico-ovata, apice obtusa, basi rotundata, 22–29 cm. longa, 10–13·2 cm. lata, coriacea, supra ad costam densius pubescentia, aliter puberula, subtus molliter albo-pubescentia, costa subtus valde prominente, nervis lateralibus utrinque circa 20 supra conspicuis subtus prominentibus intra marginem conspicue anastomosantibus, nervulis arcte reticulatis pagina utraque prominulis, petiolo 2·5–3·5 cm. longo supra canaliculato indumento ei ramulorum simili obtecto suffulta. *Flores* albi (ex *Kerr*), solitarii, axillares, pedicello 5–12 mm. longo indumento ei ramulorum nisi sparsiore et pallidiore simili tecto suffulti; bracteae sericeae; alabastra circa 2·5 cm. longa.. *Petala* 12, oblanceolata, obtusa, 3·5 cm. longa, 1 cm. lata. *Filamenta* circa 2 mm. longa, antheris (apiculo 1 mm. longo incluso) circa 4 mm. longis. *Gynophorum* et carpella adpresse ferrugineo-pubescentia, stylo glabro sicco atro ovario breviore. *Carpella* matura approximata, ambitu oblonga, obtusa, 1·5 cm. longa, fusca, pallide lenticellata, sparse adpresse pubescentia, breviter stipitata.

Doi Intanon, c. 1300 m., evergreen forest, *Kerr* 5342.

Vern. Cham Pi Luang (ex *Kerr*). (*see* p. 225.)

* (78)18607 Wt 122—P 23 1000 10/22 E & S A

282 **Talauma Kerrii,** *Craib* [Magnoliaceae-Magnolieae]; a *T. Hodgsonii*, Hook. f. et Th., ramulis haud glabris, areola stipulari petiolo aequilonga, filamentis brevioribus, connectivo haud longe producto recedit.

Arbor circa 8 m. alta (ex *Kerr*); ramuli primo adpresse hirsuti, mox glabri, cortice luteo-stramineo vel subbrunneo-stramineo obtecti. *Folia* oblongo-oblanceolata vel oblonga, apice obtusa, costa excurrente breviter apiculata, basi late cuneata vel rotundato-cuneata, ad 37 cm. longa et 13 cm. lata, coriacea, glabra, subtus pallidiora, costa straminea supra parum elevata subtus valde prominente, nervis lateralibus utrinque 15 rectis bene intra marginem anastomosantibus supra conspicuis subtus prominentibus, nervulis rete pagina utraque prominens efficientibus, margine integra, parum recurva, petiolo ad 5 cm. longo robusto basi conspicue incrassato suffulta, areola stipulari petiolo aequilonga. *Flores* solitarii, terminales, pedicello robusto glauco glabro 4–6-annulato suffulti, ad 5·5 cm. longi. *Stamina* circa 1·4 cm. longa, filamentis brevibus, connectivo breviter producto apice obtuse triangulari vel subtruncato. *Carpella* glabra, tuberculata, stamina bene superantia.

Nan, Doi Tiu, circa 700 m., evergreen forest, *Kerr* 5060.

Artabotrys Vanprukii, *Craib* [Anonaceae-Unoneae]; *A. siamensi*, Miq., similis, sed ramulorum et foliorum costae pilis adpressis haud divergentibus distinguendus.

Ramuli primo dense adpresse ferrugineo-pubescentes, demum glabri, cortice brunneo vel cinereo obtecti, lenticellis inconspicuis. *Folia* oblongo-elliptica vel obovato-elliptica, apice rotundata obtusave, basi rotundata, cuneato-rotundata, vel rarius cuneata, interdum parum inaequilateralia, ad 12 cm. longa et 5·5 cm. lata, chartaceo-coriacea vel coriacea, supra iuventute ad costam adpresse ferrugineo-pubescentia, matura nitida, glabra vel ad costam inferne puberula, subtus primo dense adpresse ferrugineo-pubescentia, mox ad costam subdense aliter sparse adpresse pubescentia, pallidiora, costa subtus prominente, nervis lateralibus utrinque 9–12 supra conspicuis subtus prominulis intra marginem praesertim superioribus anastomosantibus, nervulis rete pagina utraque conspicuum efficientibus, petiolo 5–10 mm. longo indumento ramulorum suffulta. *Pedunculus* communis mox uncinatus, lignosus, flores saepissime 2 gerens. *Calyx* 6 mm. longus, lobis 7 mm. latis utrinque densius puberulis. *Petala* 2·7 cm. longa, limbo ad 1·5 cm. lato, utrinque breviter adpresse pubescentia. *Antherarum* connectivum supra loculos deltoideum. *Carpella* glabra, stigmate carpellis subaequilongo.

Pang Pue, c. 400 m., mixed jungle, *Kerr* 4833. Prê, 180 m. *Vanpruk* 501.

Vern. Săban Nga Kûa (ex *Kerr*).

Polyalthia viridis, *Craib* in *Kew Bull.*, 1914, p. 4, descr. ampl. *Folia* ad 33 cm. longa et 14·5 cm. lata. *Pedicelli* fructiferi lignosi, fere 3 cm. longi, receptaculo convexo 2 cm. diametro.

Carpella glabra, ambitu oblongo-elliptica, 2·5–2·8 cm. longa, 1·8 cm. diametro, stipite 2 cm. longo suffulta. *Semina* solitaria.
Hue Pāng Hūng, Mê Hawng Sawn, c. 500 m., *Kerr* 5474.

Goniothalamus calvicarpa, *Craib* [Anonaceae-Mitrephoreae]; a *G. Griffithii,* Hook. f. et Th., carpellis glabris recedit.

Arbor 3–4 m. alta (ex *Kerr*); ramuli primo adpresse ferrugineo-pubescentes, demum glabri, cortice fusco-brunneo vel cinereo-brunneo striato obtecti, lenticellis demum conspicuis. *Folia* elongato-oblanceolato-oblonga, apice acuminata, basi cuneata, 19–29 cm. longa, 4–6 cm. lata, subcoriacea, matura glabra vel subtus pilis adpressis sparsis hic et illic instructa, pagina inferiore pallidiora, costa supra impressa subtus prominente, nervis lateralibus utrinque circa 15–17 rectis vel subrectis bene intra marginem anastomosantibus supra subprominulis subtus prominulis, nervulis paucis subtus conspicuis reticulationem laxam efficientibus, margine integra recurva, petiolo valido circa 5 mm. longo supra canaliculato glabro vel subglabro suffulta. *Flores* virides (ex *Kerr*), axillares, solitarii, pedicello 8–10 mm. longo basi parvi-bracteolato pilis adpressis ferrugineis praesertim superne sparse instructo suffulti. *Calyx* 10 mm. longus, lobis ovatis obtusis 7 mm. latis utrinque sparse adpresse pubescentibus ciliolatis. *Petala* exteriora 1·7 cm. longa, 5 mm. lata, utrinque sparse adpresse pubescentia, interiora cohaerentia, 1 cm. alta. *Stamina* vix 2 mm. longa, apiculata. *Carpella* 1 mm. alta, glabra, stigmate fere 2 mm. longo.
Sukotai, Kao Luang, c. 600 m., evergreen forest, *Kerr* 5946.

Mitrephora Winitii, *Craib* [Anonaceae Mitrephoreae]; ab affini *M. Edwardsii,* Pierre, foliis pro longitudine angustioribus, petiolis longioribus et ut videtur floribus maioribus, a *M. grandiflora,* Bedd., cui florium magnitudine similis, foliis basi saepissime cordatulis recedit.

Arbor parva (ex *Winit*); ramuli iuventute fulvo-tomentosi, mox glabri, cortice cinereo reticulato obtecti, lenticellis parvis conspicuis. *Folia* lanceolata, ovato-lanceolata, rarius subelliptico-ovata, apice obtusa, rotundata, vel subacuminata et acutiuscula, basi rotundata vel cordatula, interdum parum inaequilateralia, 5–11 cm. longa, 3·5–4·7 cm. lata, subcoriacea, supra glabra vel ad costam inferne breviter pubescentia, subtus pallidiora, ad costam nervosque laterales densius fulvo-pubescentia, aliter sparsius pubescentia, nervis lateralibus utrinque 9–15 supra tenuibus conspicuis subtus prominentibus intra marginem praesertim superioribus arcuatim coniunctis, nervulis gracilibus supra conspicuis vel subconspicuis subtus rete gracile prominulum efficientibus, margine parum recurva, densius breviter ciliata, petiolo sat crasso 4–5 mm. longo indumento ramulorum supra canaliculato suffulta. *Pedicelli* circa 1 cm. longi, fulvo-tomentosi, apicem versus bracteola vix 1 cm. longa instructi. *Calyx* 1 cm. longus, dorso fulvo-tomentosus, intra sparse pubescens. *Petala* exteriora alba (ex *Winit*), oblongo-obovata, vel elliptico-obovata, circa 4 cm. longa et 2 cm. lata, extra adpresse fulvo-pubescentia, intra apicem basemque versus sparse pubescentia, interiora purpurea (ex *Winit*), dorso medio fulvo-pubescentia, ungui 1·5 cm. longo dorso fulvo-pubescente suffulta. *Stamina* 2 mm. longa, connectivo truncato papilloso. *Carpella* 1·5 mm. alta, dense adpresse hirsuta.

Prachuab, 80 m., evergreen jungle, *Winit* 577A.

The species described above must be very near *M. Edwardsii*, Pierre, of which species apparently no flowering material can be traced. The flower was evidently described by Pierre from material in comparatively young bud.

Orophea siamensis, *Craib* [Anonaceae-Miliuseae]; ab *O. monospermate*, Craib, foliis maioribus, petalis exterioribus quam sepalis pro rata multo longioribus recedit.

Arbor circa 8 m. alta (ex *Kerr*); ramuli iuveniles sparse adpresse pubescentes, angulati, mox glabri, fusco-corticati, lenticellis subconspicuis notati. *Folia* oblongo-elliptica vel oblongo-oblanceolata, apice caudato-acuminata, obtusa, basi cuneata, saepe parum inaequilateralia, 10–16·5 cm. longa, 3–5·3 cm. lata, pagina superiore glabra, inferiore pallidiora, praesertim ad costam pilis adpressis sparse instructa, nervis lateralibus utrinque circa 6 supra subconspicuis subtus prominulis, nervulis subtus subprominulis, petiolo 5 mm. longo sat valido supra canaliculato subtus transverse corrugato suffulta. *Flores* axillares, in ramulis vel foliatis vel defoliatis positi, pauci in axillo quoque, pedunculo communi perbrevi, pedunculis partialibus et pedicellis adpresse fulvo-pubescentibus, pedicellis apicem versus unibracteolatis. *Sepala* deltoideo-ovata, subobtusa, 1·5 mm. longa, dorso adpresse pubescentia. *Petala* exteriora 4·5 mm. longa, 4 mm. lata, subacuta, extra pilis adpressis sparse instructa, intra glabra, ciliata, interiora 1 cm. longa, medio 2·5 mm. lata. *Stamina* 6. *Carpella* dorso breviter sparse pubescentia, vix 1·5 mm. longa.

Hue Wao, c. 500 m., common in evergreen forest, *Kerr*, 5069.

Stephania brevipes, *Craib* [Menispermaceae-Cocculeae]; a *S. herbacea*, Gagnep., caulibus haud omnino glabris, foliis minoribus ad nervulos subtus papillosis, inflorescentia brevi puberula recedit.

Caules graciles, volubiles, interdum inferne radicantes, iuventute sicco fusci, mox straminei vel olivaceo-straminei, sulcati, torquati, fere glabri vel apud nodos tantum puberuli vel nonnunquam omnino densius puberuli. *Folia* triangularia vel oblato-triangularia, apice obtusa vel leviter emarginata, breviter mucronata, basi late leviter emarginata vel subtruncata, lateribus rotundata, usque ad 5·7 cm. longa et 6 cm. lata, papyracea, nervis radiantibus 9–10 supra conspicuis subtus prominulis, nervis secondariis (e costa ortis) utrinque 1–3, nervulis rete gracile sub oculo armato conspicuum efficientibus, pagina superiore viridia, glabra, inferiore pallida, magis minusve glauca, ad nervulos papillosa, petiolo 3·5–6 cm. longo interdum parum puberulo suffulta. *Inflorescentia* ♂ axillaris, circa 5 mm. longa, pedunculis conspicue puberulis, pedicellis circa 0·75 mm. longis. *Sepala* 6, circa 1–1·25 mm. longa et 0·75 mm. lata, inter se subaequalia. *Petala* 3, flabelliformia, 0·6 mm. longa, paulo latiora quam longiora. *Synandrium* 0·5 mm. altum, apice 0·5 mm. diametro.

Doi Sutep, evergreen jungle, 900 m., *Kerr* 3255.

Stephania erecta, *Craib* [Menispermaceae-Cocculeae]; ab affini *S. Pierrei*, Diels, caulibus erectis, foliis crassioribus distinguenda.

Caules annui, sub anthesin erecti, saepissime simplices, 7–30 cm. alti, superne glauci, inferne pallidiores, annotini straminei, striati, glabri. *Folia* iuventute sicca glauca, ovata vel rotundata, apice obtusa, mucronulata, 3 cm. longa, 2·5 cm. lata, rigidiuscula, glabra, nervis circa 11 radiantibus, nervulis vix conspicuis, subtus pallidiora, marginata, petiolo ad 4 cm. longo suffulta. *Pseudumbellae* ♂ axillares vel inferiores ex axillis foliorum squamiformium ortae, 5-fere 10 mm. diametro, pedunculo communi 8–20 mm. longo suffultae, glabrae; pedunculi partiales breves; pedicelli 1·5–2 mm. longi, apice articulati. *Flores* expansi 2·5 mm. diametro. *Sepala* saepe varie et irregulariter connata, lanceolata vel ovato-lanceolata, 1·3 mm. longa, 0·8 mm. lata, saepe tridentata. *Petala* haud evoluta. *Synandrium* vix 1·25 mm. diametro, brevissime stipitatum.

Mûang Petchabun, c. 50 m., deciduous forest, *Kerr* 5689.

Lao name, Bua Kûa (ex *Kerr*).

This is probably the plant mentioued by Diels (in Engler Pflanzenr., Menispermaceae, p. 276) under *S. Pierrei*, Diels, as represented by Siam, *Teysmann*, Mekong, *Harmand*, and Cochinchina, *Pierre*.

A tuber received from Dr. Kerr is at present (July 1922) in flower in the Botanic Garden, Aberdeen.

Stephania Kerrii, *Craib* [Menispermaceae-Cocculeae]; ab affini *S. Delavayi*, Diels, foliis papyraceis, pedunculis masculis longioribus, drupis orbicularibus haud obovoideis recedit.

Caules volubiles, graciles vel subgraciles, saepe tortuosi, glabri, sulcati, substraminei. *Folia* orbiculari-ovata vel fere orbicularia, apice obtusa, interdum obtuse acuminata, mucronata, basi rotundata vel truncata, usque ad 10 cm. longa et 9 cm. lata, papyracea, pagina utraque glabra, superiore viridia, inferiore glauca, nervis 9 radiantibus supra tenuioribus conspicuis subtus subprominulis, nervulis reticulationem subtus plus minusve conspicuam efficientibus, marginata, integra, petiolo circa 7–14 cm. longo basi incrassato glabro suffulta. *Inflorescentiae* ♂ axillares, solitariae vel 2-fasciculatae, inferiore pseudumbellam compositam pedunculo communi 3–3·5 cm. longo suffulta e radiis 3–4 constituta, superiore elongata inferiore 2–3-plo longiore e pseudumbellis racemosim dispositis constituta pedunculo communi 3–5 cm. longo suffulta, pedunculis partialibus ad 2·5 cm. longis, bracteis parvis vel interdum infimis foliaceis; pedicelli ad 2 mm. longi, paulo infra apicem articulati. *Sepala* 3 exteriora obovato-oblanceolata vel obovato-oblonga, apice rotundata, 1·5 mm. longa, 3 interiora obovato-oblonga, 1·75 mm. longa, 1·25 mm. lata. *Petala* 3–4, circa 1·25 mm. longa. *Synandrium* 0·75 mm. altum, apice 0·8 mm. diametro, stipite distincto inferne incrassato suffultum. *Inflorescentia* ♀ e pseudumbella axillari vel ramulum brevem axillarem terminante pedunculo communi ad 1·3 cm. longo suffulta ad 1 cm. diametro constituta; pedicelli 1·5 mm. longi. *Ovarium* semiovoideum, glabrum; stigmata 6-partita. *Drupa* orbicularis, 7 mm. diametro; endocarpium faciebus depressum, dorso utrinque costulis circa 16 ornatum.

Chiengmai, 300 m., scrub jungle, *Kerr* 3309. Doi Sutep, 500 m., mixed jungle, *Kerr* 3275.

Stephania oblata, *Craib* [Menispermaceae-Cocculeae]; a *S. herbacea,* Gagnep., foliis crassioribus, petalis carnosis latioribus quam longioribus, synandrio altiore, a *S. Delavayi,* Diels, inflorescentia minore magis condensata, floribus maioribus, ab ambabus foliorum nervulis rete laxius efficientibus recedit.

Caulis gracilis, glaber, sicco iuventute fuscescens, mox stramineus, sulcatus, torquatus. *Folia* oblata, apice rotundata, costa excurrente breviter apiculata, basi rotundata, subtruncata, vel emarginata, ad 4 cm. longa et 4·5 cm. lata, papyracea, glabra, subtus pallidiora, nervis radiantibus 9 supra conspicuis subtus prominulis, nervulis supra parum impressis subtus subprominulis rete laxum efficientibus, margine pallida, parum reflexa, petiolo ad 5 cm. longo circa 1 cm. supra laminae basem inserto suffulta. *Pseudumbellae* ♂ axillares, solitariæ, vix 1 cm. diametro, glabrae, pedunculo communi circa 2·7 cm. longo apice parvi-bracteato suffultae, pedunculis partialibus circa 5 ad 2·5 mm. longis, pedicellis vix 2 mm. longis. *Sepala* 6 vel 8, exteriora 2 mm. longa, 1 mm. lata, interiora exterioribus paululo breviora iisque aequilata. *Petala* carnosa, flabelliformia, 1 mm. longa, 1·5 mm. lata. *Synandrium* 1 mm. altum, apice 1·5 mm. diametro.

Doi Sutep, 720 m., mixed jungle, *Kerr* 2610.

Cyclea ciliata, *Craib* [Menispermaceae-Cocculeae]; species nova foliis peltatis pagina neutra glabris, inflorescentia ♂ paniculata axillari, sepalis connatis, calyce haud ad medium fisso, synandrio conspicue exserto distincta.

Caules herbacei, e radice perenni orti, volubiles, pilis longiusculis saepissime deflexis sat copiose tecti, striati, demum subsulcati, pallide corticati. *Folia* ovata lateve ovata, apicem versus angustata, longe mucronata, basi truncata vel leviter emarginata, 8–9 cm. longa, 5·3–7 cm. lata, papyracea, supra viridia, subtus pallidiora, subglauca, pagina superiore pilis longis sat rigidis sparse strigosa, inferiore pilis iisdem nisi minus rigidis et numerosioribus instructa, nervis radiantibus 9–11 supra conspicuis subtus prominulis, nervulis pagina utraque conspicuis, margine longe ciliata, petiolo 2·5–3·3 cm. longo 8–13 mm. supra laminae basem affixo indumento caulium suffulta. *Inflorescentia*

♂ elongato-paniculata, axillaris, ad 7·5 cm. longa et 1 cm. diametro, pedunculo communi 1·5–2·5 cm. longo suffulta, pedunculis partialibus ad 4 mm. longis, pedicellis 1–1·75 mm. longis, partibus omnibus pubescentibus vel substrigillosis. *Calyx* extra strigillosus, 1·8 mm. longus, 4–lobatus, lobis deltoideis circa 0·5 mm. longis. *Corolla* 0·6 mm. longa, apice lobulata, glabra. *Synandrium* 2 mm. altum, apice 0·5 mm. diametro.

Doi Sutep, 900 m., on low herbage in evergreen jungle, *Kerr* 3356.

Cyclea varians, *Craib* [Menispermaceae-Cocculeae]; a *C. gracillima*, Diels, caule haud glabro, petiolo longiore, a *C. Wattii*, Diels, petiolo haud glabro distinguenda.

Caules e radice perenni volubiles, pilis saepissime deflexis et crispatis hirsuti, primo pallidi, striati, mox fuscescentes, sulcati. *Folia* late ovata, ovata, vel lanceolato-ovata, apice subacuta, mucronata, basi truncata, rarius rotundata, haud rarius cordata, 5–12 cm. longa, 3·5–7·4 cm. lata, chartacea, supra mox ad costam, nervos, nervulosque parce hirsuta, subtus pallidiora, interdum subglauca, molliter pilosa, nervis radiantibus circa 11 supra conspicuis vel subprominulis subtus prominentibus, nervis secondariis (e costa ortis) utrinque 5–6, nervulis reticulationem laxam supra conspicuam subtus prominulam efficientibus, ciliata, marginata, petiolo ad 6 cm. longo 8–10 mm. supra laminae basem affixo crispatim piloso suffulta. *Inflorescentia* ♂ axillaris, anguste paniculata, e pseudumbellis sat densis constituta, interdum ad pseudumbellam unicam redacta, pedunculo communi ad 3 cm. longo cum pedunculis partialibus adpresse setuloso suffulta. *Flores* virides (ex *Kerr*), expansi 3 mm. diametro, pedicellis circa 1 mm. longis apicem versus articulatis glabris suffulti. *Sepala* 4, oblongo-obovata vel oblongo-elliptica, 1 mm. lata, glabra. *Corolla* carnosula, 0·75 mm. alta, apice lobulata, haud rarius e petalis 4 solutis margine involutis constituta. *Synandrium* corolla paululo altius. *Infloresecentia* ♀ masculae similis sed saepissime ramulis brevibus lateralibus gesta. *Carpellum* gibboso-semiovoideum, glabrum, stigmate 3-partito. *Drupa* (vix matura) suborbicularis, 4 mm. diametro.—*Cyclea* sp.n., Craib, Contrib. Fl. Siam, p. 10.

Mê Ta, 480 m., *Kerr* 2573 (♂). Ban Pong, 330 m., mixed jungle, *Kerr* 1940 (♀).

Capparis adunca, *Craib* [Capparidaceae-Cappareae]; species floribus axillaribus solitariis, ovario tomentoso in stylum conspicuum angustato, pedicellis post anthesin incrassatis uncinatis vel saltem curvatis distincta.

Ramuli virides, primo pilis albis brevibus tecti, cito glabri, cortice viridi mox parum brunnescente striato obtecti, lenticellis haud conspicuis. *Folia* ovata vel late lanceolata, rarius ovato-elliptica, apice obtusa, breviter mucronulata, basi rotundata vel cuneato-rotundata, 5–7 cm. longa, 2·7–4 cm. lata, membranacea, pagina utraque cito glabra vel hic et illic pilis brevibus albis stellatis sparse instructa, nervis lateralibus utrinque 6–8 intra marginem anastomosantibus supra subconspicuis subtus prominulis, petiolo 5–7 mm. longo indumento ramulorum supra canaliculato suffulta. *Flores* saepissime ramulis brevibus lateralibus gesti, axillares, solitarii, pedicello circa 1·3 cm. longo indumento ei ramulorum simili tecto sub anthesin recto cito post anthesin praesertim superne incrassato uncinato suffulti; alabastra pilis parvis stellatis albis plus minusve caducis instructa. *Sepala* oblonga vel obovata, intra glabra, 13 mm. longa, 8 mm lata, interiora basi angustata, dorso medio carinata, exteriora dorso 3-carinata. *Petala* oblanceolato-obovata, 2·5 cm. longa, 11·5 mm. lata, duo approximata, basi callosa, intra pubescentia. *Stamina* numerosa, glabra, petalis subaequialta vel ea paulo superantia. *Pistillum* staminibus paulo brevius, tomentosum gynophoro sat robusto; ovarium fusiforme, circa 3 mm. longum, stylo subaequilongum, placentis 3 multiovulatis.

Mûang Pichit, c. 50 m., straggling or climbing shrub in scrub jungle, *Kerr* 5672.

Capparis Kerrii, *Craib* [Capparidaceae-Cappareae]; species nova habitu *C. foetidae*, Blume, similis sed indumento ferrugineo, spinis brevioribus sparsioribus, petiolo paulo longiore ala angusta undulata instructo recedit.

Frutex circa 2-metralis (ex *Kerr*), partibus fere omnibus iuventute indumento brevi ferrugineo e pilis stellatis constituto dense tectis, ramulis gracilibus indumento delapso viridibus striatis. *Folia* obovato-oblanceolata, apice acuminata, acuta, basi cuneata, ad 7 cm. longa et 3·8 cm. lata, membranacea vel chartaceo-membranacea, supra indumento ferrugineo brevi iuventute obtecta, mox sparsius inaequaliter instructa, subtus indumento simili ad costam nervosque laterales dense tecta, aliter sparse instructa, nervis lateralibus utrinque 6–8 intra marginem arcuatim iunctis supra conspicuis vel leviter impressis subtus prominentibus, margine integra, parum recurva, petiolo 7–9 mm. longo indumento ferrugineo stellato obtecto supra canaliculato lamina decurrente anguste undulatim alato suffulta. *Flores* axillares, solitarii vel ad 5 superpositi, pedicellis circa 1 cm. longis suffulti; alabastra sicco viridia, mox plus minusve glabrescentia. *Sepala* oblonga vel elliptico-oblonga, apice rotundata, 5 mm. longa. *Petala* oblonga, 6 mm. longa, 2·5 mm. lata. *Gynophorum* 1·3 cm. longum, glabrum; ovarium glabrum, stylo brevi incluso vix 1·5 mm. longum, placentis 3.

Ban Pong Yêng, 750 m., *Kerr* 3568.

Capparis latifolia, *Craib* [Capparidaceae-Cappareae]; *C. crassifoliae*, Kurz, similis sed foliis maioribus subtus haud glabris, gynophoro haud glabro distinguenda.

Frutex scandens; ramuli tomentosi, grisei vel interdum ferruginei, pilis intermixtis griseis et ferrugineis diu persistentibus, striati vel mox sulcati, aculeis brevibus basi validis tomentosis rectis vel subrectis deflexis. *Folia* elliptica, obovato-elliptica vel oblata, basi cuneata vel subacuminata, apice emarginata, mucrone indurato reflexo instructa, 5·5–10·5 cm. longa, 6–9 cm. lata, chartacea vel rigide chartacea, pagina superiore glabra vel ad costam nervosque laterales pilis paucis stellatis hic et illic instructa, inferiore pilis brevibus stellatis albis et ferrugineis instructa, nervis lateralibus utrinque 5 supra conspicuis subprominulis subtus prominentibus rectis intra marginem anastomosantibus, nervulis pagina utraque conspicuis, petiolo ad 2 cm. longo pilis iisdem stellatis tecto supra canaliculato suffulta. *Flores* axillares, seriatim dispositi. *Fructus* immaturus 1·8 cm. longus, pedicello ad 3 cm. longo indumento ei ramulorum simili tecto et gynophoro ad 4·5 cm. longo praesertim inferne pilosulo suffultus.

Mûang Lom Sak, c. 200 m., deciduous forest at edge of swampy ground, *Kerr* 5738.

Vern. Kawn Kawng Krûa.

The young fruits have stellate hairs in patches here and there. These hairs appear in many cases to be actually in situ but in others as if derived from the branches or leaves in the process of drying.

Capparis nana, *Craib* [Capparidaceae-Cappareae]; species nova parvifolia, floribus seriatim dispositis, a *C. disticha*, Kurz, eiusque affinioribus ovario dense tomentoso, gynophoro plus minusve glabrescente distinguenda.

Suffrutex 2–3-pedalis (ex *Kerr*); ramuli divaricati, graciles, fere glabri, pallide virides, striati, aculeis recurvis basi decurrentibus apice nitido-brunneis mox glabris circa 2 mm. longis instructi. *Folia* subrhombeo-ovata, apice acuminata, mucronata, basi cuneato-rotundata vel fere rotundata, 3–fere 4 cm. longa, 1·5–2·2 cm. lata, membranacea, pagina utraque sicco viridia, inferiore parum pallidiora, superiore primo sparse pilosa, cito glabrescentia, inferiore sparse pilosula, nervis lateralibus utrinque circa 6 pagina utraque subconspicuis intra marginem anastomosantibus, costa subtus prominente, petiolo gracili circa 3 mm. longo sparse pilosulo supra canaliculato suffulta. *Flores* axillares, solitarii vel ad 3, seriatim dispositi, pedicello gracili ad 1·8 cm. longo primo sparse pilosulo mox plus minusve glabrescente suffulti; alabastra ambitu oblongo-elliptica vel elliptica, viridia, albo-pilosula. *Sepala* oblongo-elliptica, apice rotundata, 4·5 mm. longa, 2·25 mm. lata, intra glabra. *Petala* oblongo-oblanceolata, apice rotundata, 6 mm. longa, 2 mm. lata, duo approximata, basi callosa, intra pubescentia, dorso densius pilosa. *Stamina* 8, glabra, filamentis circa 1·5 cm. longis, antheris 1·75 mm. longis. *Pistillum* staminibus subaequialtum, gynophoro primo plus minusve piloso cito glabrescente; ovarium circa 1 mm. altum, in stylum eo paulo breviorem angustatum, cum stylo tomentoso-pilosum, placentis tribus pauci-ovulatis.

Mûang Petchabun, c. 100 m., often forming wide patches in bamboo jungle, *Kerr* 5723.

Capparis siamensis, Kurz, For. Fl. Br. Burma, I. p. 63.

Ratbouri, *Teysmann*, 5927. Pran, jungle, 5 m., *Marcan* 631, 637.

Specimens collected by Marcan in a locality not far from Teysmann's collecting ground show that *C. siamensis* is evidently deciduous. The plant is not glabrous, as described by Kurz, the young branchlets being densely covered with a low felt and the leaves being thinly pubescent on both sides, especially on the nerves. The fruit, on a woody gynophore 2·5 cm. long, is about 3·5 cm. long and 2 cm. diameter, apiculate, tomentose, and with 8 longitudinal rows of prominent tubercles, 4 rows being on distinct continuous ridges, the other 4 being without continuous ridges.

Capparis subhorrida, *Craib* [Capparidaceae-Cappareae]; a *C. horrida*, Linn. f., foliis tenuibus deciduis recedit.

Frutex scandens; ramuli saepissime ferruginei, pilis brevibus stellatis ferrugineis et griseis dense tecti, pilis diu persistentibus, laeves, mox striati, aculeis deflexis basi parum decurrentibus circa 3 mm. longis instructi. *Folia* lanceolata, ovato-lanceolata, vel oblongo-lanceolata, apice acuminata, acuta, basi late cuneata vel rotundata, 5·5–10 cm. longa, 3·2–4·2 cm. lata, membranacea, sicco utrinque viridia, supra glabra, nitentia, subtus pallidiora, pilis brevibus albis et hic et illic ferrugineis densius tecta, nervis lateralibus utrinque 5 supra conspicuis subtus prominulis intra marginem anastomosantibus, nervulis supra subconspicuis, petiolo ad 1 cm. longo supra canaliculato indumento ei ramulorum simili tecto suffulta. *Flores* axillares, seriatim dispositi. *Fructus* vix maturus, ambitu elliptico-ovatus, 2·3 cm. longus, pedicello 8–15 mm. longo indumento ramulorum et gynophoro 2·2 cm. longo hic et illic sparse pubescente suffultus, glaber.

Nakawn Tai, c. 200 m., mixed deciduous forest, *Kerr* 5826.

Vern. Sai Sū Yai (ex *Kerr*).

Capparis Winitii, *Craib* [Capparidaceae-Cappareae]; ab affini *C. siamense*, Kurz, spinis deficientibus, floribus minoribus, inter alia distinguenda.

Frutex vel *arbor* parva, sempervirens, ramulis primo pilis brevibus stellatis plus minusve dense tectis cito glabrescentibus cortice fuscescente striato obtectis demum omnino glabris. *Folia* lanceolata vel ovata, rarius ovato-elliptica, apice obtuse mucronulata, basi cuneata vel rotundata, saepissime cordatula, 6·5–11·5 cm. longa, 3–5·8 cm. lata, chartacea vel chartaceo-coriacea, matura glabra, subtus pallidiora, nervis lateralibus utrinque 4–7 intra marginem anastomosantibus supra conspicuis subtus prominentibus, nervulis rete pagina utraque conspicuum vel subconspicuum efficientibus, integra, petiolo circa 1 cm. longo supra canaliculato cito glabro suffulta. *Flores* in axillis foliorum novellorum solitarii, pedicellis sat robustis petiolo subaequilongis ut ramulis pubescentibus suffulti; alabastra ovoidea ellipsoideave, iuventute indumento ei ramulorum simili tecta, mox nisi ad sepalorum margines plus minusve glabrescentia; corolla pallide viridis vel viridi-lutea, ad bases petalorum superiorum aurantiaca, demum fusco-brunnea vel purpurea (ex *Kerr* et *Winit*). *Sepala* exteriora vix 9 mm. longa, interiora 1·25 cm. longa, dorso pilis brevibus stellatis sparse instructa, plus minusve glabrescentia, intra superne marginem versus dense pilosa. *Petala* ad 2 cm. longa. *Stamina* pistillo subaequialta. *Gynophorum* praecipue superne tomentosum; ovarium dense tomentosum, circa 2 mm. altum, stylo subaequilongum, placentis 3 multiovulatis.

Muang Hawt, 225 m., *Kerr* 2938. Reheng, Mê Kor, 360 m., *Winit* 100.

Lao name, Nam Khi Let or Khi Ka Ton (ex *Winit*).

Scolopia rhinanthera, *Clos*, var. **siamensis,** *Craib* [Bixaceae-Flacourtieae); var. nov. foliis basi latis, perianthio 5-mero, placentis duabus distinguenda.

Bangkok, below 5 m., marshy ground; small tree c. 4 m. high, branches with stout simple spines, *Kerr* 4292.

Polygala Kerrii, *Craib* [Polygalaceae-Polygaleae]; a *P. karensium*, Kurz, foliis minoribus rigidioribus, bracteis brevioribus inter alia recedit.

Frutex circa 3 m. altus (ex *Kerr*); ramuli iuventute breviter crispatim fulvo-pubescentes, mox glabri, angulati, demum teretes, cortice cinereo-brunneo obtecti, lenticellis subconspicuis. *Folia* lanceolata vel oblanceolata, apice longius acuminata, acuta, basi cuneata, 4–8·5 cm. longa, 1·1–2·2 cm. lata, chartacea, supra ad costam nervosque laterales puberula, aliter hic et illic puberula, subtus pallidiora, pilis longioribus saepissime crispatis eodem modo distributis instructa, nervis lateralibus utrinque 7–9 intra marginem anastomosantibus supra subconspicuis subtus prominentibus, nervulis paucis subtus conspicuis vel pagina utraque subconspicuis tantum, margine integra, ciliolata, petiolo ad 1 cm. longo pilis iis ramulorum similibus instructo suffulta. *Racemi* et oppositifolii et ramulos laterales terminantes, ad 7 cm. longi, pedunculo communi brevi vel ad 8 mm. longo cum rhachi ut ramulis pubescente suffulti; pedicelli circa 4 mm. longi, puberuli; bracteae deciduae, 1·75 mm. longae, cuspidato-acuminatae, ciliatae. *Sepalum* superius cucullatum, 6 mm. longum, aliis fere duplo longius, omnibus ciliatis; alae 1·3 cm. longae, densius ciliolatae. *Corolla* 1·5 cm. longa, carinae crista lobulata. *Ovarium* 1·75 mm. altum, compressum, ciliatum, stylo circa 1·4 cm. longo.

Doi Intanon, c. 2100 m., open ridge, flowers bright yellow, *Kerr* 5326.

Xanthophyllum obliquum, *Craib* [Polygalaceae-Xanthophylleae]; ab affini *X. excelso*, Blume, foliorum nervis lateralibus obliquis haud patulis, floribus minoribus recedit.

Arbor circa 20 m. alta (ex *Kerr*); ramuli primo minute sparse puberuli, cito glabri, iuventute angulati, lutescentes. *Folia* oblonga vel oblongo-oblanceolata, apice acuminata vel caudato-acuminata, obtusa, basi cuneata, interdum subacuminata, 5–10 cm. longa, 2–3·5 cm. lata, coriacea, sicco lutescentia, subtus pallidiora, pagina utraque glabra, nervis lateralibus utrinque 6–8 supra conspicuis vix prominulis subtus prominentibus sat obliquis saepissime parum arcuatis rarius subrectis, nervulis subtus prominulis, margine integra, sicco undulata, petiolo circa 6 mm. longo supra canaliculato suffulta. *Paniculae* et axillares et terminales, foliis paulo breviores vel iis parum longiores, rhachi et ramulis complanatis cum pedicellis circa 3·5–5 mm. longis aureo-puberulis. *Sepala* ciliolata, utrinque breviter adpresse pubescentia, exteriora ovato-deltoidea, 2 mm. longa, 1·75 mm. lata, crassa. *Corolla* 4·5 mm. longa, carina petalis aliis paulo breviore. *Filamenta* petalis adnata, haud inter alia connata, inferne ampliata. *Discus* crenulatus. *Ovarium* et gynophorum glabra, ovulis circa 8, stylo pubescente 2 mm. longo.

Dan Sai, Kao Keo Kang, c. 1100 m., evergreen forest, *Kerr* 5766.

var. **viride,** *Craib*, foliis minus coriaceis sicco viridibus a typo recedit.

Dan Sai, Kao Keo Kang, c. 1300 m., evergreen forest, *Kerr* 5766A.

Xanthophyllum siamense, *Craib* [Polygalaceae-Xanthophylleae]; ab *X. affine*, Korth., foliis maioribus tenuioribus, floribus minoribus distinguendum.

Arbor circa 12-metralis (ex *Kerr*), ramulis sparse puberulis substramineis mox brunnescentibus angulatis. *Folia* lanceolata vel oblongo-lanceolata, apice acuminata, obtusa, basi cuneata vel subacuminata, 15–19·5 cm. longa, 3·6–5·8 cm. lata, coriacea, viridia vel lutescente-viridia, subtus pallidiora, supra glabra, subtus ad costam sparse puberula, nervis lateralibus utrinque 6–8 intra marginem anastomosantibus supra subconspicuis vel fere conspicuis subtus prominentibus nervulis subtus prominulis margine integra, sicco undulata, parum recurva, pallida, petiolo 1 cm. longo sparse puberulo mox glabro supra canaliculato suffulta. *Inflorescentia* et axillaris et terminalis, semper ramosa, ad 15 cm. longa, ramulis lateralibus terminales saepe aequantibus, densius aureo-puberula, pedunculis compressis, pedunculo communi ad 2·5 cm. longo, floribus albis (ex *Kerr*) fasciculis saepe suboppositis pseudoverticillatis pedicellis 3–5 mm. longis suffultis. *Sepala* exteriora ovata vel elliptico-ovata, apice obtusa rotundatave, 2·75–3·5 mm. longa, 1·8–2·25 mm. lata, utrinque adpresse pubescentia, interiora obovato-elliptica vel elliptica, 3·5 mm. longa, 2·75 mm. lata, extra adpresse pubescentia, intra sparse adpresse pubescentia, omnia ciliolata. *Petala* 6–7 mm. longa, carina aliis paulo breviore dorso pilosa. *Filamenta* petalis adnata, haud connata, inferne ampliata, intra ad latitudinem maximam pubescentia, antheris pilis albis divergentibus instructis.

Ovarium 1 mm. altum, glabrum, ovulis circa 8, stylo pubescente circa 4·5 mm. longo, gynophoro distincto crassiusculo glabro.

Ban Kawng Hě, 960 m., evergreen jungle, *Kerr* 3583.

Indigofera oblonga, *Craib* in *Kew Bull.*, 1914, p. 6, descr. ampl.

Racemi axillares, pedunculo communi petiolo breviore indumento ei ramulorum simili tecto suffulti; bracteae filiformes, alabastra conspicue superantes; alabastra adpresse brunneo-hirsuta, paulo ante anthesin apice acuminata; pedicelli paulo ultra 1 mm. longi. *Calyx* antice 3·5 mm. longus, extra griseo-hirsutus. *Vexillum* oblongum, 8 mm. (stipite brevi lato incluso) longum, 5·5 mm. latum; carina et alae vexillo paulo breviores.

Doi Pāhom Pok, Mg. Fāng, c. 1100 m., open evergreen forest, flrs. pinkish, *Kerr* 5171.

Mastixia euonymoides, *Prain* in Journ. As. Soc. Beng., LXVII. p. 295, *descr. ampl.*

Pedicelli 2 mm. longi; receptaculum pedicello paulo longius. *Calyx* 1 mm. longus, truncatus. *Petala* 4, sat crassa, 4·5 mm. longa et 3 mm. lata. *Stamina* 8, filamentis 3 mm. longis, antheris vix 1·5 mm. longis. *Discus* conspicuus, lobatus. *Stylus* crassus, superne gradatim angustatus, 2 mm. supra discum productus, stigmate bilobo.

Doi Sutep, 1670 mm., evergreen jungle, *Kerr* 3237—tree c. 30 m. high.

Described originally from fruiting material (Kachin, *King's Collector !*) this species was treated as incompletely known in Wangerin's monograph (in Engler Pflanzenr.). Kerr's material shows that *M. euonymoides* belongs to the subgenus *Tetramastixia*. In this group *M. rostrata* Blume alone has strictly opposite leaves and a truncate calyx. *M. rostrata* (Java, *Koorders* 2309 *α* ! 25634 *β* !) can be readily distinguished by the markedly caudate-acuminate leaves.

Brandis in Indian Forester, 1907, p. 57, t. 7, refers a plant collected in British Bhutan by Haines (No. 916 !) to *M. euonymoides.* This plant has a lobed calyx, 5-merous flowers (ex Haines' description), and moreover has alternate leaves whereas *M. euonymoides* has a truncate calyx, 4-merous flowers, and strictly opposite leaves.

Paederia linearis, *Hook. f.*, Fl. Brit. Ind., III., p. 197.

Petchaburi, 50 m., *Marcan* 521, 640.

The type material of this species (Tenasserim, *Griffith*, K.D., 2911 !) was not sufficiently complete to determine the relationship of the plant. Sir Joseph Hooker placed *P. linearis* provisionally near *P. tomentosa*. Marcan's specimens have mature fruit and show that the affinities of the species are with the first group not with the second as arranged in the Flora of British India. The fruit is compressed, broadly elliptic about 7 mm. long and 5 mm. broad; the pyrenes are black, with a distinct straw-coloured wing.

Primula siamensis, *Craib* [Primulaceae]; *P. nutanti*, Delavay ex Franchet, affinis, sed calycis lobis longioribus angustioribus apice haud acuminato-rotundatis differt.

Folia oblanceolata vel oblongo-oblanceolata, apice rotundata vel obtusa, basi in petiolum angustata, ad 7·5 cm. longa et 2·4 cm. lata, membranacea, efarinosa, supra tenuiter pilosa, subtus ad costam, nervos, nervulosque longius et densius pilosa, nervis lateralibus utrinque circa 9 bene intra marginem ramosis cum ramulis in hydathodos sat longos excurrentibus subtus conspicuis margine breviter densius ciliata, petiolo ad 3·5 cm. longo alato suffulta. *Scapus* solitarius, inflorescentiam paucifloram primo capituliformem mox breviter spicatam gerens, pilis brevibus farini-potentibus tectus, apice albo-farinosus; bracteae deciduae, oblongo-lanceolatae vel lanceolatae, calycem vix aequantes, sparse farinosae vel marginem versus tantum albo-farinosae. *Calyx* extra densius albo-farinosus, 6·5 mm. longus, lobis ovatis vel oblongo-ovatis acutiusculis 2·5 mm. longis. *Corollae* violaceae (ex *Kerr*) tubus (in flore brevistylo) 1·2 cm. longus, limbus 1·3 cm. longus, lobi circa 9·5 mm. longi, apice irregulariter dentati. *Antherae* bene inclusae, circa 2·75 mm. longae.

Doi Chieng Dao, in crevices of limestone rocks, c. 1700–2000 m., *Kerr* 5582.

Androsace similis, *Craib* [Primulaceae]; species nova ad sectionem *Pseudoprimulam*, Pax, pertinens, ab *A. axillari*, Franchet, cui maxime affinis, indumento densiore distinguenda.

Herba estolonifera. *Folia* orbiculari-reniformia, ad 1·7 cm. diametro, chartacea vel subrigide chartacea, pagina utraque sparse hirsuto-pilosa, subtus parum pallidiora, nervis vix conspicuis, margine lobulata, lobulis pauci-dentatis vel subintegris, petiolo 1·7–3 cm. longo pilis divergentibus sat copiose tecto suffulta. *Scapi* 6–21 cm. longi, inflorescentias saepius 3 rarius 2 vel 4 superpositas bracteatas et praeterea foliiferas, foliis 2 vel 3 basalibus nisi paulo minoribus et brevius petiolatis similibus, gerentes, anguste sulcati, hirsuto-pilosi, pilis plus minusve deflexis in sulcis densissimis mox cinereis; pedicelli ad 2 cm. longi, superne densius hirsuto-pilosi, pilis deflexis. *Calyx* 3·5 mm. longus, pilis albis divergentibus sat rigidis extra instructus, lobis 1·75 mm. longis obtusis. *Corollae* albae (ex *Kerr*) tubus calyce paulo longior, lobis obovato-cuneatis emarginatis circa 2·75 mm. longis et latis. *Antherae* 0·75 mm. longae, filamentis brevibus.

Doi Chieng Dao, c. 2100 m., open grassy ground, *Kerr* 5588.

Lysimachia Smithiana, *Craib* [Primulaceae]; a *L. cephalantha*, Knuth, cui affinis, foliis minoribus, floribus paucioribus recedit.

Herba basi lignosa, caule pauci-ramoso, ramis erectis vel decumbentibus, pilis crispatis brevibus primo dense mox sparsius induto. *Folia* opposita, late ovata, ovato-lanceolata, vel rarius oblongo-elliptica, apice mucronata, basi cuneata vel subtruncata, 1–2 cm. longa, 0·7–1·6 cm. lata, chartacea, supra pilis sat rigidis primo parce instructa, mox glabra, subtus pallidiora, iuventute praecipue ad costam breviter hirsuta, demum fere glabra, nervis lateralibus utrinque 3 pagina inferiore subconspicuis, integra, petiolo brevi vel ad 6 mm. longo supra canaliculato suffulta. *Inflorescentia* terminalis, e floribus paucis (saepissime 2–3) constituta. *Calyx* fere ad basem partitus, 6 mm. longus, segmentis lanceolatis acutiusculis 1·5 mm. latis dorso sparse hirsutis. *Corolla* 6·5 mm. longa, fere ad basem partita, segmentis ovatis vel elliptico-ovatis 4 mm. latis dorso rubro-glandulosis. *Filamenta* circa 2 mm. longa, antheris fere 1·5 mm. longis apiculatis. *Ovarium* 1 mm. altum, superne pilis erectis rigidiusculis instructum; stylus 4 mm. longus.

Doi Pāhom Pok, Mg. Fāng, open grassy jungle, c. 1600 m., *Kerr* 5186.

Symplocos Rajaniana, *Craib* [Symplocaceae]; speciebus zeylanicis maxime affinis, ramulis iuventute dense villosis, foliis primo supra nisi ad costam glabris subtus dense molliter adpresse pubescentibus distincta.

Arbor circa 8 m. alta (ex *Kerr*); ramuli hornotini dense villosi, annotini tomentosi, demum glabrescentes, cortice brunneo vel cinereo-brunneo irregulariter striato obtecti, lenticellis haud conspicuis. *Folia* lanceolata, apice acuminata, acuta, basi cuneata vel late cuneata, ad 6 cm. longa et 2·5 cm. lata, supra iuvenilia ad costam longius dense albo-pubescentia, aliter glabra, matura ad costam puberula, subtus primo dense molliter adpresse subfulvo-pubescentia, mox sparse sed praesertim ad costam nervosque pubescentia, costa supra impressa subtus prominente, nervis lateralibus utrinque 8 intra marginem amastomosantibus supra conspicuis subtus prominentibus, nervulis subtus prominulis, margine argute denticulata, mox conspicue recurva, petiolo circa 5 mm. longo indumento ramulorum suffulta. *Spicae* e ramulis annotinis cum foliis novellis ortae pedunculo communi brevi incluso circa 1·5 cm. longae, fulvo-pubescentes. *Receptaculum* 1·5 mm. altum, adpresse pubescens. *Sepala* oblonga vel oblongo-obovata, apice obtusa, incurva, vix 2 mm. longa et 1·5 mm. lata, extra adpresse pubescentia, intra glabra. *Corolla* 9 mm. diametro, segmentis ellipticis vel oblongo-ellipticis ad 2 mm. latis. *Filamenta* ad 5 mm. longa, gracilia, glabra, antheris parvis. *Discus* conspicuus, 5-angularis, hirsutus. (*see* p. 255.)

Doi Sutep, evergreen jungle, c. 1600 m., *Kerr* 4684.

Rivea Clarkeana, *Craib* [Convolvulaceae-Convolvuleae]; ab affini *R. hypocrateriformi*, Choisy, sepalis longioribus fructescentibus angustioribus recedit.

Planta perennis; caules volubiles, fistulosi, iuventute sericei, demum sparse breviter adpresse pubescentes, brunneo-corticati. *Folia* oblata, apice retusa, saepissime apiculata, basi late cordata, ad 16 cm. longa et 21 cm. lata, chartacea vel rigide chartacea, supra glabra, subtus pallidiora, iuventute sericea, demum ad costam nervosque dense adpresse albo-pubescentia, aliter sparse adpresse pubescentia, nervis supra conspicuis subtus prominentibus, fere e basi 7-nervia, nervis secondariis (e costa ortis) utrinque 3 omnibus intra marginem anastomosantibus, nervis transversis pagina utraque conspicuis, integra, petiolo ad 13 cm. longo apice biglanduloso indumento ei caulium simili tecto suffulta. *Cymae* axillares et terminales, 3–5-florae, pedunculo communi ad 7 cm. longo suffultae, pedunculis partialibus circa 5–7 mm. longis, pedicellis terminalibus fere 1 cm. longis, omnibus sericeis; bracteae et bracteolae deciduae. *Calyx* 1·4 cm. longus, partibus exterioribus sericeus. *Corolla* in alabastro adpresse albo-pubescens, expansa 8 cm. longa, apice 6·5 cm. diametro tubo circa 4·5 cm. longo. *Fructus* operculatus, brunneus, nitidus, magis minusve globosus, paulo ultra 1 cm. diametro, sepalis duriusculis patulis vel reflexis persistentibus.—*R. ornata*, Choisy, var. *Griffithii*, C. B. Clarke, pro parte ?

Chiengmai, 300 m., cultivated from seeds collected in deciduous jungle near Lampang, *Kerr* 3383.

Glossocarya siamensis, *Craib* [Verbenaceae-Caryopterideae]; a *G. molli*, Benth., partibus omnibus minus pubescentibus recedit.

Ramuli iuventute breviter subdense crispatim pubescentes, demum glabri, pallide brunneo-corticati, conspicue striati. *Folia* ovata vel oblonga, apice breviter acuminata, basi cordata lateve cordata, ad 9 cm. longa et 5·5 cm. lata, chartacea, pagina utraque sed inferiore sparsius ad costam nervosque puberula, subtus pallidiora, nervis lateralibus utrinque 4–5 intra marginem arcuatim iunctis supra conspicuis subtus prominulis, integra, petiolo 6–10 mm. longo supra canaliculato suffulta. *Corymbi* 3–7 cm. diametro, et terminales et in axillis superioribus positi et ibi vel pedunculo nudo suffulti vel ramulos breves terminantes, foliis subaequilongi vel iis paulo longiores; pedunculi partiales ad 2·5 cm. longi, folia parva basem versus interdum gerentes; pedicelli breves; pedunculi et pedicelli densius breviter pubescentes. *Calyx* obpyramidali-cupularis, 3 mm. longus, apice denticulatus, extra puberulus, distincte nervosus. *Corolla* non visa. *Fructus* circa 8 mm. longus et 2·5 mm. diametro, et puberulus et pilis longioribus sparsius instructus.

Bankgok, under 5 m., on bushes along canal, *Kerr* 4502.

Hymenopyramis cana, *Craib* [Verbenaceae-Caryopterideae]; ab *H. brachiata*, Wall., foliis subtus canis recedit.

Frutex; ramuli primo adpresse plus minusve crispatim pubescentes, quadrangulares, 4-sulcati, mox puberuli, cinereo-brunneo-corticati, lenticellis longitudinaliter elongatis plus minusve lineatim dispositis. *Folia* elliptico-ovata, ovata, rarius lanceolata vel obovata, apice acuminata, acuta, basi cuneata vel rotundato-cuneata, ad 9 cm. longa et 5·2 cm. lata, rigide chartacea vel subcoriacea, supra sicco fuscescentia, ad costam puberula, subtus cana, nervis lateralibus utrinque 5–6 cum costa supra impressis subtus prominentibus, nervis transversis supra leviter impressis subtus prominulis, integra, petiolo 6–10 mm.

longo pubescente suffulta. *Inflorescentia* generis. *Flores* adhuc ignoti. *Calyx* fructescens inflatus, ei *H. brachiatae*, Wall., similis, circa 1 cm. longus; fructus 4 mm. longus, hirsutus et glandulosus.

Mê Ping Rapids, Kêng Soi, on rocks, c. 400 m., *Kerr* 4637.

XXXVI.—FRUIT CULTURE IN FLORIDA.

Fruit-growing is a subject of importance in tropical countries, not only from the point of supplying markets for local consumption, but also in the hope of establishing an export trade to markets in temperate and more densely populated countries. The accompanying résumé of a paper by Dr. J. C. Th. Uphof, in which he gives his experiences of fruit-growing in tropical and sub-tropical Florida, should be of interest to those similarly engaged in other tropical countries.

Fruit-growing in Florida has become an important industry during recent years, and has been developed through the introduction of modern systems of orchard management, the use of machinery, the latest methods in combating insect pests and plant diseases, and in organising a sound system of marketing. These results have been largely possible through the enterprise of American and European financiers, the work of the United States Agricultural Experiment Stations and the Department of Agriculture, and the lessons learnt from the study of similar industries in the neighbouring State of California.

Oranges, grape fruit, tangerines and pecans are already on the markets as crops of first importance, whilst the cultivation of avocados, mangos, and other tropical fruits is being prosecuted with energy. It is hoped that the pineapple industry, which during the last eight years has steadily declined, will also be revived.

Citrus Fruits.

Nurseries.—Oranges are budded on to sour orange or grape fruit stock when it is three to four years old. Satsuma oranges are generally budded on to *Citrus trifoliata*, as this stock can stand the cold better in the northern part of Florida.

Seeds of the stock are sown in nurseries in December and January, that of *Citrus trifoliata* in September and October. Sowings are made in rows 2 ft. apart, and the seedlings transplanted when one year old to rows 4 ft. apart, where for one or two years they remain to get established. They are then budded, wax cloth being used to fasten the bud, and, provided the bark easily separates from the stem, the operation may be carried out at any time of the year. In the spring seedlings are topped, but the shoot from the introduced bud is staked if necessary and only pinched back when it is some 30 in. long.

Planting.—The land is first cleared, broken, and prepared, and the young trees planted out in December and February during their resting period. They must not be planted too deep as their roots are surface-feeders, and care must be taken not to expose the roots before planting. The best plan is to have the holes opened only just ahead of the planters who bring the seedlings in boxes from the nurseries. It is advisable to mix about 1 lb. of chemical fertiliser with the soil of each plant before filling in the hole; fresh manure is not recommended. A thorough watering must be given after planting and repeated every ten days for some time, each plant receiving 5 to 10 gallons. The usual planting distances are, for oranges and grape fruit, 25 × 25 ft., or in the best soils 30 × 30 ft., for Satsuma oranges, 20 × 20 ft., for lemons 20 × 25 ft., for limes 15 × 20 ft., for kumquat oranges 10 × 15 ft.

A most important fact to be borne in mind is that Citrus fruits must have good drainage. In Florida, where the land is usually very sandy, a hard pan is occasionally found a few feet below the surface, and this is generally be broken by dynamite, so as to lower the water level of the soil.

Manures.—The supply of organic matter must receive careful attention by way of green manures and in regular applications of chemical fertilisers.

As green manures, leguminous plants are generally grown, and of these preference is given to Velvet Beans (*Stizolobium Deeringianum*, Bort., and *S. niveum*, Roxb.) and the Iron and Brabham varieties of the Cow Pea (*Vigna sinensis*, L.). In the matter of chemical fertilisers the number of applications and composition of the fertiliser require to be varied according to the age of the crop. Young trees receive three or four applications a year, in the spring, once or twice in the summer, and finally in September. The spring and summer fertilisers contain 5 per cent. nitrates, 6–8 per cent. phosphates and 2–3 per cent. potash, but in the autumn the nitrates are reduced to 2–3 per cent. The first application is 1 to 2 lbs. a tree, and is increased by 1 lb. a tree until the trees are five to six years old and are in full bearing. Fertiliser is then given three times a year with a percentage of 3 to 4 of nitrates, 7 to 8 of phosphates and 3 to 4 of potash, until the trees are some ten years old when the amount per tree is 15 to 30 lbs. yearly, whilst large, old trees may require as much as 30 to 70 lbs.

Catch crops and honey.—Catch crops of cabbage, lettuce, beans and strawberries, and even peaches are grown for the first three or four years, but should then be cut out.

Bee-keeping provides a useful side crop, besides being important to the trees for pollination purposes. Excellent honey is obtained from the Citrus flowers, and the light-coloured Italian bee, which is common in the United States, is the one usually kept. When the flowers are over, however, the bees may be removed.

Pruning.—This is confined to thinning out unnecessary branches and shaping the tree and is generally done in summer.

The Crop.—The trees flower in March and April and occasionally again in the early summer. The fruit is gathered from November to the following April.

The following are the varieties of fruit in cultivation in Florida :—

Oranges.—*Parsons Brown.*—One of the earliest to fruit (Oct. and Nov.). The fruit is of good dessert quality and is sweet even whilst the skin is still green. Grows best when grafted on sour orange stock.

Pineapple.—A leading mid-season orange (Dec. to March). Excellent dessert qualities, with a pineapple flavour. Travels well. Grows vigorously and is a prolific bearer.

Valencia Late.—A late fruiting variety (March to May). At present this fruit is fetching high prices.

Lue Gim Gong.—Another late variety. Extensively grown in some parts of Florida.

Washington Navel.—So far not grown to any extent. Kid Glove oranges, so-called because the skin readily peels, are also widely cultivated. They fetch good prices.

Tangerines.—*Dancy.*—Widely grown. Fruits December to March. A prolific bearer.

Satsumas.—*Owari* and *Ikeda* varieties are generally grown. They should be budded on stock of *Citrus trifoliata.*

Temple.—Recently introduced and at present on trial.

Grape Fruits.—*Hall.*—Ripens February and March. Good dessert. Prolific bearer.

Marsh Seedless.—Ripens February and March. Good dessert, without the bitterness characteristic of grape fruit, and almost seedless.

Walter.—Ripens February and March. Good dessert but is very "seedy." A vigorous grower and prolific bearer.

Dunecan.—Ripens April, May and June. Excellent dessert. A vigorous grower and good bearer and more hardy than the preceding.

Kumquat.—*Nagami* is the most popular variety and has oval fruits. Used for preserving.

Marumi.—Fruits roundish. Used for preserving.

Meiwa.—Can be eaten as a dessert fruit in a fresh state.

Lemons.—Grown only in southern Florida as they cannot stand the cold.

Seedless Villafranca.—Commonly planted. Vigorous grower and good bearer.

Lisbon.—Recommended as its fruit ripens during the winter months.

Limes.—More generally cultivated than lemons. The groves are composed of seedling trees.

Tahiti is recommended as a budded variety.

Avocados.—The Avocado is coming into favour as a salad, especially in the northern markets. It is generally grown in the south of the State, as only the varieties belonging to the Mexican group can stand the cooler climate in the north.

They can easily be grown from seeds sown at stake, but budded varieties obtained from nurserymen in southern Florida are preferred.

For budding purposes locally obtained seed is sown about an inch deep in rich loam in boxes, 5 ins. square and 14 ins. deep. and must be kept moist. When the seedlings are about 10 to 12 ins. high and the bark readily separates, they are budded, the buds being taken from selected trees and from twigs about the size of a pencil.

Budded seedlings are planted out 21 × 21 ft. for the weaker varieties, to 30 × 25 ft. for the more vigorous ones and the inferior trees should be removed at a later stage to allow the others to develop. Holes should be dug about 3 ft. across and 2 ft. deep and well-rotted manure applied. Drainage is important, and hard pans must be broken if necessary. During the dry seasons frequent cultivation of the plantation is necessary to preserve the moisture of the soil.

Early and *Baldwin* are early varieties which mature their fruit in July. *Trapp*, *Fuerte*, *Lula*, *Nimlish* and *Queen* ripen from October and November till the early spring.

Mangos.—Although this fruit is a comparatively recent introduction and its cultivation is confined to the warm, southern part of the State, it has secured a ready market. The majority of the trees are seedlings, but many grafted and budded varieties are being grown. It prefers well drained, undulating land and is very responsive to fertilisers, which are applied in the same manner as they are to Citrus trees. Planting out is generally done in midsummer at a distance of 21 × 21 ft. to 26 × 26 ft., according to the fertility of the soil, the plants being protected from the sun by cheese cloths or some similar material. Thorough surface cultivation is essential, and a cover crop of Velvet beans is generally grown during the rainy season. The following varieties are recommended : *Mulgoba*, fruits late, of excellent quality, though an irregular bearer; *Amini*, fruits early and is a prolific bearer. The fruit is not picked until it is almost ripe, but this necessitates careful packing and quick transport.

Peaches.—Before planting out, land intended for peach-growing is generally put under a crop of Velvet beans. The young peach trees are put in during their resting period in December and January, when they are 3 to 4 ft. high, and are pruned back at planting. They should receive a good watering.

Pruning is confined to thinning out and shaping the trees, which are grown as dwarf trees and not as espaliers. The fruit is picked when it is starting to colour, but whilst the flesh is still firm. Varieties in cultivation are: *Peen-to*, *South China*, *Bidwell's Early*, *Angel*, *Hall*, *Jewel*, *Bidwell's Late*, *Waldo*, and *Millen's Favourite*. The best variety for the warmer parts of the country is *Jewel*.

Persimmons.—The Japanese Persimmons or Kaki were introduced some forty years ago, but new varieties are occasionally met with. The fruit finds a regular market.

They are generally propagated by cleft or whip grafting, as budding has not proved successful. The stock used is seedlings of Japanese Persimmon or the American *Diospyros virginiana*, the latter being preferred as it is a more vigorous grower.

Stock plants are first planted in seed beds and when 10 to 12 in. high are planted out in rows 2 ft. by 6 in. apart, where they are grafted. When the grafts are established they are put out in the plantation during December and January at distances 15 × 20 ft. Varieties with an upright growth such as *Castata*, are planted closer, those with a more spreading habit like *Hachiya* are planted further apart. They do not need so much fertiliser as is given to other fruit trees, 5 lbs. containing 3 per cent. nitrates, 6 per cent. phosphates, and 10 per cent. potash is sufficient for six-year old trees. Pruning and cultivation is carried out as with the crops already mentioned.

Fruits are cut or clipped from the trees when they are quite ripe though before they soften. The following varieties are in cultivation: *Hachiya*, a vigorous grower, bearing fine, large fruits with a deep yellow flesh; *Okama*, a vigorous grower and prolific bearer, the fruits are large and of fine quality with a light, clear flesh and a light-brown centre; *Hyakume*, a good grower and fruits freely, fruits large with dark-brown flesh, sweet and crisp; *Triumph*, ripens from September to December, medium size fruit, flesh yellow and but few seeds; *Tsuru*, a late variety, vigorous grower and good bearer, fruits large, flesh orange yellow, but astringent until quite mature; *Gailey* is planted between the rows as it produces great quantities of pollen and materially assists the fruit production of the orchard generally.

Pecans.—This fruit is generally grown in the northern part of the State, and is similar to a Walnut, but smoother and more elliptic. Its fleshy kernels are in demand for candies and cakes, and when ground are used to flavour ice creams.

They are propagated by budding and grafting, but these operations require experience, as they are not always successful. Planting out takes place in January and February, the distance depending on the variety and varies from 40 to 75 ft., root pruning taking place previously. The trees take 10 to 12 years before they carry full crops. Varieties in cultivation are the following, and are chiefly selected for the large thin "shell" of the fruit:

Curtis, a medium-sized fruit with a thin shell, easily cracked, and with a rich flavour; *Money-maker*, a good bearer, fruit medium size and shell rather thicker; *Frotscher*, a good grower and bears well, fruit large; *Schley*, a medium size fruit of good quality and fine flavour; *Russell*, a thin-shelled, medium size fruit, a regular and good cropper; *Success*, a good bearer with large sweet nuts, rather late in season.

Meteorological Data.—The range of temperatures and rainfall which has to be considered in Florida, and on which the foregoing observations on fruit culture have been made are indicated in the following table in which are given the records for Jacksonville in the north-east, approximately 30° N. 81° W., Tampa on the Gulf of Mexico, at approximately 28° N. 83° W., and Miami in the south, at approximately 26° N. 80° W.

Observations of the U.S. Weather Bureau for 1920.

	Jacksonville.				Tampa.				Miami.			
Month.	Max. Temp F.	Min. Temp F.	Av. Temp F.	Rain-fall. Inches	Max. Temp F.	Min. Temp F.	Av. Temp F.	Rain-fall. Inches	Max. Temp F.	Min. Temp F.	Av. Temp F.	Rain-fall. Inches
Jan. -	79	25	57	1·21	82	35	64	2·70	81	35	69	0·41
Feb. -	74	32	54	9·16	76	38	59	3·10	82	41	64	1·60
Mar. -	88	31	60	0·82	85	36	64	0·60	83	34	68	0·06
April -	88	45	69	3·42	87	46	72	8·04	87	48	75	3·15
May -	87	61	72	7·41	89	62	76	1·49	87	64	76	10·33
June -	95	66	79	8·27	92	67	80	4·49	86	65	79	3·90
July -	92	67	80	5·47	93	68	81	12·20	88	70	81	6·61
Aug. -	94	68	81	7·46	93	69	81	5·66	88	69	80	4·12
Sept. -	95	53	79	7·19	92	62	80	6·49	89	70	80	6·94
Oct. -	82	45	69	0·11	87	50	72	0·12	83	59	75	5·04
Nov. -	80	38	62	5·38	84	42	66	3·07	82	54	72	3·73
Dec. -	76	35	56	3·35	80	39	60	1·47	81	43	68	1·72
Year -	—	—	—	59·20	—	—	—	49·42	—	—	—	47·61

The following extremes have been recorded :—

	Minimum temp.	Maximum temp.
Jacksonville - - - -	10° F. (Feb. 1899).	104° F. (July 1879).
Tampa - - - - -	18·9° F. (Dec. 1894).	97·5° F. (June 1918).
Miami - - - - -	27° F. (Feb. 1917).	96° F. (July 1907 and Aug. 1919).

Fungus and Insect Pests.

The following are the principal diseases encountered :—

Root Disease.—" Foot Rot," caused by *Phytophthora terrestria.* Chiefly attacks old sweet-seedling groves, and is rarely found where the sour orange stock has been raised, as this appears very resistant to attacks. It first appears in the collar or in the main roots, just below the surface of the soil. The decaying bark has the appearance of being water-soaked and a watery gum is found beneath it. Diseased parts are cut out and the wounds painted with an antiseptic. The use of seedlings of the sour orange stock is the best way to prevent the appearance of this disease.

Stem Diseases.—" Withertip," caused by *Colletotrichum gloeosporioides.* Attacks the twigs and branches, especially of lime and lemon varieties. It appears as a withering and dying back of the twigs and branches. Pruning is recommended, and some growers spray with Bordeaux Mixture (4–4–50) directly after winter pruning.

" Gummosis," cause at present unknown. Appears generally on sweet oranges and grapefruit varieties. Appears as an exudation of gum and the formation of characteristic spots on the trunk and large branches. The treatment recommended is the removal of the dead and diseased bark down to the healthy wood; treat with an antiseptic and cover with tar or whitelead paint.

" Dieback." At present the cause of this disease is not known.

" Scaly Bark " is caused by *Cladosporium herbarum,* var. *citricolum.* Spraying with Bordeaux Mixture (5–5–20) is recommended.

Leaf Disease.—" Melanose " is caused by *Phomopsis citri.*

Fruit Diseases.—" Fruit Rot," caused by *Colletotrichum gloeosporioides.* Causes an anthracnoselike spotting of the fruit. An ammoniacal solution of copper carbonate is recommended and must be applied every ten days until the disease is under control.

" Fruit Canker," caused by *Pseudomonas citri,* was generally reported, but has been got under control by a well-organised State campaign and quarantine. It appears on the fruit and young twigs as characteristic light brown spots 1/16th–¼ in. in diameter, occurring singly or in groups and coalescing. On the leaves it appears as watery spots. All attacked trees must be destroyed.

" Citrus Scab " is caused by *Cladosporium citri.*

Of insect pests the following are the commonest :—Citrus White Fly (*Dialeurodes citri*), Purple Scale (*Lepidosophes Beckii*), Rust Mite (*Eriophyes oleivorus*), Florida Red Scale (*Chrysomphalus aonidum*), and Cloudy-winged White Fly

(*Dialeurodes citrifolia*). Spraying is recommended with a mixture of soap ½ lb., paraffin oil 2 gallons, water 1 gallon, diluted to 10 to 50 times with water.

Biological control by the introduction of entomogenous fungi has received considerable attention and is assisted by the Florida State Plant Board, who distribute fungi cultures for this purpose.

XXXVII.—NOTE ON JUNGERMANNIA HUMILIS.

W. H. Pearson.

Being interested in *Jungermannia humilis*, Hook. f. & Tayl., on account of having received specimens from New Zealand, which I thought might be referred to it, I wrote to Kew asking permission to see the original specimen from Kerguelen's Land collected by Dr. Hooker on the Antarctic Expedition. The Director kindly sent me the specimen, which had been referred to the genus *Lophocolea* by Stephani, after having been examined by him, as he states in his "Species Hepaticarum," vol. II, p. 50 (1906).

I was also favoured by having the opportunity of examining two specimens from the same region, collected by Cunningham, which had been named by Stephani, *Lophocolea humilis*, Hook. f. & Tayl. (his own handwriting being on the packets). Also in a Set of Exotic Hepaticae purchased from Weigel there was a specimen named by Stephani, *Lophocolea humilis*, Hook. f. & Tayl., which had been collected by Dusén in Patagonia.

On careful examination I find the four specimens named *Lophocolea humilis* by Stephani are four widely different species belonging, so far as my knowledge of Hepaticae goes, to three different genera; they all agree, however, in having large underleaves. Unfortunately the specimens being sterile, it is somewhat difficult to determine whether a plant is a *Lophocolea* or a *Leioscyphus*, but one character, the postical branches, is constant in the type of *Leioscyphus humilis*, and this with the large free underleaves, along with a firmer texture, sufficiently enable me to refer it to that genus, and not to *Lophocolea* which has lateral branches with the underleaf often connate to the adjoining leaf.

The specimens collected by Dusén are also to be referred to *Leioscyphus*. It is, however, an entirely different species from *humilis*; the shapes of the leaves, some of which are apiculate, and the different shape of the underleaves at once separate it.

One of Cunningham's specimens is a true *Lophocolea* and the other a *Conoscyphus*.

I add a full description and figures of the four species.

The terms used in my descriptions denoting size of plants and cells are those adopted by Dr. Spruce, in his "On Cephalozia, its subgenera and some allied genera." Malton (1882), and other works.

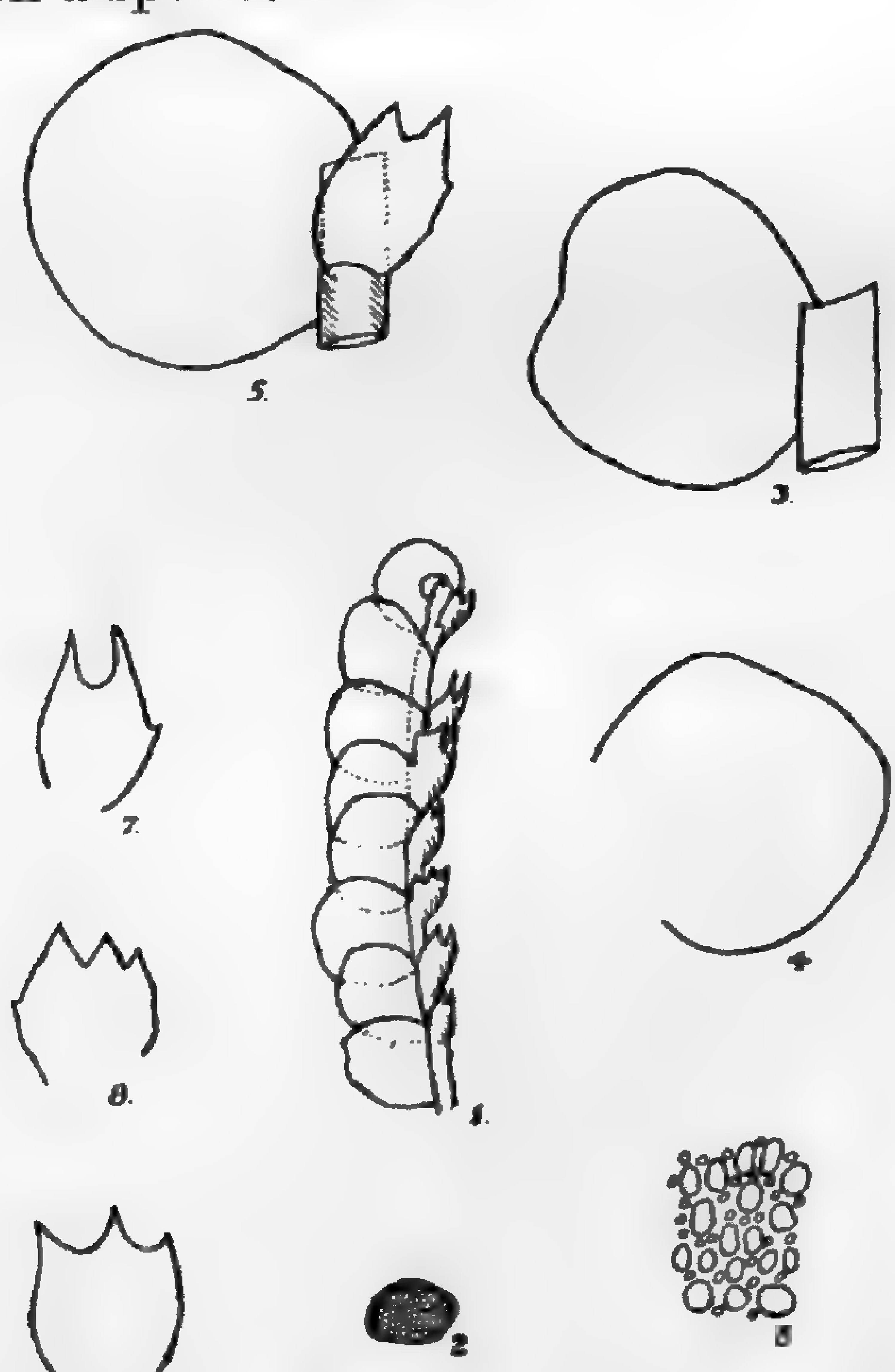
Leioscyphus humilis [*Hook. f.* & *Tayl.*] *Pearson*. Dioicous. Small, pale brown in colour, caespitose. Stems simple or slightly branched, branches postical or rarely postico-lateral, ascending stem frontally compressed, 30 cortical cells, dark coloured but similar in size to inner, which are 12 × 8 cells in diameter; rhizoids ascending to apex of stem, delicate, hyaline. Leaves horizontally inserted, imbricate, concave, secund, antical (lower) margin slightly decurrent, postical (upper) often extending a little beyond the stem; orbicular or broadly ovate, entire or slightly retuse; cells minute, roundish, walls thin, trigones distinct. Underleaves free from the leaves, large (patulous), concave, oval or broadly oval, bifid to $\frac{1}{3}$, sometimes trifid, segments acute, sinus rounded or acute, sometimes unidentate on one side. No ♂ or ♀ seen.

Dimensions: Stem 1 cm. long; with leaves 0·75 mm. wide; 0·1 mm. to 0·2 mm. diameter; leaves 0·75 mm. × 0·75 mm., 0·65 mm. × 0·75 mm.; cells 0·015 mm.; underleaves 0·5 mm. × 0·4 mm.; segments 0·15 mm., 0·5 mm. × 0·3 mm., segments 0·15 mm.

Kerguelen's Land: 1846, *J. D. Hooker*, in Herb. Kew.

Observations. The postical branches, free underleaves, and texture clearly refer this species to *Leioscyphus* instead of to *Lophocolea* to which genus Stephani has referred it.

Of course it has no connection with the *Solenostoma humilis* of Mitten, if such a species exists.



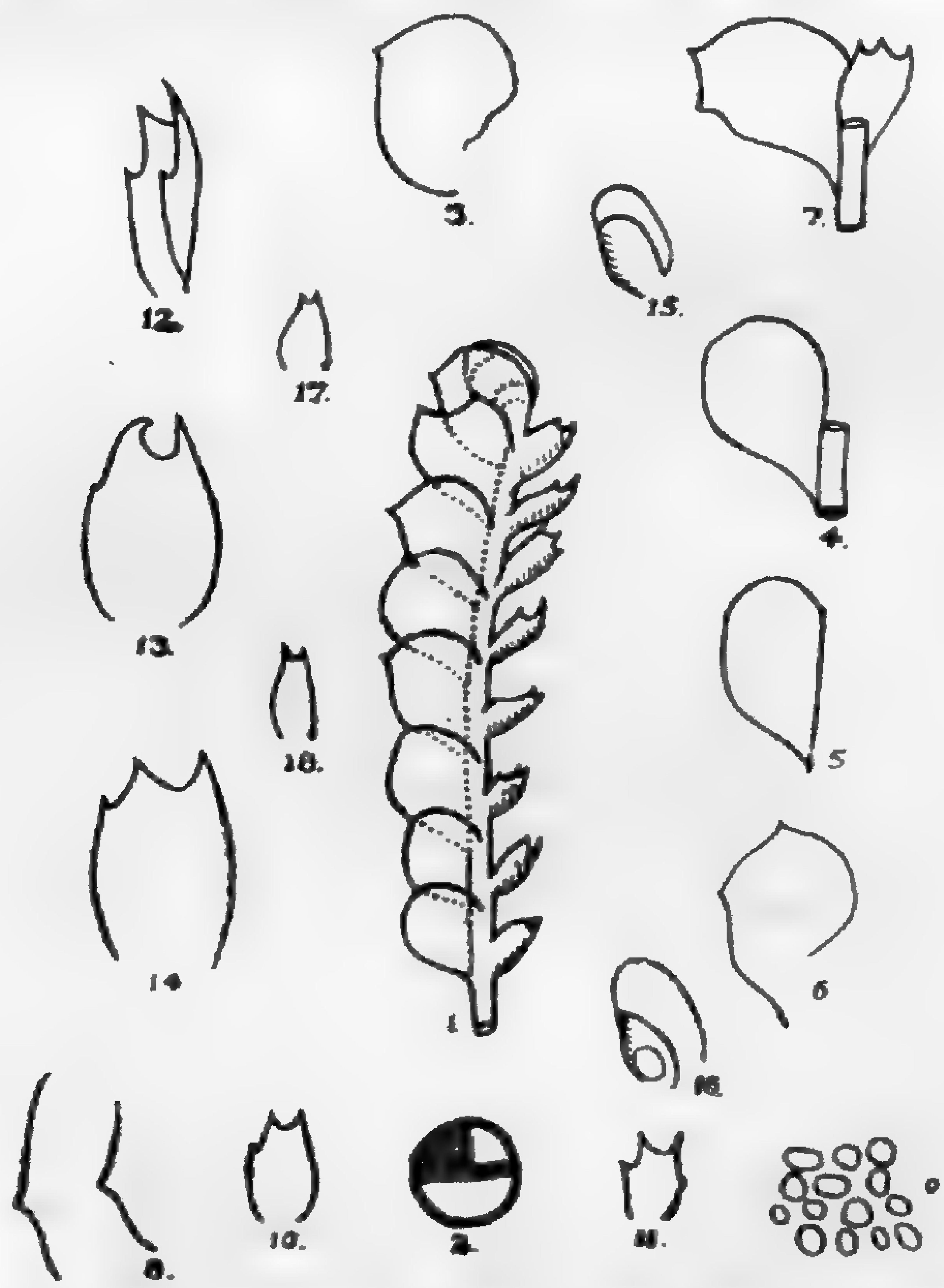
Description of Text figures. Fig. 1. Portion of stem, postical view (× 12). 2. Cross-section of stem (× 25). 3, 4. Leaves (× 25). 5. Leaf & underleaf (× 25). 6. Portion of leaf (× 130). 7–9. Underleaves (× 25).

Leioscyphus patagonicus, *Pearson,* sp. nov. Dioicous. Small dark olive brown in colour, caespitose, flagelliferous. Stem slightly ramose, branches postical, innovant terminal branches postico-lateral; radiculose, rhizoids few, delicate, hyaline, ascending to apex of stem, arising from stem below the underleaves, cross-section of stem round, cortical cells smaller than the inner, 50 to 60, inner 15 cells in diameter. Leaves obliquely inserted, patent (50°) to erecto-patent (30°), secund, subopposite, imbricate obovate-spathulate, entire, apiculate or bi-apiculate; antical (lower) margin decurrent or sometimes longly decurrent; postical (upper) margin covering stem or extending a little beyond; cuticle polished; cells small, roundish, walls thickened, trigones absent. Underleaves free from leaves, large, patulous, concave, oval, bidentate to 1/5th, with a small tooth on one or both sides, segments acuminate, sinus broad, rounded.

Androecia on short lateral catkins, 4 pairs of perigonial bracts, bracts oval, bracteoles oval, bidentate, segments acute.

Dimensions. Stems 1 to 2 cm. long; with leaves 0·7 mm. wide; diameter 0·1 mm. to 0·25 mm.; leaves 1·1 mm. × 0·7 mm., 0·1 mm. × 0·7 mm., 0·9 mm. × 0·7 mm.; cells 0·02 mm.; underleaves 0·55 mm. × 0·4 mm., segments 0·1 mm., 0·55 mm. × 0·3 mm., segments 0·125 mm., 0·5 mm. × 0·3 mm., segments 0·15 mm. perigonial bracts 0·6 mm. × 0·4 mm.; perigonial bracteoles 0·5 mm. × 0·3 mm.

Patagonia, Molyneux Sound: 1st June, 1896, *P. Dusén.*

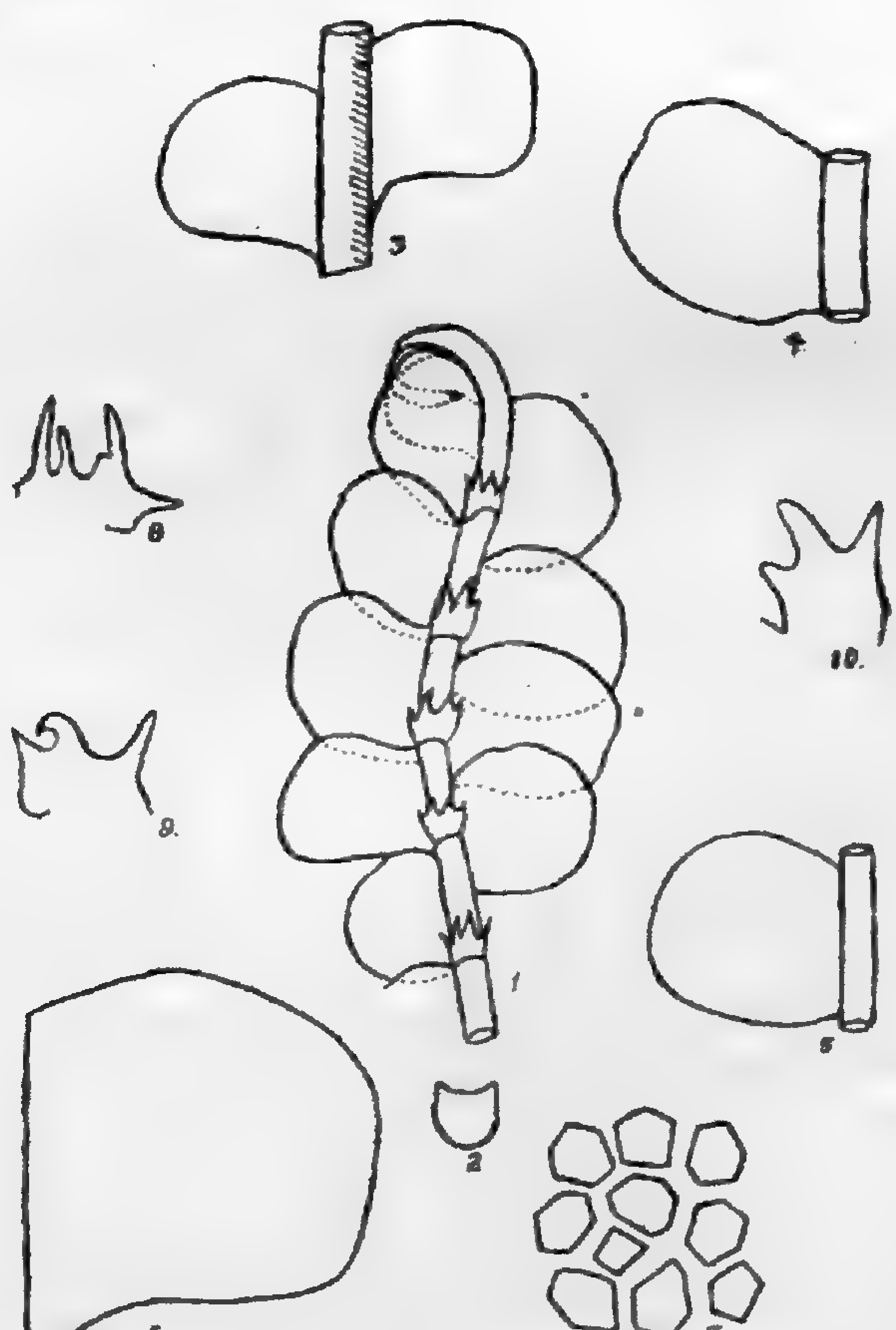


Description of Text figures. Fig. 1. Portion of stem, postical view (× 12). 2. Cross-section of stem (× 25). 3–6. Leaves (× 12). 7. Leaf & underleaf (× 12). 8. Margin of leaves (× 25). 9. Portion of leaf (× 130). 10, 11. Underleaves (× 12). 12, 13, 14. Ditto (× 25). 15, 16. Perigonial bracts (× 12). 17, 18. Perigonial bracteoles (× 12).

Observations. The specimen was named by Stephani *Lophocolea humilis*, Hook. & Tayl. from which it differs in shape of leaves, presence of teeth on them and other characters.

Lophocolea subretusa, *Pearson,* sp. nov. Dioicous. Medium size; pale brown in colour; loosely caespitose; stem sparingly ramose, branches horizontal or slightly ascending, lateral, cross-section of stem broader than high, antical plane, postical convex, 40 to 45 cortical cells, similar in size or slightly smaller than inner which are large and hyaline, with distinct trigones, 12 × 12 cells in diameter. Leaves horizontally inserted, alternate, imbricate, rotund-quadrate or broadly oval-quadrate, longer than broad, entire or retuse, antical (lower) margin very slightly decurrent, postical (upper) margin covering stem, cells between smallish and medium size, quadrate, 4–5 and 6-sided, walls thick, trigones indistinct or wanting. Underleaves narrowly connate with leaf on one side, trifid or quadrifid to below the middle, often with one or two smaller teeth, segments lanceolate-acuminate.
No ♂ or ♀ seen.

Dimensions. Stem 2 cm. long; with leaves 3 mm. wide; diameter 0·3 mm.; leaves 1·25 mm. × 1· mm., 1·1 mm. × 1· mm., 1· mm. × 0·8 mm., 0·9 mm. × 0·8 mm.; cells 0·03 mm.; underleaves 0·4 mm. × 0·3 mm.; segments 0·2 mm., 0·35 mm. × 0·35 mm., segments 0·2 mm.



Description of Text figures. Fig. 1. Portion of stem, postical view (× 8). 2. Cross-section of stem (× 12). 3–5. Leaves (× 12). 6. Leaf (× 25). 7. Portion of leaf (× 130). 9, 10. Underleaves (× 25).

Tyssen Islands: Falkland Sands; January, 1868, *Cunningham* 106 in Herb. Kew.

Observations. These specimens have been named by Stephani *Lophocolea humilis*, Hook. f. & Tayl. It is a true *Lophocolea* but widely different from *L. humilis*.

The nearest species from the Antarctic according to the description is *Lophocolea microstipula*, St., also collected by Cunningham (Fretum magellanicum), which has obovate entire leaves with a narrow base. Nothing is said of any retuse leaves and the underleaves are described as free.

Conoscyphus flaccidus, *Pearson*, sp. nov. Dioicous. Small; pale brown in colour, apices dark brown; loosely caespitose. Stem on cross-section slightly angular and frontally compressed; simple or slightly ramose, soft, flaccid, delicate texture; branches postical, erect, almost equal in size to stem, rhizoids delicate, hyaline, arising from the base of the underleaves in bunches. Leaves secund, imbricate or amplexicaul, erecto-patent (30°), reniform or orbicular, margin entire except that at the antical (lower) base there are usually 1 to 4 teeth, antical margin decurrent, crispate; postical (upper) margin rotundate, slightly ampliate, extending to beyond the stem, rarely furnished with 2 very minute teeth; texture soft, flaccid; cuticule papillose; cells small, irregular in size, roundish, walls thick, trigones large. Underleaves free from the leaves, large, concave, broadly oval, bifid to 1/3rd, unidentate on both sides, segments acute, sinus wide, rounded. No antheridia or archegonia were seen.

Dimensions. Stems 2 cm. long; with leaves 1 mm. wide; diameter 0·1 mm. to 0·2 mm.; leaves 0·9 mm. high × 1·25 mm. broad; cells 0·02 mm.; underleaves 0·5 mm. × 0·4 mm., segments 0·15 mm., 0·45 mm. × 0·4 mm., segments 0·15 mm.

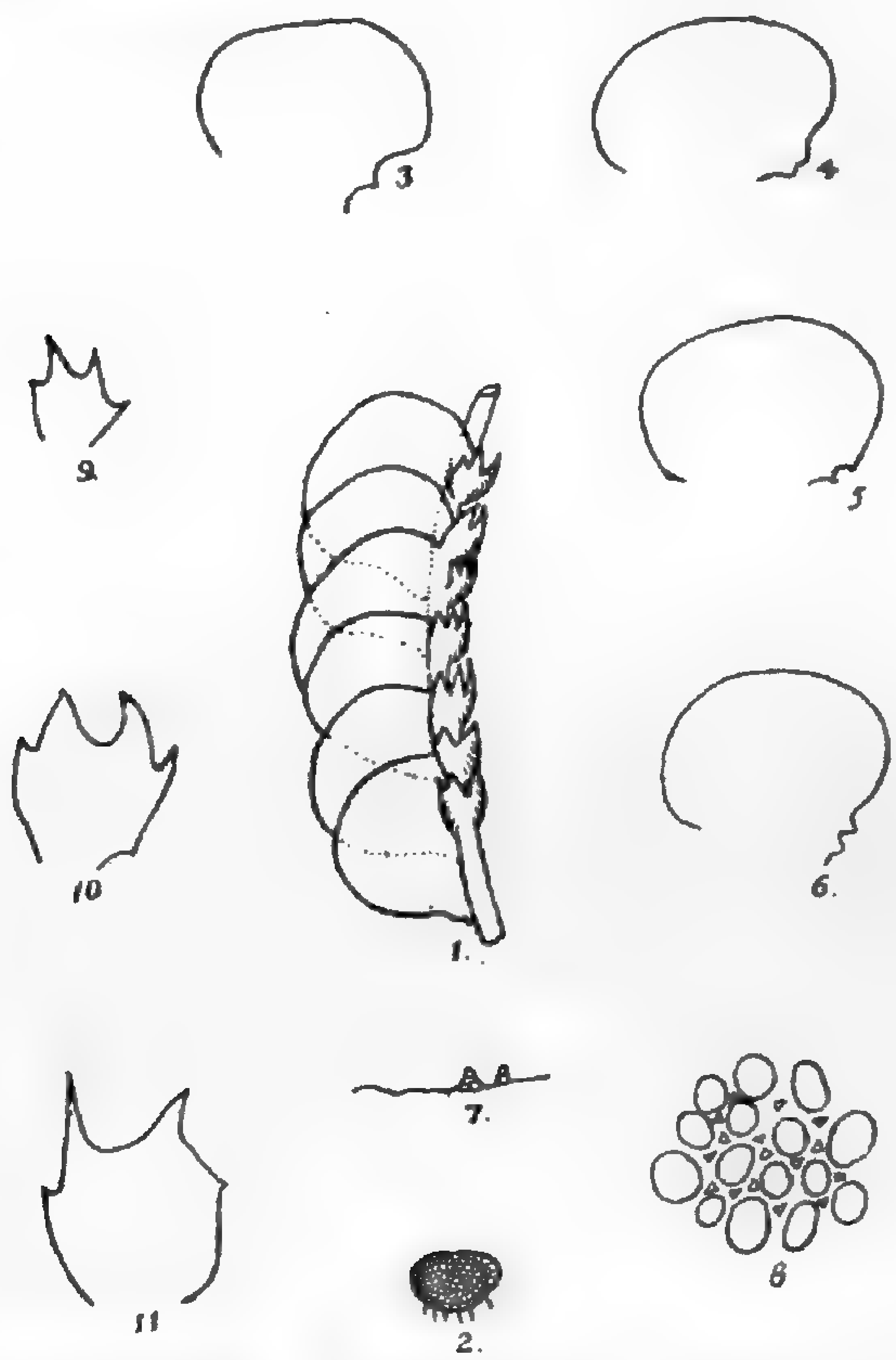
Straits of Magellan: Punta Arenas; March, 1868, *Cunningham* 194, in Herb. Kew.

Observations. The soft, flaccid texture of the plant with the reniform or orbiculate leaves and their dentate, crispate base distinguish this species from any other; some cells are free from colouring matter and are larger, giving the leaves an ocellate appearance.

Its nearest ally is *Conoscyphus trapezioides*, Sande-Lacoste, from Java, from which it differs in the shape of its leaves and underleaves. *Conoscyphus trapezioides* (Sande-Lacoste) St. (= *Chiloscyphus trapezioides*, Sande-Lacoste,) has been made a synonym of *Conoscyphus inflexifolium*, Mitten, by Stephani, to which species he also refers *Diploscyphus borneensis*, De Notaris; if the descriptions and figures of Sande-Lacoste and De Notaris are of any value this reference is difficult to understand.

Specimens of *Conoscyphus borneensis* collected by Prof. Setchell in Tutuila agree exactly with De Notaris's description and figures. The specimens named by Stephani *Lophocolea* *humilis* from Punta Arenas collected by Cunningham are quite different and as stated, nearly allied to *C. trapezioides*.

When moistened for examination, the soft flaccid stems of this plant are remarkable.



Description of Text figures. Fig. 1. Portion of stem ($\times$ 12). 2. Cross section of stem ($\times$ 25). 3–6. Leaves ($\times$12). 7. Margin of leaf at base ($\times$ 25). 8. Portion of leaf ($\times$ 130). 9. Underleaf ($\times$ 12). 10, 11. Under leaves ($\times$ 25).

XXXVIII.—MISCELLANEOUS NOTES.

W. H. Hudson.—The recent death of that keen lover of nature and charming writer, William Henry Hudson, cannot pass unnoticed in the Bulletin.

If only as a contributor to the Bulletin, Mr. Hudson's name deserves to be remembered with gratitude. He it was who contributed the list of the wild birds in the Gardens in the "Wild Fauna and Flora," published in 1906, and his list is prefaced by some characteristic and most interesting notes on the habits of the birds found wild in Kew.

His claim to remembrance however rests on a more important and possibly little known service to the Gardens.

The Queen's Cottage grounds owe their present wild natural condition of untouched rural beauty very largely to Hudson's efforts. As at the time he wrote and championed the cause of the Queen's Cottage grounds being left as a Bird Sanctuary, so now, demands are made that the public shall be given access to the grounds and be allowed to wander where they will.

People fail to appreciate how much they gain from the grounds being kept sacred as a wild preserve and the beauty of which they can see fully and quite unspoilt by trodden-down paths, disfigured bluebells and an absence of bird life.

All that is now enjoyed by the real lovers of nature who come to Kew is largely due to the passionate energy with which Hudson took up the cause of the preservation of the Cottage Grounds and it is fitting to conclude this brief tribute to his memory by quoting the concluding paragraph of his introductory note on the Birds of Kew in the Wild Fauna and Flora.

"To the volume of beautiful bird sound produced by all these true singers must be allied the calls, songs, and other notes, some highly musical, of such species as the daw and jay, nuthatch, ring-dove, turtle-dove, green wood-pecker, cuckoo, wryneck, little grebe, and many others. Even in a perfectly rural district it would not be easy to find so great a variety in the same space; and it is indeed this variety and abundance of bird music which to the lover of nature gives to Kew Gardens its principal charm. This charm, and its value as a place of refreshment and delight to the millions of London, it will retain so long as the open spaces which abut upon it—Old Deer Park and Syon Park—continue open, and the Queen's Cottage ground is kept, as the late Queen wished it to be kept, in its present state, as a fragment of unspoilt wildness, and the favourite haunt and breeding-place of all the most attractive species of birds which inhabit Kew."

South Australian Botany.—The British Science Guild (South Australian Branch) has apparently arranged to issue a series of Handbooks of the Flora and Fauna of South Australia. The first part of the "Flora of South Australia"* in this series, by J. M. Black, has recently been received. In addition to an author's preface, this part contains a brief history of botany in South Australia, a glossary of botanical terms, a key to the families, and a systematic account of the Pteridophyta, Gymnosperms and Monocotyledons. The arrangement followed is that of Engler & Prantl. Family, generic and specific descriptions of all the indigenous plants and established aliens are given, together with keys to the genera and species. The descriptions of the Orchidaceae (by Dr. R. S. Rogers) are fuller than most others in the book and it is unfortunate that the standard reached in them has not been attained in the majority of the generic and specific descriptions of the remaining families dealt with in this part.

The black and white text illustrations will doubtlessly be of considerable value to those who use the work as an introduction to South Australian botany. They might have been increased in number with advantage.—W. B. T.

* Flora of South Australia, Part I., by J. M. Black. Cyatheaceae-Orchidaceae. Adelaide, 1922. 3*s.*

West Indian Agricultural College.—The first year's prospectus of the West Indian Agricultural College, which is to be opened at St. Augustine's, Trinidad, in October has just been issued.

The provisional arrangements include the following courses and facilities for study :—

(1) The Diploma Course, which will extend over three years and give a thorough training in the science and practice of Tropical Agriculture.

(2) A one-year Course in Elementary Agricultural Science.

This course is intended for those who cannot take the full course and should be of value in affording students with some practical training on the scientific side of tropical planting and up-to-date methods of production and management.

(3) Courses for Agricultural Officers.

These are intended for officers who have been selected for service in Tropical Agricultural Departments and should be of very great benefit if arrangement can be made whereby they can take such courses before proceeding to their substantive appointments.

Provision is also being made for Post Graduate Research by University Graduates of other Institutions. This should be one of the most valuable sides of the College's activities.

Many problems in Tropical Agriculture, especially in Plant Pathology, Physiological Botany, Genetics, &c., await solution, and research undertaken by competent Research Students should lead to results of far-reaching importance, which cannot fail to be of value to agriculturists in all parts of the Tropical Dominions of the Empire.

The opportunity thus afforded to University Graduates to carry out their research work in the tropics and to see something of a tropical fauna and flora is one which British scientific workers have long desired.

Copies of the Prospectus can be obtained from the Secretary of the College, 14, Trinity Square, London, E.C. 3, and further particulars can also be obtained from him or from the Principal, St. Augustine's, Trinidad.

Contributions to the Flora of Siam.—*Michelia Rajaniana* and *Symplocos Rajaniana* described on pages 225 and 239 were named by Prof. Craib in honour of H.H. Prince Bidyalankarana (whose family name is Rajani), Vice-Minister of Commerce, under whose auspices the Botanical Section of the Ministry was inaugurated.

Beech Wood and the Brush Industry.—Although in some parts of the country beech wood is sold at little above the price of firewood, it is an important timber in the home counties where it realises a satisfactory price and enters into the manufacture of a wide range of articles. Even the smallest pieces of sound wood are put to some good use, whilst decaying wood and sawdust are utilised for the generation of steam. Amongst the many uses of beech wood that of the brush industry is very prominent and an idea of its importance may be gleaned from the large number of manufacturers represented each year at the British Industries Fair. Beech is not the only wood used by brush manufacturers but it is the principal wood utilised, for the blocks of such kinds of ware as scrubbing, boot, clothes, and nail brushes. For such work the blocks into which the bristles are secured must be made of wood that will withstand the boring of a large number of holes and the subsequent secure wiring of the bristles into position without the fracture of the slender divisions between the holes. At the same time the wood must be reasonable in price and easily obtainable. Beech combines the necessary properties in a high degree, in fact no other wood has yet been found that answers the purpose so well. An idea of the strain put upon the blocks may be gathered from the fact that 187 holes are required in a boot brush block $8\frac{1}{2}$ in. by $2\frac{1}{2}$ in. by $\frac{1}{4}$ in., and 140 holes in a scrubbing brush block $1\frac{1}{2}$ in. by $2\frac{3}{4}$ in. by $\frac{3}{8}$ in. These holes have then to be filled with bristles and the bristles tightly wired. Beech is, however, only used to finish off the commonest brushes. For the better grades of scrubbing brushes a very thin veneer of beech, dyed black, is placed over the wires and the brush is finished off with a back of horse chestnut. The back must be of a white wood that finishes with a very smooth surface and does not splinter. Lime, sycamore and horse chestnut are all used but the latter is by far the best wood for the purpose. For boot brushes the back may be sycamore, cherry, sweet chestnut, birch or various other kinds, and for clothes brushes all these woods are used with others such as mahogany, ebony, and other exotic woods that finish well and take a good polish.—W. D.

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ROYAL BOTANIC GARDENS, KEW.

BULLETIN
OF
MISCELLANEOUS INFORMATION.

No. 9] [1922

XXXIX.—OOSPORES IN CULTURES OF PHYTOPHTHORA FABERI.

S. F. Ashby.

Phytophthora faberi, Maubl. the cause of podrot, patch canker and chupon wilt of cacao has been reported from most parts of the tropical Old and New Worlds where the tree is cultivated. It has been isolated and studied in pure culture by a number of authors, more particularly by Coleman, Rosenbaum, Rorer and McRae. Coleman and Rorer mention the finding of bodies in nature which they believed were oospores and Coleman saw similar bodies in cultures; these bodies however were devoid of antheridia and were in all probability nothing but chlamydospores which are developed freely by the fungus on and in the pod wall and in pure cultures. Neither Rosenbaum nor any of the other investigators who have worked with the fungus has reported the finding of oospores. The writer has repeatedly isolated this species from cacao in Jamaica and more recently from cacao in Grenada but has never seen a trace of oospores in pure cultures on a variety of media including bean, oat and corn meal agars. The outcome however is different when the cacao fungus is grown in mixed culture with more or less related forms. In Jamaica two species of *Phytophthora* attack the coconut palm, one being a strain of *P. parasitica*, Dast. while the other, which is the cause of a serious budrot, closely resembles the cacao fungus. It also has never been found to develop oospores in pure culture and the same observation applies to a *Phytophthora* isolated in the present year from rotting cotton bolls in St. Vincent which in its vigour of growth, mycelial characters and asexual reproduction appears to be identical with the form from the budrot of the coconut. (This *Phytophthora* from cotton bolls in St. Vincent is quite distinct from the species isolated by Miss E. M. Wakefield from cotton bolls in Montserrat which both she and the writer consider to be a strain of *P. parasitica*). In pure culture the cacao fungus differs

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from the coconut and cotton-boll strains in growing less vigorously and in developing sporangia less luxuriantly but chlamydospores more freely; it does not form the characteristic mycelial aggregates usual in cultures of the coconut form. In all other respects including conidiophores and shape and size of the sporangia the three fungi cannot be distinguished in pure culture. Neither the coconut nor the cotton boll form has been found to infect cacao pods.

The first observations on mixed cultures were made when the writer was working in the Mycological Laboratory of the Ministry of Agriculture at Kew (now the headquarters of the Imperial Bureau of Mycology) in the summer of 1920. Pure and mixed cultures of the cacao and coconut budrot *Phytophthora* isolated in Jamaica were grown on slants in tubes of French bean agar for two months (July–September) in an incubator at 25° C. The two *Phytophthora* were inoculated in the mixed cultures by placing a fragment of agar carrying growing mycelium at two points on the slant about one inch apart. A colony of each form developed independently and after a few days they met and mingled. At the end of two months the pure cultures contained no oospores but they had developed freely in the mixed cultures throughout the colony of the cacao fungus and as far as the centre of the other growth. The mature sexual bodies were of the "*infestans* type" with persistant antheridia and a golden-yellow thickened oogonial wall. The mean size of 46 oospores was $23 \cdot 3\ \mu$ and the extremes were 19 and $26 \cdot 5\ \mu$; the oogonial wall averaged $29\ \mu$ with a variation from 25 to $32 \cdot 5\ \mu$. The result of growing the two forms in mixed culture with strains of *P. parasitica* will be considered later.

In order to confirm these findings, if possible, pure and mixed cultures of the cacao, coconut and cotton boll *Phytophthora* were grown in Barbados during the present year. The cacao culture was a recent isolation from a diseased pod in Grenada, the two cultures from the coconut had been isolated in Jamaica some years earlier while the cotton boll culture was a recent isolation from St. Vincent. The *Phytophthora* were grown on slants in tubes from a single batch of lima-bean agar.*

Five successive transfers of the pure cultures were made, after growth for two days, before mixed cultures were prepared in

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* The medium employed was a thin lima-bean agar prepared from white mature beans. 100 grams of whole beans were soaked in a litre of water for two hours and then steamed in an Arnold steriliser for three-quarters of an hour. The extract was poured off the beans and they were pulped in a mortar and the pulp returned to the extract, the mixture filtered through muslin and the latter squeezed. 16 grams of "bacto" agar were added and the liquid boiled for a few minutes and poured through coarse muslin. It was tubed and sterilised in the autoclave at 12–15 pounds pressure for 20 minutes. This mode of preparation yielded a nearly clear agar with a deposit of unruptured cells. It was sloped without raising the sediment.

the way described above. Each combination was run in duplicate by reversing the position of the two colonies on the slant. The cultures stood on a table under a large bell jar in subdued light from the middle of April to the middle of July when they were examined. The temperature of the room seldom exceeded 30° C. and was never below 22° the mean being near 26° C. No oospores could be found in any of the pure cultures and they were not present in the mixtures of the two coconut cultures nor in the mixtures of those with the cotton-boll culture. Oospores were present, however, in all the mixed cultures containing the cacao *Phytophthora.* In these mixtures of the cacao fungus with the two coconut cultures and the cotton boll culture the sexual spores were of the "*infestans* type" with a yellow more or less thickened oogonial wall. The thick-walled hyaline oospore filled the oogonial cavity, as a rule, leaving only a dark line between the walls, but examples were frequent in which the oospore did not fill the cavity. A persistant antheridium was always present, usually hyaline but occasionally stained yellow. The oogonia and antheridia always appeared to be developed on separate hyphae but it was not possible to trace these hyphae definitely to the same mycelium. The interesting observation was made that in a few examples no walled oospore was present but the plasmatic contents completely filled the mature thick-walled yellow oogonium, the wall of which showed the pitted appearance characteristic of the mature chlamydospore; in all such cases a perfect persistent antheridium was present. The oospores were developed in the dense surface plectenchyma, and to a depth of about 2 millimetres below it: they were scanty at greater depths in the agar. In some portion of the slants, the mature oogonial wall showed a dark, rather indefinitely limited outer zone with a rough or wrinkled surface but elsewhere this zone was lacking and the wall appeared to be smooth. Oospores were abundant throughout the growth area of the cacao *Phytophthora* but became scanty towards the centre of the other colony. There was mutual penetration of the two colonies but the vigorous coconut and cotton-boll strains appeared to push into the colony of the cacao fungus deeper than the latter did into their zones. This tendency was clearly shown in some additional mixed cultures in which a colony of the coconut *Phytophthora* was allowed to develop for two days before the cacao fungus was inoculated on the upper part of the slant. In these examples, oospores were present up to the apex of the slant and the mycelial aggregates of the coconut strain were present at the apex also, indicating that it had grown through the cacao colony. A series of transfers of the pure cultures at short intervals did not appear to be necessary for subsequent development of oospores in the mixed cultures as they were formed abundantly when the cultures were mixed after one such transfer.

The mean size and variation of the oospores were approximately the same in all combinations of the cacao with the coconut and cotton-boll *Phytophthora* with the exception that when a colony of a coconut culture was inoculated on a slant two days ahead of the cacao inoculation, the oospores which developed were on the average smaller than when the inoculations were made simultaneously. The data are summarised in the table showing the results for all cultures.

The absence of oospores from pure cultures of the three *Phytophthora*, their close relationship as indicated by the mycelial growth and the size and shape of the asexual spores, and the more vigorous growth of the coconut and cotton boll strains which appear to be identical suggested rather strongly that all may be strains of one heterothallic species, the two vigorous forms being plus strains and the more weakly growing cacao form a minus strain. The behaviour of cultures grown from the oospores might be expected to throw further light on this hypothesis but unfortunately attempts to germinate them have not met with success, hitherto. The results moreover of growing the cacao and coconut forms in mixed cultures with strains of *P. parasitica* do not support that view. When the author was at Kew a mixed culture of the cacao *Phytophthora* isolated in Jamaica was grown on French bean agar with a strain of *P. parasitica* isolated from *Ricinus communis* in India by J. F. Dastur. The culture was maintained for two months in an incubator at 25° C. and then examined. Oospores were present in the cacao colony, averaging $23 \cdot 6\ \mu$ in diameter with a variation of $20–25 \cdot 3\ \mu$. Pure cultures of *P. parasitica* from castor develop oospores having a mean diameter of $18 \cdot 6\ \mu$. The form from budrot of the coconut was grown at the same time in mixed culture with a strain of *P. parasitica* from the coconut, which in pure culture developed oospores having a mean diameter of $19 \cdot 3\ \mu$. Oospores were numerous in the growth zone of the budrot form and in that of the "parasitica" strain but they were of the same size throughout the mean being $19 \cdot 2\ \mu$. The fact that oospores of the same type and the same mean size and variation are formed in all mixed cultures of the cacao *Phytophthora* both with closely related forms and with an unrelated species indicate that the oospores are actually those of *Phytophthora faberi*. It is of interest to note that the oospores of the strain of *P. parasitica* developed in contact with the growth of the *Phytophthora* from coconut budrot were of the same size as those in pure culture.

The oospores of *P. faberi*, which have normally a mean diameter of $23 \cdot 1–23 \cdot 6\ \mu$ and a variation of $17 \cdot 8–28 \cdot 6\ \mu$, are substantially larger than those of *P. parasitica* (mean of $18 \cdot 6$) but approach closely in size to those of *P. meadii*, McRae (mean of $24 \cdot 50$) and *P. colocasiae*, Rac. It is evidently distinct from the last species. The coconut *Phytophthora* is apparently identical with *P. palmivora*, Butl. which should include provisionally the form which the writer obtained from cotton-bolls in St. Vincent. The absence of oospores both in pure and mixed cultures of this species and some growth differences as well as its inability to infect cacao pods, distinguish it from *P. faberi*. It would seem to the author no more justifiable to include it in one species with *P. faberi* than to unite it with *P. meadii*.

P. palmivora might prove to be a useful species for growing in mixed cultures with other forms which develop oospores in pure cultures either scantily or not at all. *P. nicotianae*, Br. de Haan appears to be such a species concerning the oospores and relationship of which nothing very definite is known although it is a destructive parasite on tobacco in some parts of the East.

Table showing Cultures in which Oospores were present or absent and their Mean Size and Variation.

Culture.	Oospores.			Oogonial wall.	
	Number measured.	Mean diameter.	Variation.	Mean diameter.	Variation.
1. Pure cacao. p.	none	—	—	—	—
2. Pure coconut p. no. 2	none	—	—	—	—
3. Pure coconut p. no. 3	none	—	—	—	—
4. Pure cotton boll p.	none	—	—	—	—
5. Mixed coconut p. 2 + 3	none	—	—	—	—
6. Mixed coconut 2+cotton boll	none	—	—	—	—
7. Mixed coconut 3 and cotton boll	none	—	—	—	—
8. Mixed cacao + coconut 3	46	23·3	19–26·5	29·0	25–32·5
9. Mixed cacao + coconut 3	52	23·1	17·8–27·8	28·6	22–35
10. Mixed cacao + coconut 2	30	23·1	19–28·6	28·9	21·8–35·5
11. Mixed cacao + cotton boll	84	23·5	17·8–28·6	29·0	22–35
12. Mixed cacao + "parasitica" (castor)	22	23·6	20–25·3	28·8	25–33
13. Pure "parasitica" (castor)	—	18·6	15·6–20·4	22·6	—
14. Mixed coconut 3 + "parasitica" (coconut strain)	30	19·2	16–21·5	23·5	20–26
15. Pure "parasitica" (coconut)	—	19·3	—	—	—
16. Mixed cacao + coconut 3 (coconut 3 inoculated 2 days before cacao)	43	22·0	17·8–27·3	—	—

All measurements in terms of μ.

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XL.—THE FRUITING OF GINKGO BILOBA AT KEW.

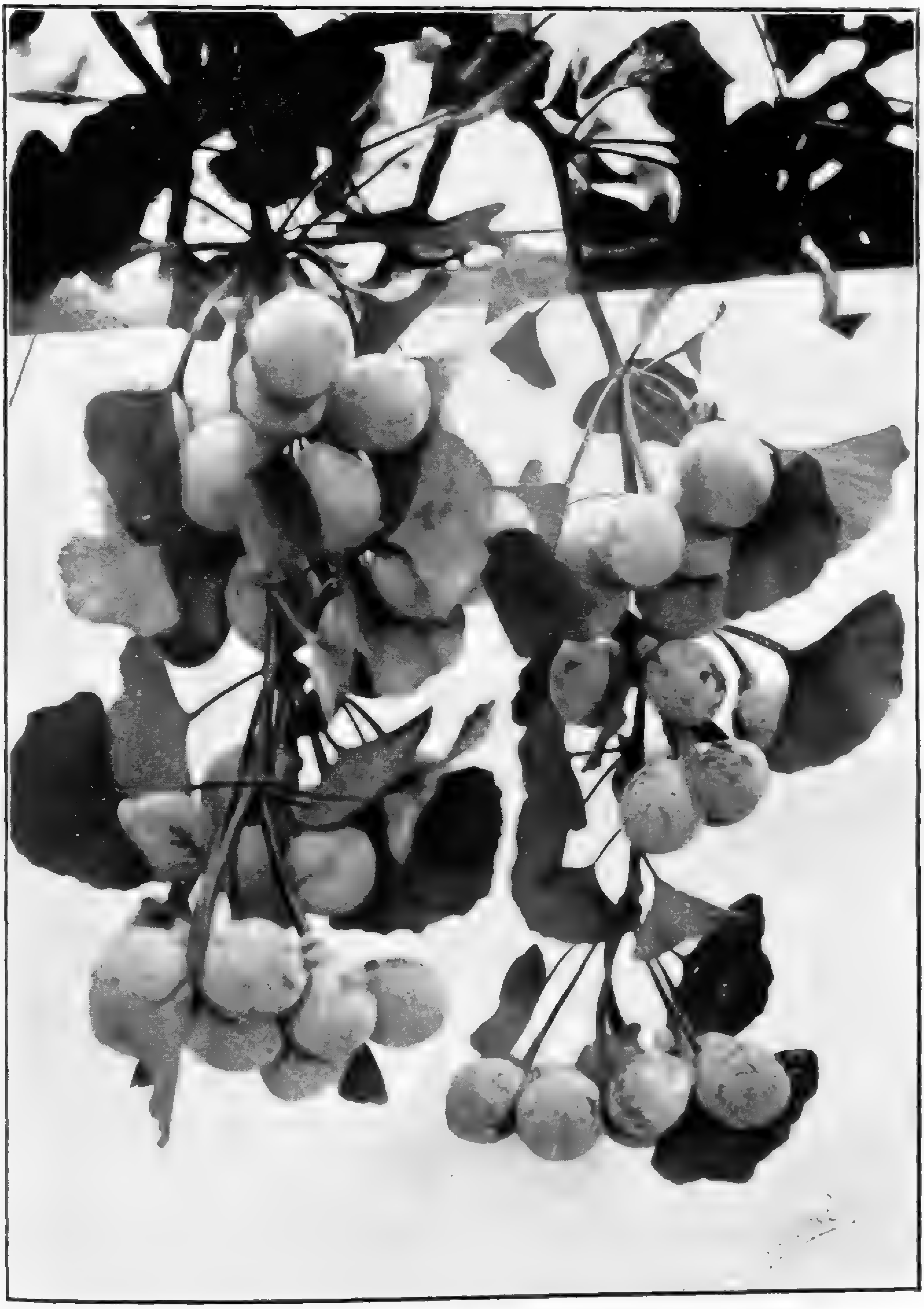
W. DALLIMORE.

Considerable interest was created by the publication in *K. B.* 1920, p. 47, of a note on the fruiting of *Ginkgo biloba* Linn. (the Maidenhair Tree) at Kew. The "fruits" (seeds), some 4 or 5 in number, were produced during 1919 on an old male tree near the Main Gate, the fruiting branch having been grown from a graft of a female tree obtained in 1911 from the Director of the Montpellier Botanic Garden.

The note gave rise to correspondence casting doubt upon the truly dioecious character of the species and in October 1920 Professor F. A. F. C. Went of Utrecht wrote :—" In connection with this note I should like to make a few remarks on the fruiting of a male *Ginkgo* tree in the Botanical Garden of the University of Utrecht. There is a very old male tree in that garden whose early history is unknown, but its age is perhaps more than one hundred years. The diameter of the stem at ground level is more than one meter. For many years the tree stood in the shadow of some large elm trees. These were removed five years ago, in order to get space for the building of a new laboratory. The consequence was that the tree got more sun, and the upper branches have since considerably developed.

" In recent years the tree has blossomed frequently and, just as at Kew, 'so profusely as to litter the ground beneath it with its small green cylindrical inflorescences.' Only in the autumn

Plate I.



GINKGO BILOBA.

To face page 262.

of 1918 one branch was seen bearing several bright yellow 'fruits.'

"It was evident that this was a small female branch and the question arose, how was this possible? Was it a case of a male tree producing one female branch or was it possible that this branch had formerly been grafted on the tree? This last supposition seemed to be improbable because the branch grows at the height of about twelve meters above the level of the earth. Moreover why did it never before bear fruits? At least I am sure that since 1896, when I became Director of the Garden, no fruits have been produced. They are too conspicuous to be overlooked.

"I thought this phenomenon curious enough to be worth noting. Is it possible that the alteration of the conditions mentioned above has been the cause of the production of these female flowers? No fruit was observed in the years 1919 and 1920, though possibly female flowers may have been produced on that branch, but they are so inconspicuous that it is not easy to detect them at such a height."

A curious fact relating to the *Ginkgo* was revealed in 1914 by His Majesty the King of Italy who asked Sir David Prain if the Maidenhair Tree at Kew produced fruits. When told that it did not His Majesty explained that he had two examples of the tree in the Quirinal Garden which fruit profusely every season in spite of the fact that there is no male tree there and that so far as His Majesty could ascertain there is no example of a male Ginkgo in Rome.

Mr. E. H. Wilson* who has a wide knowledge of the maidenhair tree in China, Japan and North America says "The trees bear either male or female flowers but the two sexes are never found on one and the same individual unless deliberately grafted together."

Professor Chodat writing from the University of Geneva in November 1920 to Dr. A. W. Hill concerning the Utrecht tree says "I would rather be inclined to believe that in the case reported by Professor Went, a female branch has been at some time grafted on the male tree as it has been done in several botanic gardens.

"Here we have in the Jardin des Bastions side by side both male and female trees but I never observed that the male should bear female catkins or fruits or the reverse."

In referring to the fruiting of female trees in the absence of pollen-bearing specimens he adds.—"But the beautiful female tree in the Jardin du Lai (formerly Jardin Anglais) about one mile distant is quite isolated. This year, and I have made the same remark for many years, this tree is covered with well developed fruits.

* The Romance of our Trees, p. 69 (1920).

"Is it fertilised by the pollen grains brought by the wind, or is it parthenogenetic I do not know? The case should be investigated. We may try to solve the problem."

We hope that Professor Chodat will undertake this investigation for despite, or perhaps because of, its antiquity *Ginkgo* appears still to possess morphological problems that would well repay scientific research. It was only in 1895 and 1896 that Professor S. Hirase carried out in Tokyo* the experiments which resulted in the discovery that motile male sperms take part in the fecundation of *Ginkgo*, this genus therefore like the Cycads (which also possess motile male sperms) is to some extent intermediate between other flowering plants and ferns. The reason for the belated maturation of the embryo in the seed is another interesting problem, the embryo sometimes does not complete its development until after the fall of the seed. Research work in Britain would be difficult owing to the scarcity of female flowers but there are plenty of female trees on the Continent that flower and fruit every year, and where these trees exist investigations might be made.

So far as is known the fruits matured by the Kew tree in 1919 were the first to be ripened in Britain and there have been no more until the present year. There are now two large clusters, as shown by the accompanying photograph.

Returning to the Utrecht tree there is an interesting problem respecting it, in addition to the fruiting branch, as it may very well be the first *Ginkgo* introduced into Europe. The species was first made known to Western botanists by Dr. Engelbert Kaempfer, a surgeon in the employ of the Dutch East India Company, who in the course of business visited Japan in 1692. On his return to Holland he wrote several books on botany and travel and in 1712 published his *Amoenitatum Exoticarum*, on p. 811 of which he gave a description of *Ginkgo* with a full plate drawing of shoot, leaves and fruit. Some years later, apparently between 1727 and 1737 a tree was procured and planted in the Botanic Garden, Utrecht. This marked its introduction into Europe during the present era.† As the tree lives to a great age and succeeds under conditions that would be fatal to many species there is every probability that the original tree is still living. Most of the earlier trees raised both in Britain and on the Continent appear to have been males. Wilson‡ says that "in 1790 an English amateur named Blake, sent a *Ginkgo* plant to M. Gaussen de Chapeau-rouge who had a garden at Bourdigny, a village two leagues from Geneva, Switzerland. This tree is historical. It proved to be a female, the discovery being made by Auguste Pyramus De Candolle in 1814. Scions of this tree were distributed over Europe by its discoverer and grafted on

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* Journ. Coll. of Science, Japan, vol. viii, pt. 2, 1895 & vol. xii, pt. 2, 1898.

† For an account of Ginkgo in the Jurassic and Tertiary ages *see* A. C. Seward, F.R.S., and Miss J. Gowan, in Ann. of Bot. xiv, pp. 109–154 (1900).

‡ *loc. cit.*, p. 56 (1920).

male trees including those at Vienna and Montpellier." May it not be that grafts were sent at the same time to Utrecht and have been lost sight of until the removal of the elm trees mentioned by Professor Went admitted more light and resulted in the better development of a grafted branch that had hitherto been too weak to flower? In the same way is it certain that male branches have not been grafted upon isolated female trees?

Apart from the interest attached to the fruits or seeds of female trees their decorative value is no greater than that of males whilst the latter are infinitely preferable for public gardens and for gardens attached to residences, owing to the abominable odour of the falling fruit of female trees in autumn. Unfortunately it is not possible to separate the trees before they flower therefore the selection of sex must be left to chance. *Ginkgo biloba* is a tree that might be more extensively employed than at present in schemes of decorative planting for it is very hardy, succeeds under a great variety of conditions, is not susceptible to disease and is rarely attacked by insects. Although the best development is attained by trees growing in a clear atmosphere, good results are obtained in towns, and even under the worst possible conditions of smoke and dust trees live for many years. There is a decrepit specimen growing behind a wall adjoining High Street, Brentford, where for many years it has been hemmed in by high walls and exposed to the dust and dirt of a busy town and constant stream of traffic. Yet it lives on. Well grown trees can be transplanted with safety and specimens 25 feet high have been moved at Kew without difficulty.

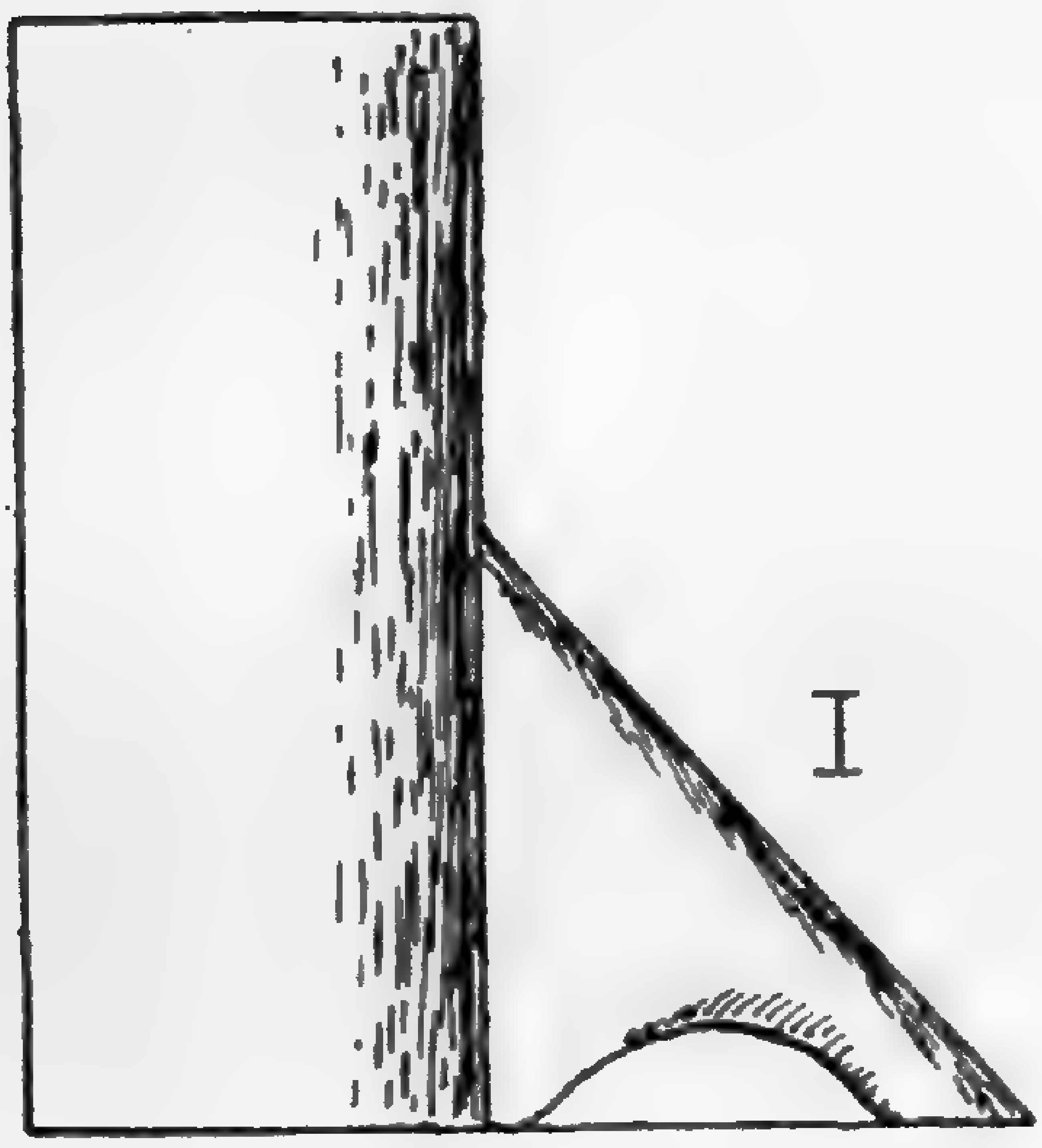
Apart from the value of the edible seeds *Ginkgo* has little economic value, the timber being weak, of no special use, and too scarce to give it any place in commerce.

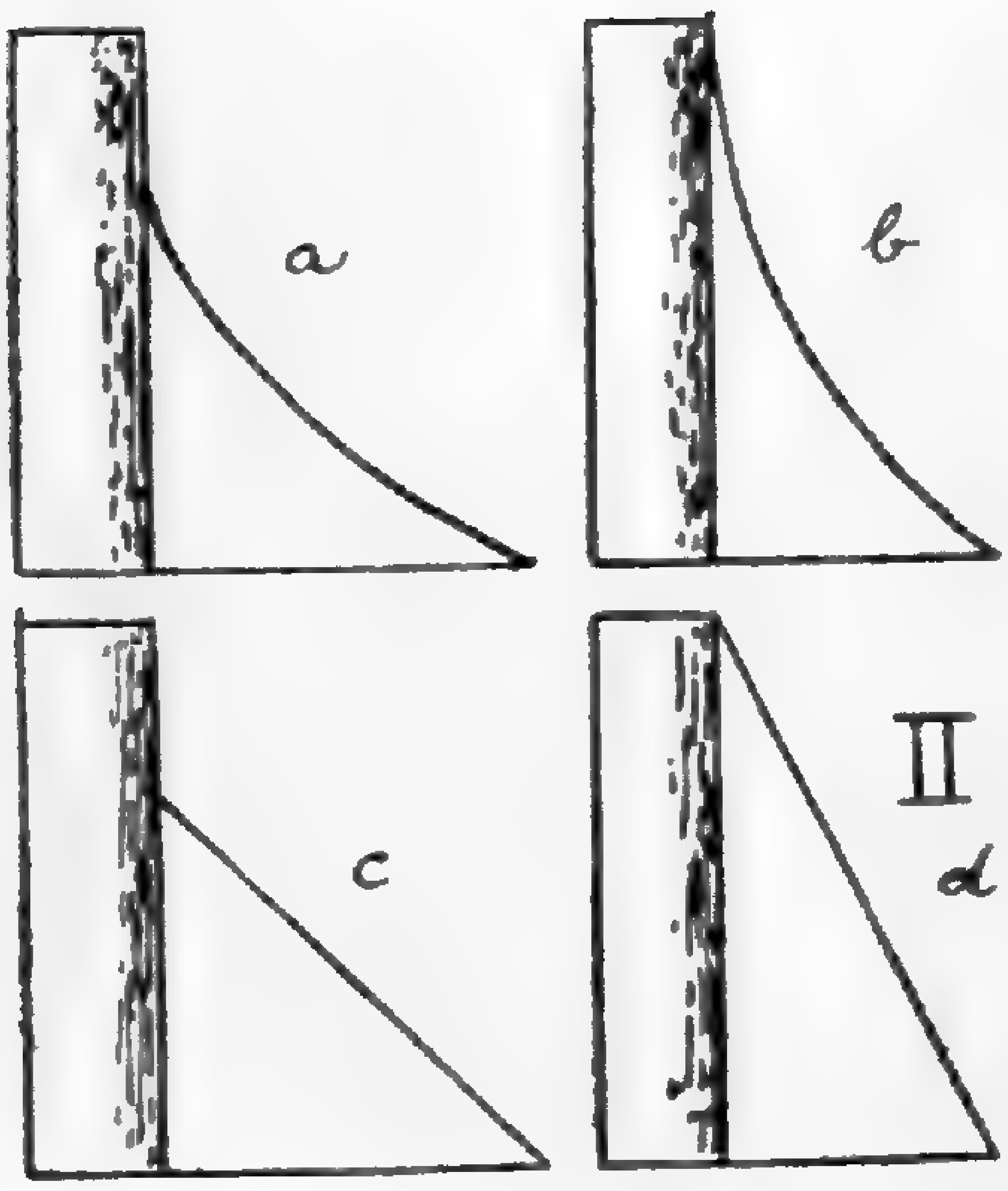
XLI.—BUTTRESSES AS AN ASSISTANCE TO IDENTIFICATION.

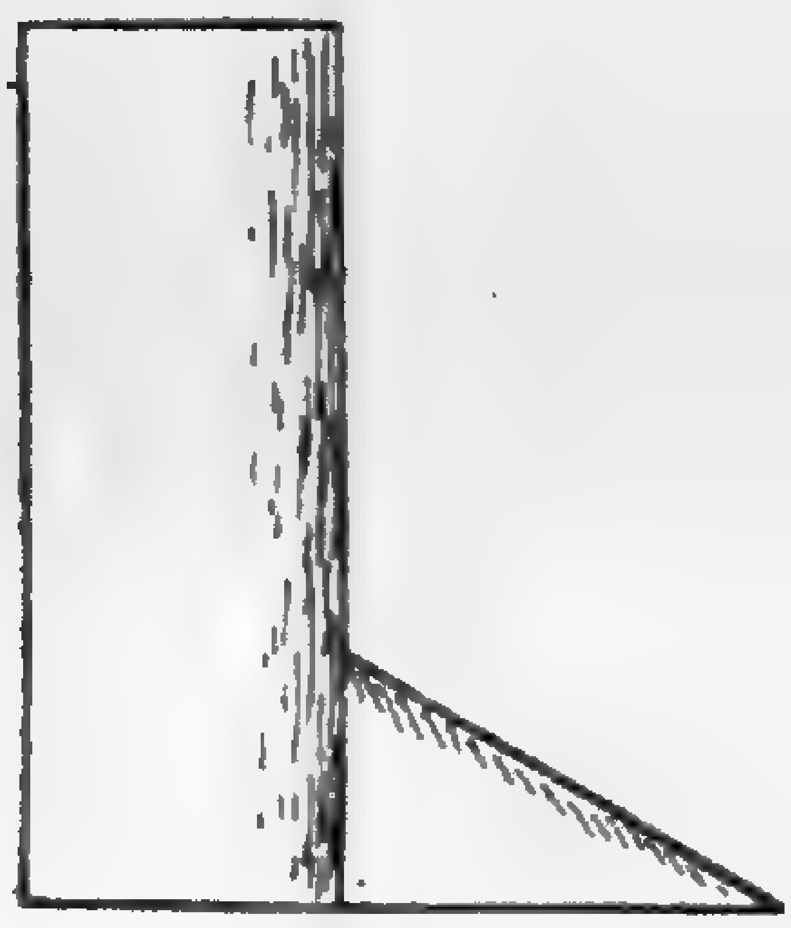
T. F. Chipp.

It is a little strange that one of the most striking characteristics of trees in the tropical Rain Forests, namely the buttresses, should have received such scant attention. Works on plant geography as a rule give them but a brief notice, forest floras hardly refer to them at all and then only in very general terms, and collectors in their field notes accompanying specimens, rarely record even their presence.

Their function is generally considered to be in assisting to support the massive trunks, and where the subject is dealt with at any length, attention is generally directed to the stilt or prop roots of the Mangrove formation, or to record the huge dimensions of the largest plank buttresses. Mr. H. N. Whitford in his appreciative study of "The Vegetation of the Lamao







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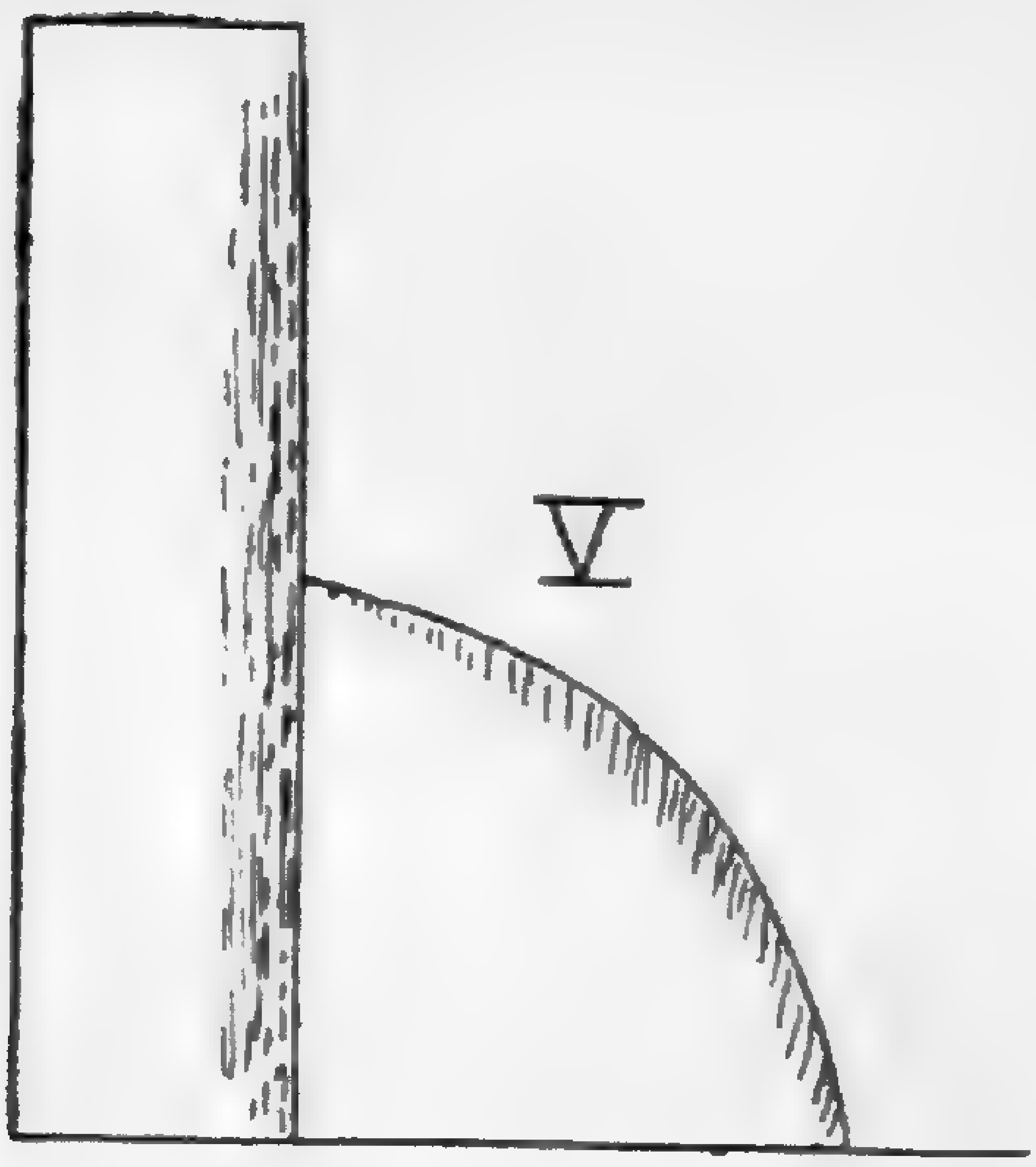

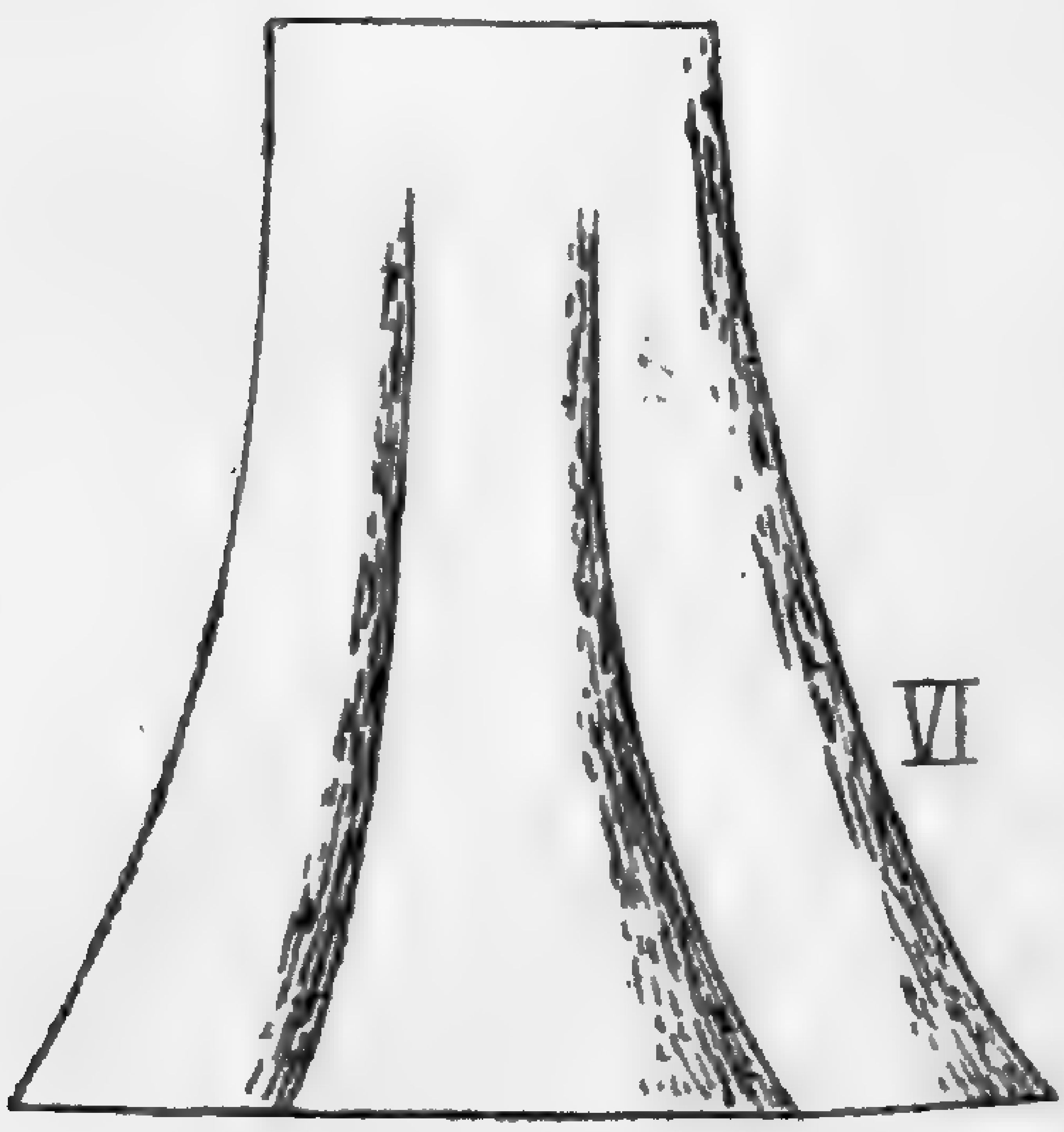

Forest Reserve" (Phil. Journ. of Sci. I. p. 419) treats the subject more in detail and states that his observations lead him to conclude that buttresses are only developed by trees reaching a dominant position, and thereby enabled to develop wide crowns, and that the extent to which the buttress is developed is in proportion to the spread of the crown.

The majority of trees able to assume dominant positions in the tropical Rain Forests always appear to develop buttresses; and trees that do not attain to such positions do not exhibit any tendency to do so. Whilst normally trees that develop buttresses have no tap roots, information supplied by Dr. F. Foxworthy from his work on *Dracontomelon dao* in the Philippines provides an instance of trees developing buttresses in addition to a marked taproot. As it is usual for the same species and genera to attain dominant positions in the forest, and as the size of the buttresses varies considerably for the same species of tree in different or the same locality, observations were made to see if there was any factor in connection with the buttresses that was more or less constant.

It was found that the presence, absence or the style of the buttress enabled the trees to be considered under four headings.

In the first are grouped those cases of stilt roots or hollow buttresses, where a growth arises some distance above the ground and curves downwards, when it may remain more or less cylindrical (as in the Mangrove and *Ficus* spp.) or a thickening may occur in the upper angle of the root and stem (*Musanga Smithii* P. Beauv.) or this thickening may extend downwards so as to form a more or less complete plank buttress (*Tarrietia utilis* Sprague).

A second group comprises those cases where the buttress is a thickening in the angle formed by the stem and the main roots arising at the collar and spreading laterally along the surface of the ground. Here the buttress is solid and plank-like, as in the majority of the big forest trees.

In a third group no distinct buttress is formed but the bottom part of the stem is grooved or fluted, the folds passing at the base into the main lateral roots.

The four thgroup includes a very few trees of dominant position where the bole is cylindrical to the ground (*Mimusops*).

A further consideration of the specimens that are included in the third group, namely those that exhibit solid, plank buttresses, revealed another point in that the shape of the buttress is constant for the species or genus, regardless of its size.

If the buttress be considered to be a right angled triangle with the right angle at the base of the tree, it will be seen that the side of the triangle representing the height to which the buttress reaches on the tree, bears a definite relation to the base of the triangle, or the length the base of the buttress stretches along the root from the tree. The hypotenuse of the triangle, that is the outside edge of the buttress is straight, concave or convex, between the highest point of the buttress on the tree and the farthest point of the buttress from the tree on the ground.

The following are examples of observations made in the West African Rain Forests to illustrate this constancy of shape.

Group I.—Trees possessing stilt-roots or buttresses arising in the upper angle of sub-aerial roots, developing imperfectly or rarely perfectly formed plank buttresses :—

Rhizophora.
Avicennia.
Ficus spp.
Musanga Smithii.

Tarrietia utilis (if buttressed, the height of the buttress equals the length of the base, and the hypotenuse is straight) (Fig. I.).

Group II.—Trees possessing perfectly formed plank buttresses, which arise in the angle of the stem and lateral surface roots :—

a. *Eriodendron.* *Bombax.*	The height of the buttress equals or is double the base and the hypotenuse is straight or concave (Fig. II.).
b. *Piptadenia.* *Parkia.*	The height equals (Fig. II.*c.*) or is half the length of the base and the hypotenuse is straight (Fig. III.).
c. *Entandrophragma.* *Lophira.*	The height is less than half the length of the base, and the hypotenuse is concave (Fig. IV.).
d. *Terminalia.* *Anopyxis.* *Khaya.* *Triplochiton.*	The height equals the base, and the hypotenuse is straight (Fig. II. *c.*).
e. *Cynometra sp.* (Ananta, Twi).	The height equals the base, and the hypotenuse is convex (Fig. V.).

Group III.—Trees with stems deeply furrowed or fluted towards the base but not possessing any real buttresses, (Fig. VI.) :—

Alstonia congensis.
Chlorophora excelsa.
Cylicodiscus gabunensis.

Group IV.—Trees with cylindrical trunks right to the base :—

Mimusops.

Further investigation of this subject may provide information of much assistance in the identification of trees in the forest, where only the base can be seen and the crowns are hidden in the tangled canopy above.

XLII.—ON THE OCCURRENCE OF A SPECIES OF FUSARIUM IN UGANDA.

W. Small.

In a previous communication to the Kew Bulletin,* the present writer described from Uganda a wilt of carnations, *Delphinium*, *Nigella* and *Cosmos* which was shown to be due to a species of *Fusarium*. The same *Fusarium* has been encountered since on other plants, and it is thought that an account of its occurrence may be of some interest. The new host plants include seedlings of the cashew nut (*Anacardium occidentale*, L.), the silky oak (*Grevillea robusta*, A. Cunn.), the rose apple (*Eugenia jambos*, L.), and the loquat (*Eriobotrya japonica*, Lindl.). The attack of the *Fusarium* on the first of these takes the form of a severe wilt disease which is new, so far as the writer is aware, and which is described in some detail in the following pages. The occurrence of the *Fusarium* on the other three hosts is not of the same deadly nature as on the first, but is nevertheless worthy of record and discussion. The fungus has been found also on carnations and *Antirrhinum* associated with *Heterodera radicicola*, Greef. The facts recorded in this paper extend the host range of this fungus which is now provisionally labelled *Fusarium udum*, Butl. There are doubtless numerous unreported cases of the deaths of garden and other plants, and it is probable that so vigorous a fungus and one so difficult to eradicate when established in the soil, is pathogenic to many plants. It has been recorded on only one plant of economic importance in Uganda, the pigeon-pea (*Cajanus indicus*, Spreng.) and then, not as an original, but as an induced infection, the result of an experiment which is mentioned later. Evidence obtained from soil cultures points to its being able to subsist saprophytically and tide over non-parasitic periods of its life on organic debris in the soil, while it would appear to gain an entrance to the tissues of its host through the smaller roots after the typical manner of the soil-dwelling, semi-saprophytic fungi that cause wilt disease. Various species of *Fusarium* behave in this manner. That the species under discussion should be included among them is supported by the results of the inoculation experiments carried out.

Symptoms of the Wilt Disease of Cashew Nut.

The writer's attention was drawn to the cashew nut wilt in April 1921 by the officer in charge of the Government Plantation, Kampala, who pointed out that a large number of cashew nut seedlings was dying off in the nursery. A cursory glance at a bed of seedlings was sufficient to show that the percentage of affected plants was very high, and subsequent observations in several groups of plants showed as much as 100 per cent. There seemed to be no case of recovery from an attack of the fungus.

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* *Kew Bulletin*, 1920, p. 321.

The diseased plants had been grown from seed and had not been disturbed in any way.

The most characteristic symptom of the disease under discussion was the softening of the hypocotyls of the attacked seedlings, the tissues of which were, in cases, so completely disorganised that they collapsed under easy pressure or broke when a pull was exerted to remove the diseased plant from the soil. This condition was analogous to that found in carnations affected with the same wilt disease and it doubtless gave rise to the alternative name "crown-rot," which has been used by van der Bijl in South Africa.* It likewise led the writer to presume the cause of the disease to be similar to, if not the same as, that of the carnation wilt, viz., a species of *Fusarium*, although at the moment no *Fusarium* mycelium or conidia such as were found externally on wilted carnation plants could be found on the diseased plants under examination. The leaves of affected plants withered and fell off. Owing to the breaking down of the cortical tissues, the roots, especially the smaller, were usually soft to the touch. While the lower part of the hypocotyl might be rotten, the upper portion of it might be quite firm. Microscopic examination of sections of the latter showed the cells of the parenchyma to be unaltered and full of starch, while sections of the firmer parts of the former showed the presence of mycelium in quantity. Good preparations were obtained from both hypocotyls and roots by staining with haematoxylin and alcoholic eosin, as recommended by E. J. Durand,† after killing in Durand's modified Gilson's mercuric chloride solution and clearing away the usual brown discolouration in a saturated aqueous solution of chloral hydrate. Hyphae were found in the bundles of the roots, but their choking of the vessels was never complete enough to account for the wilting and death of the plants. In fact, they were always much more plentiful in the root cortex and in the starch cells of the parenchymatous tissues of the hypocotyl. At times the body of a cell of the latter would appear to be a tangled mass of hypae. The hyphae resembled very markedly those found in sections of wilted carnations and described as follows‡ by the writer—"This internal mycelium varied in thickness, was much branched, and was seen to pass freely from tracheids to parenchyma without constrictions. The main hyphae in a tracheid would give off numerous slender branches which could be followed as they penetrated the pits." Where hyphae were present, no cell-contents or stored material such as starch could be seen, and it is conceivable that the effects of the fungus are more of an organic character leading to starvation or of a toxic character leading to poisoning than of a physical character leading to a mechanical choking of the ducts. A certain amount of blackening of diseased root or hypocotylar

* Ann. Appd. Biology, ii, 267, 1915–16.
† Phytopathology, 1. 120. 1911.
‡ *loc. cit.*, p. 321.

tissues in the form of streaks was always present, but it was difficult, owing to the general brown colour of diseased parts, to trace the streaks from one part of the plant to another. Only chlamydospores were seen within the tissues.

As already mentioned, none of the plants collected for laboratory study showed any external mycelium, but a few seeds which had not germinated were taken with fungi *in situ* from affected beds. These seeds were rotted by moulds, and one species each of *Nectria* and *Pestalozzia*, the latter near to *P. palmarum*, Cke., was present upon them. On only one or two seeds, mycelium accompanied by microconidia which recalled strongly those of the carnation *Fusarium* was found. It seemed possible that the germination of those seeds had been prevented by attacks of the *Fusarium* in the soil of the beds, but whether this was definitely so could not be determined. The few seeds obtained were so permeated by moulds that sterilisation had to be thoroughly done, so thoroughly that, in every case, whatever living organisms may have been within were killed.

Isolation of the Cashew Nut Fusarium and its growth in Pure Culture.

Fresh material when surface-sterilised by careful washings in successive portions of rain water, distilled water, and mercuric chloride solution (1 : 1000), and placed in a moist atmosphere, showed plentiful typical mycelium in tufts of a honey-yellow, white, or pale-pink colour after two or more days. The mycelium frequently took the form of coremial strands. Those plants of which the hypocotyls were in a collapsed, soft, and watery condition gave the best results. The first mycelial tuft invariably appeared at the base of the hypocotyl, and it bore a few microconidia after about five days (Fig. 1).

Fig. 1. Typical microconidia from damp-chamber material (cashew nut), × 500.

Microconidia were plentiful in, as a rule, seven or eight days. Meanwhile, other tufts on the hypocotyl and roots grew rapidly, bore microconidia, and coalesced to form a whitish aerial mycelium covering the whole hypocotyl and roots in about eighteen days. Before this stage, macroconidia, measuring up to 27 by $2 \cdot 5\mu$ and mostly three-septate, had been easily found.

Tissue-fragments removed under sterile conditions from hypocotyls and roots were placed in prune decoction in petri dishes after being dipped in alcohol and flamed. It was found that a growth of hyphae resembling that just described was visible in four days, that the mycelium took on a definite white or pink shade in five or six days and bore numerous microconidia in nine days. The honey-yellow colour was visible in parts of the mycelium in eleven days, and macroconidia were found in quantity in eighteen days. In several cases, chlamydospore-formation took place in six or seven days. It was thus easy to obtain inoculum for pure cultures.

The first pure cultures were made on banana plugs in sterile Roux tubes; the inoculum consisted of microconidia from the tissue-fragment cultures mentioned above. No mycelial growth was visible under four days, and it was then very sparse and white in colour. Microconidia were produced in eight days and became very numerous later, but no macroconidia or chlamydospores were seen. On slants of prune agar of 25° acidity in Fuller's scale, white or pink-white aerial mycelium covered the whole surfaces of the media in three days and microconidia were then very plentiful. They were to be found particularly in moist oily superficial streaks resembling the growth of bacteria. Macroconidia (Fig. 2) were found a little later, and chlamydospores were numerous in twelve days.

Fig. 2. Macroconidia from prune agar culture (cashew nut), × 500.

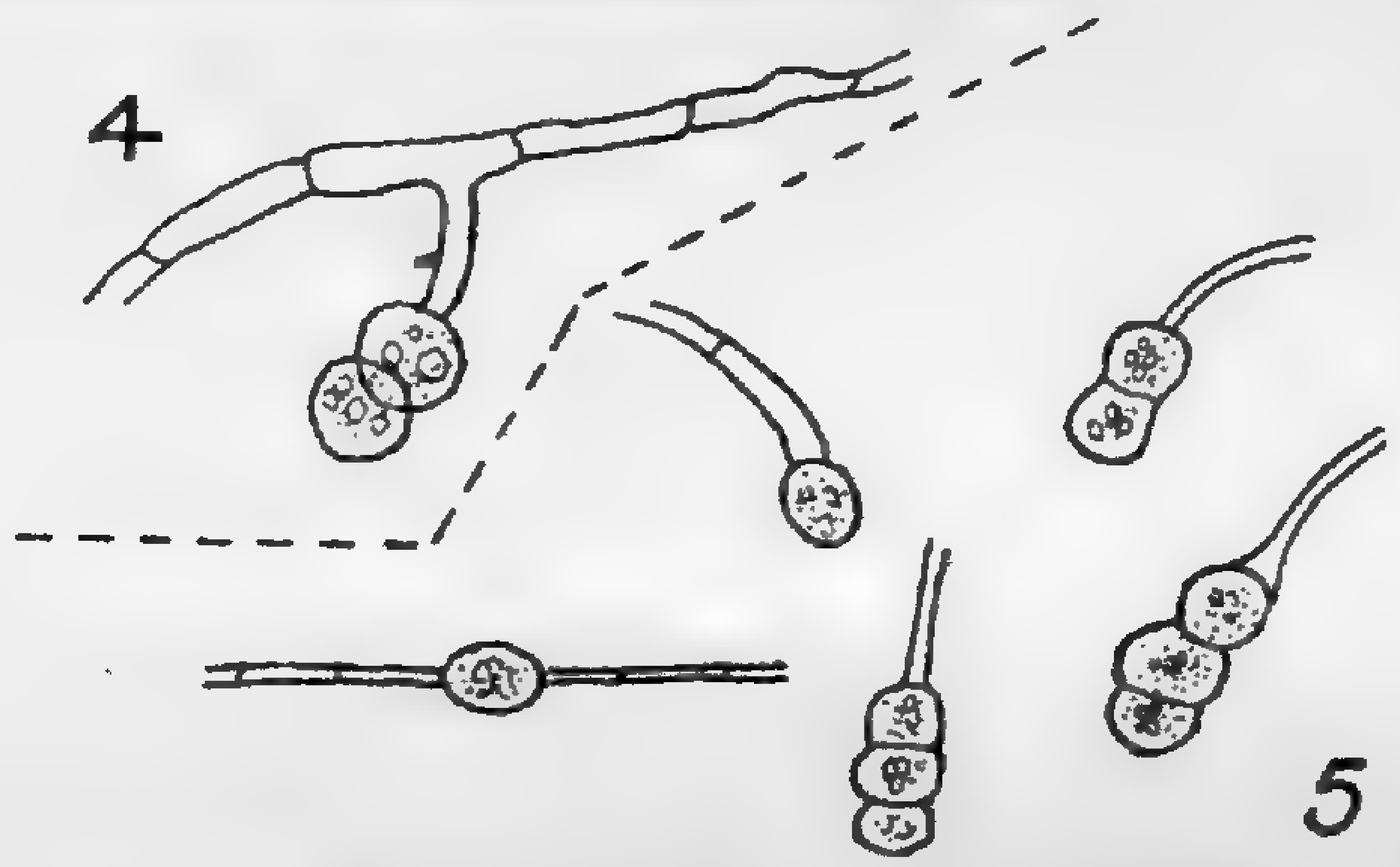
After two months and more, the surfaces of the slants were masses of macroconidia in an apparently moist condition and of a yellow tinge, and after ten months they still kept that condition. The conidia were then capable of germinating rapidly overnight in a hanging-drop of distilled water. In prune agar plates, the growth and development were similar except that the mycelium became dark-grey in colour in parts.

On glucose meat-extract agar of 30° acidity, growth was visible in twenty-four hours, and microconidia in forty-eight. The aerial mycelium was white and small in amount. After six days, the conidia were septate, and measured up to 38μ long; in twenty days they were very numerous and four or five-septate. Chlamydospores were formed in twenty days, and, after that, the mycelium became dark in colour and apparently brittle, as if it were breaking up into resting portions.

In French-bean agar of 20° acidity, the aerial mycelial growth was similar to that above, but larger and inclined towards a star-shaped flocculent habit such as was found on whole plants in the damp. Three-septate conidia were found after six days. They measured up to 35μ in length, and were in proportion broader than those of the glucose meat-extract culture above or of the rice agar culture below. Chlamydospores were formed in thirteen days, and a few days later were darker in colour than at first, of an average diameter of 10μ (Fig. 3), and evidently mature.

Fig. 3. Mature chlamydospore from French-bean agar culture (cashew nut), × 500.

In rice agar of 15° acidity, the aerial white mycelium bore microconidia in two days. Moist streaks were then quite apparent. In three days three-septate conidia were common, and in six days chlamydospores were very numerous. Later, the terminal chlamydospores were found to be in many cases two-celled (Fig. 4), and even three-celled (Fig. 5), in which case the aggregation resembled a spore of *Piricularia oryzae*, Br. and Cav., the cause of the blast disease of rice.



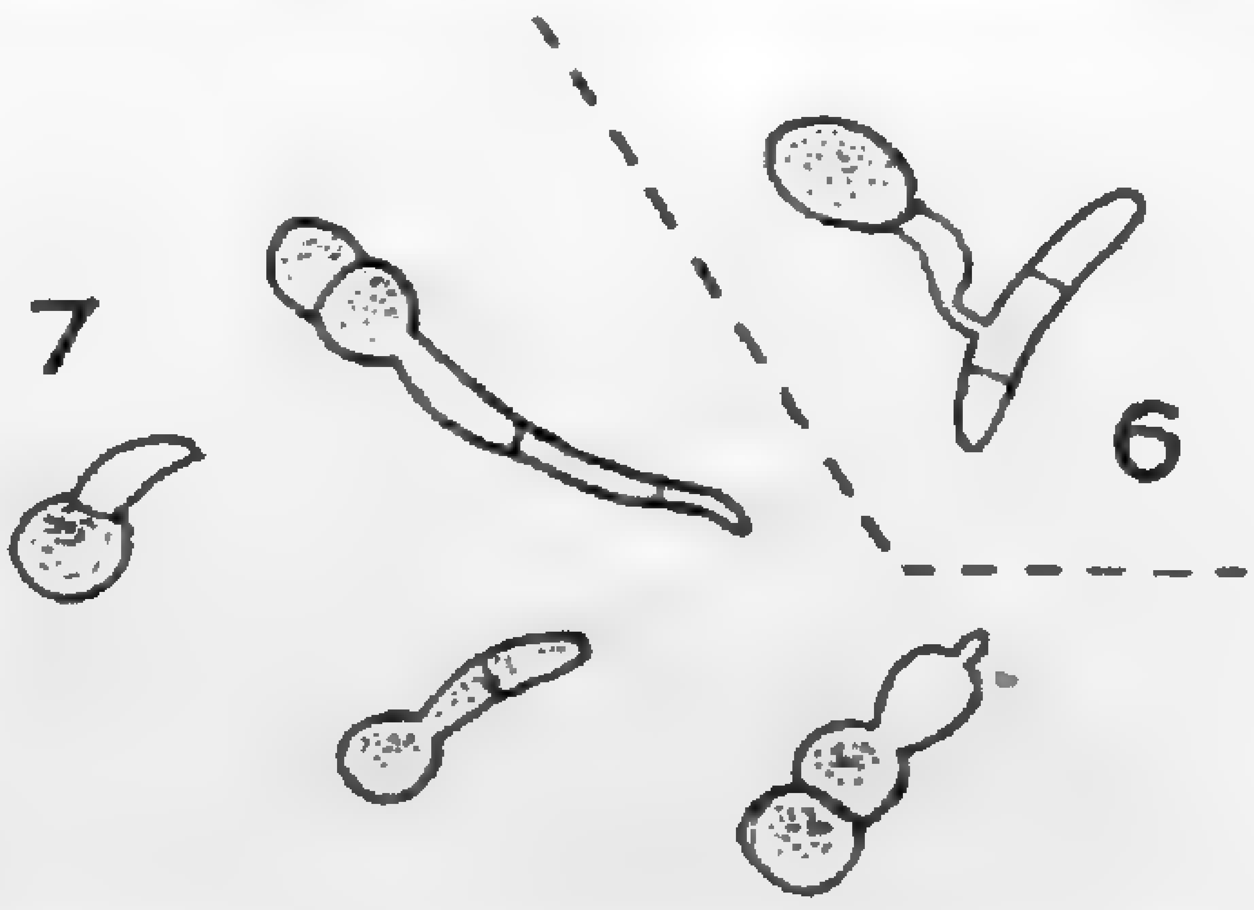
Figs. 4–5. Chlamydospore-formation in a rice agar culture (cashew nut), × 500.

These chlamydospores were found while conidial production was still in progress. Meanwhile, the aerial growth of mycelium arranged itself along definite concentric rings, and the conidia became so numerous that they covered the surface of the medium as in the prune agar slants mentioned. The largest measured 32μ long. The chlamydospores when placed in hanging drops germinated in forty-eight hours to give mycelium which produced further chlamydospores, terminal and intercalar and small, for they measured only up to 5μ in diameter, or directly to produce microconidia (Fig. 6), the latter condition being the more common. The contents of the chlamydospores were coloured brown when treated with two per cent. osmic acid, while mycelium and conidia were unaffected. The mycelium in all the above cultures was typically that shown by van der Bijl in the plates attached to his paper.*

After six months and longer, the above cultures which had been kept in the meantime at laboratory temperature (an average

* *loc., cit.*, plates 37–40.

of about 25° Centigrade), as indeed all the cultures were kept, were found to be in a moist condition. No perithecial formation was noted, but minute brownish aggregations of hyphae occurred over the surfaces of the media, more particularly in the case of the glucose meat-extract agar. In all the agar cultures, there were also the distinct surface lines of growth which resembled in a striking manner the growth of bacteria. These lines which radiated in all directions were now composed of germinating chlamydospores, micro- and macroconidia. The microconidia were always far more numerous than the larger conidia. Chlamydospores, especially when formed intercalarly, were numerous in all the old cultures, and frequently occurred in groups of three or more; their walls averaged $1 \cdot 5\mu$ in thickness No separation had taken place between the component parts of the two-celled terminal chlamydospores and their germination was observed to result in only one filament (Fig. 7).



Figs. 6–7. Germination of chlamydospores, 48 hours (cashew nut), × 500.

The *Fusarium* was also grown with success on the sterilised surfaces of cashew nut seedling hypocotyls split longitudinally and carefully steamed. These cultures were kept in moist petri dishes. The behaviour of the fungus was in all respects similar to that in the agar cultures except that the chlamydospore form was not found. In one case, the mycelium assumed a pale blue colour with white edge, as if alkali had been added by accident to part of the surface of the medium. The blue colouration eventually gave place to honey-yellow, the prevailing colour in these cultures, although the white-pink colouration was by no means wanting.

Attempts were made to grow the fungus in sterilised soil moistened with sterile distilled water. Small quantities of the soil convenient for examination were placed in petri dishes and inoculated with conidia and mycelium from the agar cultures. Similar cultures were instituted with unsterilised soil from a locality presumably free from the *Fusarium* wilt. No success was met with until the cultures were incubated at 30° C, when fungus hyphae were found spreading in all directions from the points of inoculation. Characteristic mycelium and microconidia of the *Fusarium* were also found on organic fragments in the soil of the cultures. No other spore stage of the fungus was seen. The unsterilised soil cultures were much more successful than the others.

In conidial germination in hanging-drops, the septa might disappear, and the hyaline, granular, septate germ-filaments might be visible after only one or two hours. They took their origin most often from the end cells of the conidia, sometimes from one only, frequently from both, and they branched early, were attenuated, and ramified in all directions, or remained short and thick, resembling and forming secondary conidia (fig. 8).

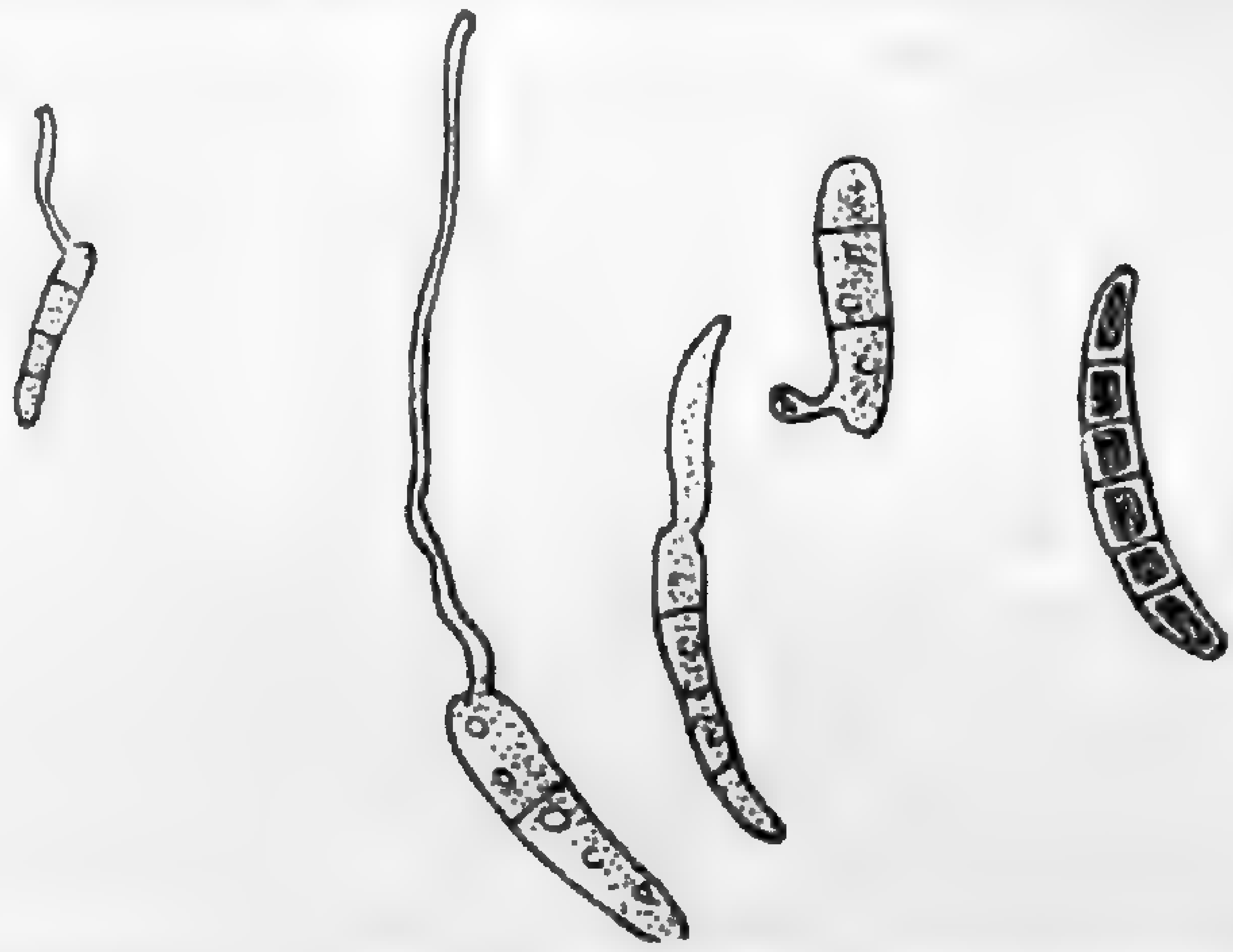


Fig. 8. Germination of macroconidia in hanging-drops (cashew nut), × 500.

Microconidia were produced terminally from long and from short filaments. Anastomosis between neighbouring filaments took place readily, and the drying-up of the hanging drop was a signal for the immediate formation of chlamydospores.

On the whole, cultural evidences pointed strongly to the identity of the previous *Fusarium* from carnation, *Nigella*, &c., with the later *Fusarium* from cashew nut, although mycelial colourings in the cultures of the latter did not seem to be so strongly marked as in the cultures of the former. There could be no denial of the likeness between the actual mycelia, conidia, chlamydospores, and the methods of conidial formation. The first-produced microconidia invariably reminded the writer of the numerous microconidia to be found in his previous cultures of the carnation strain of the *Fusarium*, and the macroconidia recalled the previous *Nigella* strain. In other words, it seemed as if the *Fusarium* from cashew nut was showing in itself the spore-characters of all three previous strains from carnation, *Delphinium* and *Nigella*—characters which seemed at the time to be sufficiently constant to be regarded as the physiological expression of each strain.* The strains, however, were not biologically distinct because no one of the three was selective in the choice of its host, all being equally pathogenic to the hosts of the others, and it was not surprising that a new strain of the *Fusarium* should show a combination of the characters of the previous three, especially when it proved to be pathogenic to one at least of the previous hosts. Moreover, it was found that a single strain might vary within itself in its degree of conidial-production.

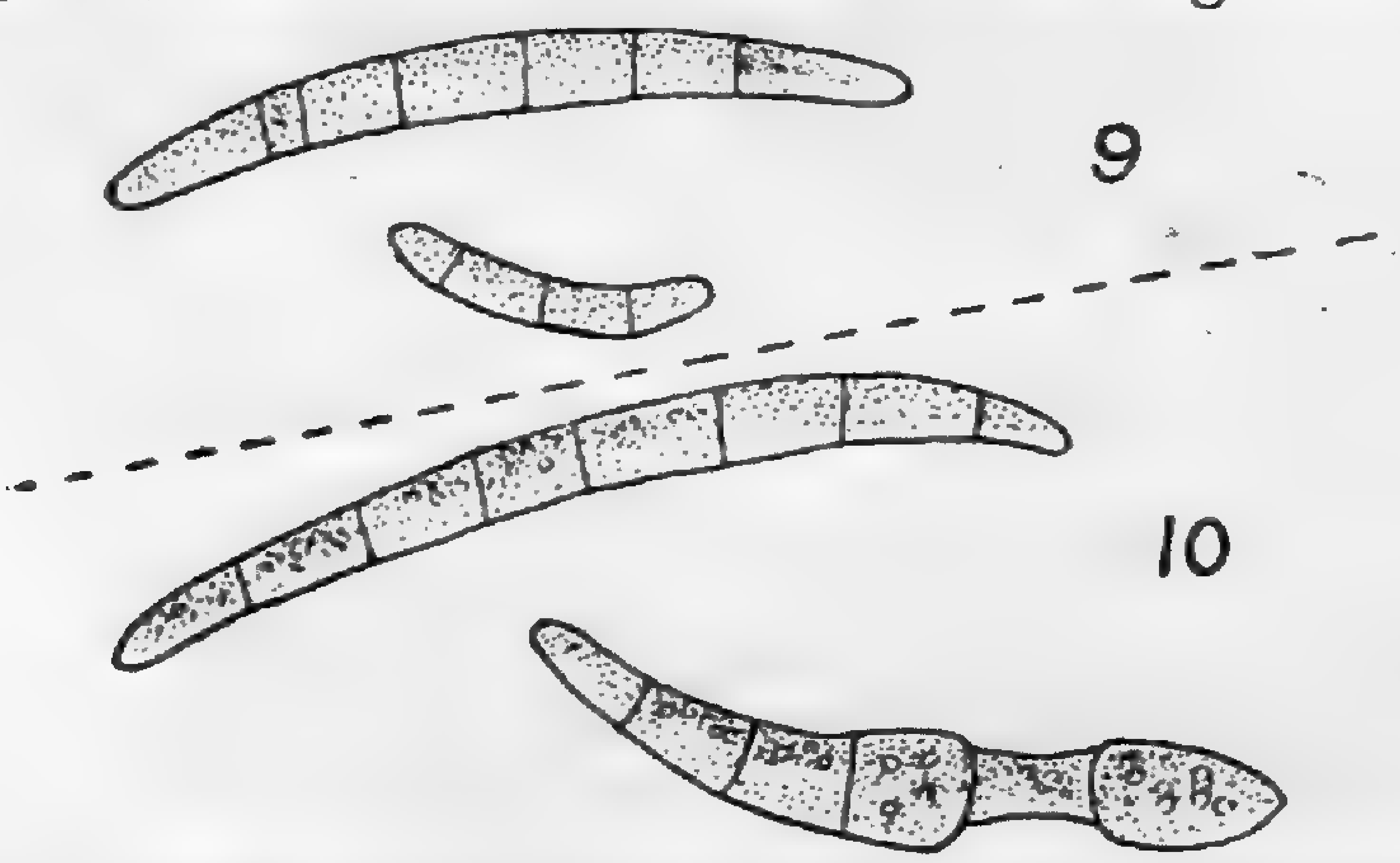
* *loc. cit.*, p. 325.

INFECTION EXPERIMENTS WITH CASHEW NUT PLANTS.

The effects of the disease had been so disastrous that only eight plants were available for inoculation experiments. The experiments were therefore less numerous than were wished. The plants were healthy seedlings about ten inches high with two pairs of leaves and all were in pots. The inoculum in all cases was drawn from the prune agar slant cultures for the reason that the conidia of those cultures germinated in water more vigorously than the conidia of the others. A suspension of spores in sterile distilled water was used, and the viability of the spores was tested in the same medium. After necessary wounds had been made and the inoculum placed in position, disturbed tissues were carefully replaced. All the plants were placed out-of-doors after a day in the laboratory.

The inoculum was placed in contact with lateral and tap roots of one plant, in wounds on a tap root and lateral roots of another, in contact with a hypocotyl under the soil level and in a wound in a hypocotyl under the soil level. It was also placed in the soil one half inch from roots, and one half inch from a hypocotyl. Two plants were kept as controls, and they remained healthy throughout the experiments.

In the cases of the plants the roots of which, both lateral and main, were treated, in one case unwounded and in the other wounded, leaf-wilting began in five days and after ten days both plants had collapsed. The hypocotyls of both were then soft and watery. After three more days, both plants were dug up, carefully sterilised, and placed in moist chambers. It was noted that, in the case of the unwounded plant, the smaller lateral roots had decayed while the tap-root was still healthy and firm, and that, in the case of the wounded tap-root, the tissues had collapsed. On the surface of the soil of the pot of the unwounded plant, *Fusarium* mycelium and typical microconidia up to 10μ long were found. After only twenty-four hours in the damp, both plants showed mycelium on the hypocotyls with numerous microconidia. Three- to five-septate macroconidia up to 60μ (fig. 9) and chlamydospores then appeared, and four days later seven-septate conidia (fig. 10) were in abundance. These large multi-septate



Figs. 9–10. Large macroconidia from an inoculated plant (cashew nut), × 500.

conidia were not found in any of the cultures of the *Fusarium* isolated from cashew nut material, but they were noted previously in cultures of the fungus from *Delphinium* and *Nigella*.* They seemed to be produced only sparingly. After another fourteen days, *Fusarium* mycelial cushions bearing conidia were found at the leaf-scars of the stem. That the fungus progressed upwards through the tissues of the plants was proved by the examination of series of sections. Hyphae were found throughout in great abundance. It was rather remarkable that both plants should behave in an exactly similar manner despite the fact that contact between hosts and the parasite had been brought about in different ways.

The plant which had been treated by placing the inoculum against the hypocotyl remained healthy and showed no signs of disease, but the plant with the wounded hypocotyl behaved in the manner detailed above for the root-treated plants even to the appearance of mycelium and conidia at the leaf-scars. The time development of the various stages corresponded to a day.

The two remaining plants, *i.e.*, those with the inoculum placed within half an inch of roots and hypocotyl respectively, did not contract the disease although the former might have been expected to do so. Neither of them was as robust as the control plants, but neither developed the *Fusarium* in the damp chamber and in neither could the presence of hyphae in the tissues be demonstrated. It is possible that they might have proved to be diseased had they been left longer in the pots. Likewise, at a later period, one of the control plants appeared to be sickening, but a careful examination of it failed to disclose the particular symptoms of the wilt disease or the presence of a parasitic fungus.

From the above experiments, it was concluded that, the *Fusarium*, a soil fungus, was capable of invading the smaller roots of young cashew nut plants with or without the help of a wound and the tap-root through a wound, and of causing death. It seemed, however, that the unwounded hypocotyl of the cashew nut seedling was impervious to the advance of the fungus—a statement that may stand further tests, if such were made, since the *Fusarium* is essentially a root parasite. Unfortunately the infection experiments were too few to justify sweeping deductions, although one has been made, but further work may be expected to strengthen the conclusion drawn with regard to liability to root-infection, for it is strongly supported by evidence from wilt diseases of other plants caused by soil fungi and by the evidence previously obtained from the study of the *Fusarium* on carnations, &c., and afterwards obtained from the *Fusarium* on *Grevillea*.

Cross-inoculation tests with the cashew nut Fusarium.

In view of the morphological resemblances between the *Fusarium* isolated from the carnation, *Delphinium*, *Nigella* and

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* *loc. cit.*, p. 325.

Cosmos wilt and that from the cashew nut, it was thought advisable to carry out a cross-inoculation experiment in order to test the pathogenicity of the cashew nut *Fusarium* with regard to one at least of the plants involved in the previous investigation into the wilt of carnation, *Delphinium, Nigella* and *Cosmos.* A large pot of healthy larkspur (*Delphinium*) seedlings happened to be available and it was therefore employed. The seedlings growing along two diameters of the pot taken at right angles to each other were so removed as to leave the remainder in four distinct groups. Each group occupied a quadrant of the soil surface, and each was separated from its neighbours by a line under one inch broad. Two opposite groups of plants were kept as controls, and the two remaining groups were treated by watering the soil, which had been carefully broken up, with, in one case, a suspension of conidia from a prune agar culture in distilled water and, in the other, a similar suspension of spores from a rice agar culture. No special effort was made to bring the inoculum into contact with the roots of the seedlings and no wounding took place. The soil of the control areas was also broken up. After inoculation the soil of the whole pot was gently kneaded into its former state. The viability of the conidia had been previously tested in hanging-drops. The results of this experiment were striking. Plants in both inoculated areas began to wilt on the sixth day and the great majority of them were dead in twenty-three days. Meanwhile, after twenty days, plants in both the control areas of the pot began to show signs of disease, and a further period of ten days proved fatal to practically all of them. Typical samples of dead or dying seedlings were taken at intervals from inoculated and control groups and were placed in a moist atmosphere after careful sterilisation. From all without exception, the *Fusarium* was recovered with mycelium and conidia resembling in all respects those obtained from the cashew nut *Fusarium* cultures. The wilted seedlings showed under the surface of the soil the blackened, soft and sunken area of stem typical of the previous wilt disease. This experiment provided further evidence, if such was required, of the virulent root-parasitism of the *Fusarium* and it might have been taken to show the rapidity with which the fungus could spread across a bridge of soil. But, in this connection, it should be remembered that the plants were fairly crowded in the pot and that there was opportunity for the fungus to spread from root to root. That it did so was shown by the general decay of the smaller roots of both inoculated and control plants.

At the same time, young mango plants, chosen because of their affinity to the cashew nut, were experimented with. the plants were healthy seedlings of eight to ten inches high and were in pots. Conidia from prune agar cultures were used. Masses of them were transferred to sterile distilled water in a watch-glass and broken up to form the inoculum. The conidia were shown to germinate freely overnight in hanging drops of the same medium. During the experiment, the mango plants were kept out-of-doors.

A few c.c.'s of the spore suspension were placed by means of a sterile pipette among the soil around the smaller roots of one plant and in contact with the unwounded lateral roots of another. Two plants were inoculated in wounds in the tap-roots made by scraping with a sterile scalpel, and other two were similarly inoculated in the hypocotyls. Two control plants were wounded one in the roots, both lateral and main, and the other in the hypocotyl. After nine months, only one plant, one of the two inoculated in a tap-root wound, had shown symptoms of disease. The other plants, including the controls, were perfectly healthy and had thrown out pairs of new leaves. The diseased plant appeared to be dead ten days after wilting had commenced, and the *Fusarium* was recovered from its roots. The injured mango, therefore, could not be said to be immune to attacks of the soil *Fusarium*, but it was apparently much less susceptible than the cashew nut. This was not altogether surprising, for mango seedlings had been grown in beds adjacent to those from which the diseased cashew nut seedlings were taken, and they had not yet been found diseased. It was unlikely that the *Fusarium* was confined to only a few beds in a nursery of many similar beds separated from each other by narrow paths and containing many species of plants both economic and ornamental. It was, indeed, more than likely that these plants were immune for the time, or only slightly susceptible, as was the mango, to the *Fusarium* wilt disease. The general health of the seedlings was a factor of importance in the continuance of the immunity of the plant, and seedlings disturbed by, say, the operation of transplanting might prove susceptible, expecially if they were subjected to root-pruning. Evidence bearing on this point is given under a later heading.

Another species of plant belonging to the *Anacardiaceae*, *Spondias lutea*, L., the yellow mombin, was tested. Seedlings were inoculated in root wounds with the cashew nut *Fusarium* and, at a later date, others were treated similarly with a strain of the *Fusarium* isolated from wilted *Grevillea robusta* seedlings. The *Grevillea* strain did not prove to be pathogenic, but, in the case of the other, wilting began in five days and the plants were dead in eleven days. The *Fusarium* was recovered by the former methods. The growth in culture was typical of previous growths and, in addition, remarkable for the production of a thick-set three-septate spore (Fig. 11) with stouter walls than usual which recalled the spore-production of the *Nigella* strain of the *Fusarium*, and for the presence of the rather scarce seven-septate conidium. On the damp-chamber material of *Spondias*, the three-septate spore was commonly associated with the

Fusarium, and an unusual development of chlamydospores was found (Fig. 11) after twenty days.

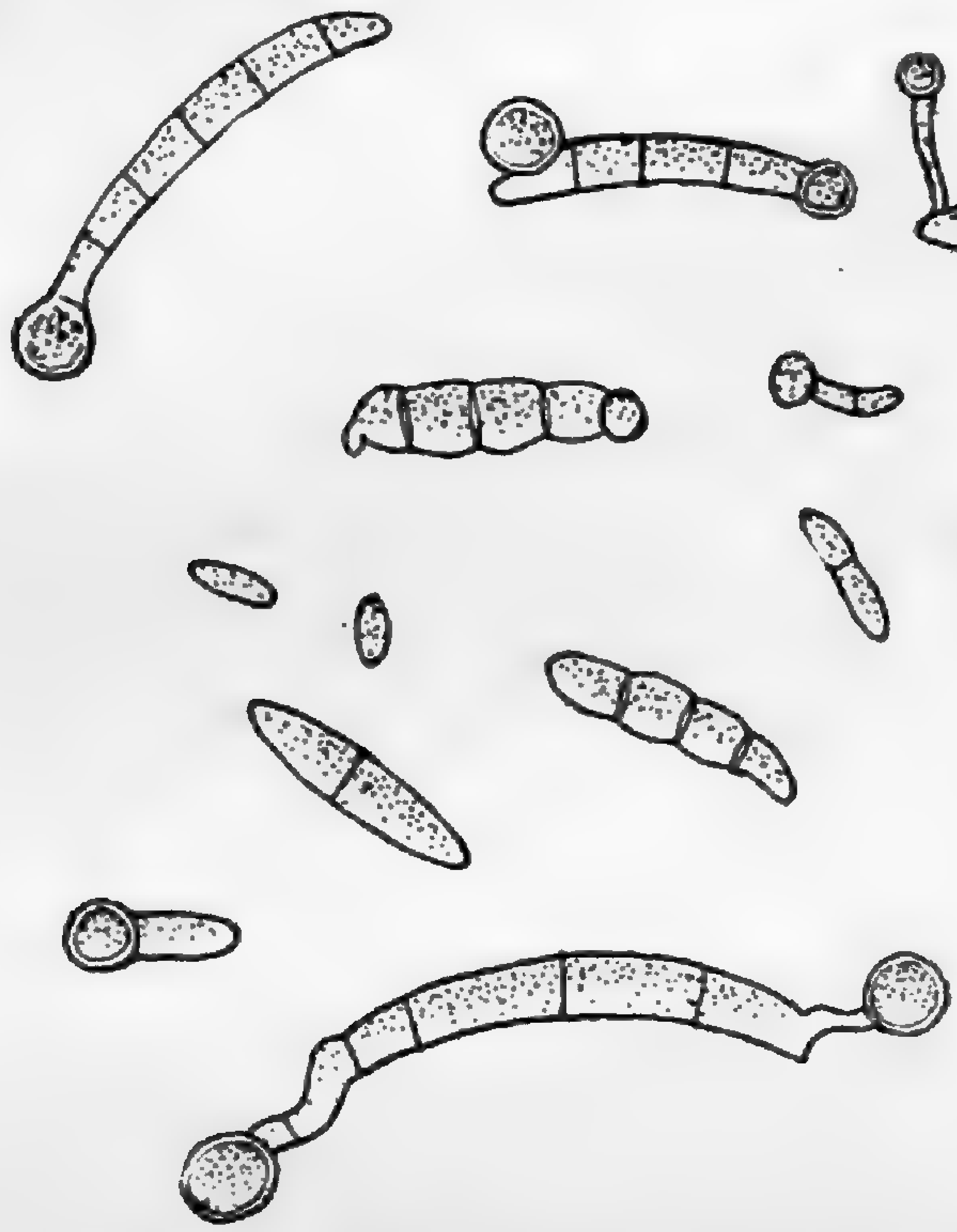

Fig. 11. Conidia and chlamydospores of the *Fusarium* recovered from *Spondias lutea* after inoculation with the cashew nut strain, × 500.

The chlamydospores were of typical size and took origin from any conidium. In fact, the fungus seemed to be passing into a resting stage for the hyphae also broke up into thick-walled portions and chlamydospores.

CONTROL MEASURES.

A direct attack on the *Fusarium* or, indeed, on any soil-inhabiting and wilt-producing *Fusarium*, appears to hold out little hope of success, as witness the efforts made with regard to cotton wilt in U.S.A. There is, unfortunately, no progress to report from the experiments carried out in Uganda. It was mentioned in the carnation wilt paper cited that treatment consisting of a soaking with a solution of carbolic acid (one ounce to one gallon of water) at the rate of one gallon of solution to every four or five square feet was not successful in killing off the *Fusarium*, and it was indicated that the soil-fungicide *Fungal* which liberates formalin might be of greater avail. Van der Bijl in South Africa had no positive results when endeavouring to free soil of the same *Fusarium*, the cause of a carnation wilt, by the use of two-hundred gallons per acre of one per cent. formalin, but injections of formalin were proved to destroy the fungus of a carnation wilt disease, *Fusarium dianthi*, Pril. and Del., in France.

It was decided to experiment with *Fungal* and *Izal*. A drop of a five per cent. solution of the latter in a culture was found to inhibit all growth of the *Fusarium*. Again, the viability of the conidia of the agar cultures in the presence of formalin vapour was tested in hanging-drops. Controls were set up and they showed that the macroconidia of all four agar cultures, especially those from the prune agar slants, germinated vigorously overnight in distilled water drops. Similar sets of conidia were placed in distilled water drops over two per cent. and four per cent. formalin, and no germination resulted in any of them. The spores became shrunken in appearance, and, after only twenty-four hours' exposure to the formalin vapour, refused to germinate when water was substituted for the formalin. The effect of formalin vapour on growing mycelium was also tested in hanging-drop cultures and found to be total inhibition of growth and spore-production followed by death.

Experiments commenced with soil fungicides were, owing to the seeds being too old, unproductive of results. In any case, it should be mentioned that the expense of using in large quantities a proprietary article like *Fungal* would be prohibitive in Uganda. It is possible that the only ordinary means of combating the *Fusarium* will be found in continued deep cultivation which might succeed in eliminating all the points of origin of the *Fusarium*. Steam sterilisation of infected soil might also be employed, but it is impracticable in the majority of cases, and a study of such factors as time of planting, water supply and soil texture has not been possible.

The Fusarium on Grevillea robusta seedlings.

Subsequent to the discovery of the cashew nut wilt, attention was drawn to a destructive wilt of *Grevillea robusta* seedlings in adjacent beds. The seedlings were twelve inches or more in height and, unlike the cashew nut seedlings, all had been transplanted. On the above-ground parts there was nothing of particular note, and the typical soft and sunken area present in the cases of the carnation and cashew nut was absent from the hard woody *Grevillea* stems. Many of the smaller lateral roots were altogether decayed or denuded of bark and cortical tissues, while the tap-roots were still comparatively firm. A histological examination, however, of pieces of tap-root showed that they were permeated by the fungus, for hyphae, microconidia, and chlamydospores were present in the tissues. As in the case of the cashew nut, mycelium was not found in quantity sufficient to choke the elements of the vascular system. In fact, it was far more plentiful in the ground tissue. It resembled the internal mycelium of the cashew nut and carnation. Conidia were much less numerous than chlamydospores, and their connection with the hyphae was less plainly seen. The chlamydospores occurred singly or in the usual small groups, and were also more numerous in the parenchyma cells than elsewhere. Their average diameter was 6–7μ and they were therefore smaller than those of the *Fusarium* in culture, but examples of full size were not wanting.

Isolation methods similar to those already described were followed. Whole plants as well as lengths of main and lateral roots were sterilised and placed in damp chambers. They yielded only the *Fusarium* in the form of the white, flocculent mycelial cushions showing coremial strand formation and bearing at first typical microconidia and afterwards macroconidia up to 53 by 5μ. The fungus occurred in this form on all parts of lateral and tap-roots but never on the stems. Several root tissue-fragment cultures were set up in prune agar, and they showed only the one fungus, the same *Fusarium*, originating from the fragments that proved fertile. The material obtained in both the ways mentioned was used to institute sub-cultures on the mediae previously employed in the study of the cashew nut wilt fungus, and the colour-, mycelial-, and spore-development was typical of former cultures. Growth occurred in concentric rings in one case and coremial strand formation was commoner in this strain of the *Fusarium* than in any other. White, pink and honey yellow were the predominant colourings. In one glucose meat extract tube culture and one prune agar plate, the mycelium in the medium was of a pale blue colour recalling that found in one of the cashew nut hypocotyl growths. This blue colour persisted although it became less and less distinct. The chlamydospores were single or double while terminal, and single or in the usual small groups while intercalar, and they germinated in the same manner as those of the cashew nut *Fusarium*. There was, therefore, no doubt of the identity of the fungus attacking the *Grevillea* seedlings.

Infection and control experiments with the Fusarium from Grevillea.

The conditions under which infection had taken place differed from those holding in the case of the cashew nut seedlings inasmuch as the *Grevillea* plants had been transplanted and root-pruned during the operation while the cashew nut seedlings had been undisturbed. On this account, it was decided to combine a control and infection experiment. Two affected beds were cleared of ail *Grevillea* plants, carefully dug over and treated as formerly, except that only one, the weaker, strength of *Fungal* was applied. A fortnight afterwards, one row of *Grevillea* seeds was sown lengthways in each bed so as to traverse the treated and the control halves of the bed, and a second line consisting of transplants was laid out parallel to the seeds. Alternate transplants in the treated halves of both beds were root-pruned, while all the plants in the control half of the *Izal*-treated bed were root-pruned and none of those in the corresponding half of the *Fungal*-treated bed were root-pruned.

After a few weeks, both rows of seeds had germinated, and at the end of ten weeks the resulting plants were well grown and healthy. They remained so at the end of six months, and there is no difference to be noted between the sets of seedlings growing in the control and treated halves of the beds. The transplants, however, provided striking results after ten weeks, inasmuch as it was apparent that the root-pruned plants were dead and dying in a distinctly greater degree than the non-root-pruned plants. In the control half of the *Izal*-treated bed where all the transplants had been root-pruned, all the plants were dead, and in the treated halves of both beds the root-pruned plants were long dead while the alternate non-root-pruned plants were only sickening. The non-root-pruned plants in the control area of the *Fungal* treated bed were in the same condition as the non-root-pruned plants of the treated areas. Representative plants were taken for examination, and the *Fusarium* was recovered from all. Sections of roots showed no differences from previous preparations. There was no distinction in kind or degree of disease between plants from the treated and control areas. It was concluded, therefore, that the *Izal* and *Fungal* treatments were quite ineffective and that a set back to the *Grevillea* seedlings in the form of transplanting operations was sufficient to ensure a parasitism of the *Fusarium* which varied in virulence according to the treatment of the plants, for the addition of root-pruning to transplanting ensured one hundred per cent. deaths. A series of cross inoculation experiments with the *Fusarium* from cashew nut, *Grevillea* and loquat is described below.

The Fusarium on Eugenia jambos seedlings.

A bed adjoining the two *Grevillea* beds referred to above had been filled with transplanted rose apple seedlings in rows, and it was found that they also were dying off in time. The number of deaths was never more than a small percentage of the number of plants, whereas in the *Grevillea* beds the deaths approached one hundred per cent. The symptoms of disease were exactly similar to those found in the *Grevillea* seedlings, and micro-preparations showed a like infestation of hyphae. No conidia were seen within the tissues and chlamydospores were scarce. In one plant, the epidermal tissues of the tap root had been invaded by the mycelium of *Botryodiplodia theobromae*, Pat. Damp chamber treatment was slow but successful in causing the development of the *Fusarium*, and root-fragments in culture media were fertile of *Fusarium* in nine out of ten cases. It seemed, therefore, that here was another case of the parasitism of the *Fusarium* but in a further reduced form. The *Eugenia* seedlings had been root pruned and were on that account more open to the entrance of the *Fusarium* into the roots, but the number of cases of attack was small. This species apparently possessed an immunity denied to the silky oak and the cashew nut.

The Fusarium on seedlings of Eriobotrya japonica.

At the same time, a few seedlings of loquat in a near by bed were observed to wilt. They also had been transplanted, but they were on the whole strong and vigorous plants. The wilt was accompanied by a symptom of the carnation and cashew nut disease, viz., the softening of the area of stem immediately below ground level. The tap-root was firm while some of the smaller roots were decayed. Hyphae were found in the root tissues as formerly, but neither conidia nor chlamydospores were seen. Pure cultures of the *Fusarium* were prepared from damp-chamber and tissue-fragment material. The lack of colour and of a large aerial mycelium in the cultures and the rapid development of the oily streaks and of conidia were striking. The aerial mycelium was small in amount and almost colourless, while three-septate macroconidia were very numerous in three days, as in the case of the cashew nut strain of the *Fusarium* grown on rice agar. Later, five-septate conidia were found in great numbers, and a three-septate sturdy spore resembling that found in the case of *Spondias lutea* inoculated with the cashew nut *Fusarium* was also common.

Further cross-inoculation experiments.

Further experiments were conducted with seedlings of silky oak, rose apple and loquat. All were healthy potted plants and were kept entirely out-of-doors. Each host was inoculated with the *Fusarium* from *Grevillea*, loquat and cashew nut. A suspension of tested conidia in sterile distilled water was used and all the plants were wounded in the larger roots before inoculation. There were three sets of each host plant and the necessary controls.

Positive results were obtained only in the case of the *Grevillea* plants, and all the rose apple and loquat seedlings remained perfectly healthy and continued their growth. The *Grevillea* plants proved susceptible to all three strains of the *Fusarium* used in inoculation, and the fungus was recovered from the dead plants with typical mycelium and conidia. The results seemed to confirm what has been apparent with regard to the degree of susceptibility of the various hosts, viz., that it varied with the host plant concerned, *Grevillea* being the most susceptible. It is to be noted that even the cashew nut strain with the help of a wound-entrance into the tissues did not prove harmful to the rose apple and loquat hosts and that these plants could be classed with the mango as regards power of resistance to the *Fusarium*. If a scale of susceptibility were to be drawn up, the cashew nut would occupy a high place in it, the loquat and rose apple allow-one, and the silky oak an intermediate position.

The Fusarium associated with Heterodera radicicola, Greef.

The afore-mentioned occurrences of the *Fusarium* were all from one area. Its association with the well-known eelworm, *Heterodera radicicola*, occurred on several *Antirrhinum* and carnation plants growing in a bed and in tubs of soil in a private garden well-removed from the other locality. The eelworm had attacked and caused the deaths of the *Antirrhinum* plants and the usual galls were present in the roots. There was no softening of the stem such as would be induced by the *Fusarium* wilt, and although mycelium was found in the affected soil and on the small lateral roots behind or in front of the *Heterodera* galls and shown to be in both cases that of the *Fusarium*, there were no hyphae in the tissues of the plants except in the galls and the smaller roots mentioned. The external mycelium was white and accompanied by microconidia on the small roots, and it passed from one root to another in strands strong enough to hold together particles of soil. When grown in culture it was typical of former growths. In one case, the soil mycelium gave rise in culture to two fungi, the *Fusarium* and *Sclerotium Rolfsii*, Sacc., the latter of which had been found associated externally with the carnation wilt in 1919,* but no *S. Rolfsii* was derived from any tissue-fragment culture. The presence of hyphae in the galls was demonstrated by sections, and their connection with the *Fusarium* was shown by inoculating the media previously used and also potato-dextrose agar with fragments of galls teased out in sterile distilled water. The *Fusarium* was obtained also from fragments of roots cut from near the galls. In the case, therefore, of the *Antirrhinum* plants, it was concluded that the *Fusarium* was introduced directly or indirectly into the galls and thus indirectly into the root tissues by *Heterodera* and that there was no evidence of its being truly parasitic on the plants. Adjacent plants were not attacked either by fungus or nematode. The case of the carnations was somewhat different, for, while they showed all the symptoms of *Fusarium* attack, there were no galls on the roots. The eelworms were confined to the crown-rot area of the stem and to the collapsed tissues of the smaller roots. Carnations which had not been attacked by the *Fusarium* were not attacked by the eelworms. Nematode root-galls frequently contain a species of fungus, and it was not surprising to find in the fungus a known soil-dweller and one capable of being destructively or weakly parasitic. The relationship between *Heterodera* and the *Fusarium* was in all probability an accidental one arising solely from the proximity of the one organism to the other, and leading, in the case of the *Antirrhinum*, to a degree of parasitism so feeble that it was only just removed from saprophytism. The case of the carnations, again, revealed the *Heterodera* as a mere agent in the destruction originated by the *Fusarium*. At a later date, galls formed on the roots of *Thunbergia erecta*, J. Anders. by *Heterodera radicicola* were examined for the presence of the *Fusarium* with entirely negative results.

Identity of the Fusarium.

During the progress of the work recorded in the foregoing pages, the writer had been struck with resemblances, details of

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* *loc. cit.*, p. 327.

which have not yet been given, between the *Fusarium* under study and that described as *Fusarium udum* by Butler on pigeon-pea in India.* The question of the identity of the *Fusarium* with one of the species separated out and described in recent years in America or with *F. dianthi*, Pril. and Del.,† the cause of a carnation disease in France, was attended with many difficulties but was not overlooked. With regard to the former, the *Fusarium* seemed to be nearest to *Fusarium radicicola*, Wollenw., the cause of a tuber-rot of potatoes,‡ and to differ from the latter in having a *Cephalosporium* stage in place of the *Cylindrophora* of Delacroix as well as in other details. Delacroix's suggestion that *F. dianthi* was carried by nematodes is of interest in view of what is recorded under a previous heading. There did not seem, however, to be any sufficient reason for going further afield than *F. udum*, a species which was set up to obviate such a position as that in which the writer found himself when confronted with the task of naming the *Fusarium*. Efforts had already been made to induce the formation of the perfect stage of the *Fusarium*, both as it occurred previously on carnations and other plants and latterly on cashew-nut seedlings, by damping the cultures and growing the fungus on steamed cashew-nut twigs and seeds, of which several were kept out-of-doors under natural conditions, but they had met with no success. The only perithecial formation found at any time was the *Nectria* on rotted cashew-nut seeds, and it was shown to have a *Fusarium* differing entirely from *F. udum*. Moreover, other forms, species of *Botryosphaeria*, *Dothiorella* and *Phomopsis*, have been found on wilted *Grevillea* seedlings left standing on the soil after death, but no evidence that any connection exists between either of them and the *Fusarium* has been derived from the culture work carried out.

The identification of the *Fusarium* being called for on grounds of convenience alone, it was therefore necessary to rely on cultural and morphological characters, and it was thought advisable to repeat some at least of Butler's cultural experiments; and also to attempt the inoculation of pigeon-pea, its host in India, to show whether or not the Uganda *Fusarium* was identical with *Fusarium udum*. Liquid and solid media prepared, as under, according to Butler's directions were inoculated with spores of the cashew nut strain from the agar cultures which had provided inoculum for the infection experiments. The standard solution for the liquid media consisted of ammonium nitrate 5 gr., potassium phosphate 2·5 gr., and magnesium sulphate 1·25 gr. in 500 cc. distilled water, and the substances mentioned below were added to flasks containing each 30 cc. of the standard solution. Notes on the cultures are appended to each.

* Memoirs of the Dept. of Agric. in India: Bot. Series 2. No. 9, 1910.

† G. Delacroix, Annales de l'Institut National Agronomique, 16, 1901.

‡ Jour. Agric. Res. 2, 4, 257, 15 July 1914.

Liquid media :—

1. Standard solution + 3 % glucose.—The best growth of all the liquid cultures took place in this medium. The medium was entirely filled, and in eight days the culture was of a pale-pink colour. Conidia were then numerous. After two months there were pale cream patches amidst a general pale pink-gray shade. Colourless chlamydospores were produced in mumbers, singly or in groups of two and three.

2. Standard solution + 3 % saccharose.—The mycelial growth was at first white, and, later, on the surface of the medium, compact, and of a faint pink colour, with concentric slightly-raised zones. Creamy patches occurred. Micro- and macro-conidia were formed in great numbers. The colour of the culture deepened, and the subaerial mycelium was of a fairly deep pink after two months. Chlamydospores were formed as in No. 1.

3. Standard solution + 3 % maltose.—The growth in the medium was dense and white, and on the surface a pale yellow colour. The aerial mycelium was small in amount, but micro-conidia were very numerous. Later the whole culture became pale yellow or creamy, of the same colour as the patches in Nos. 1 and 2. All three spore forms were produced.

4. Standard solution + 5 % glycerine.—The growth was white and dense within the medium. The aerial growth was sparse and white at first, becoming pale salmon-pink after two months. The colour persisted better in this culture than in the others. The three spore forms were found.

5. Standard solution + 5 % gum acacia.—The growth was strong and white. The white colour persisted after two months, especially in the compact aerial mycelium. Microconidia and chlamydospores were produced in numbers, but macroconidia were very scarce and smaller than usual.

6. Standard solution + 1 % peptone.—The submerged growth was small, flaky, and of a dirty white colour. The superficial growth was very sparse and colourless. No colour developed after two months. No macroconidia were found. Chlamydospore formation had only begun after two months.

7. Standard solution + 1 % asparagin.—The surface growth was larger than in Nos. 4 and 6, at first faintly pink and, later, white with very pale yellow patches. Only microconidia were produced.

8. Standard solution + 1·5 % citric acid.—Growth consisted of a few small flocculent masses which did not develop any colour. No spores were found.

9. Standard solution + 1 % sodium carbonate.—One very small submerged flocculent colony resembling those of No. 8 was visible after one month. No conidia were produced, but after two months chlamydospores were numerous.

Solid media :—

10. Normal potato (boiled in distilled water).—Growth was rapid, and in a few days the plug was wholly covered. The

mycelium was pale grey-pink with white flakes. It eventually became dirty yellow. All three spore forms were produced.

11. Acid potato (soaked for twenty minutes in 1 % sulphuric acid, rinsed, and boiled in distilled water).—In a few days white mycelium bearing microconidia was plentiful. This became faintly pink in colour and, later a pronounced salmon-pink. Coremial strands of mycelium were numerous and darker in colour than the mass. All three types of spores were produced.

12. Alkaline potato (soaked in 1 % sodium carbonate, rinsed, and boiled in distilled water).—The growth was not so dense as in Nos. 10 and 11, but micro- and macroconidia were found in plenty and a faint pink colour was developed. Chlamydospores were formed later.

13. Normal rice paste (boiled in distilled water).—Growth was immediate and copious. Spores were very numerous; the macroconidia measured up to 30μ long after three days. Later the prevailing colour was pale pink. The colour became deeper and towards the edges of the areas of growth shaded through salmon-pink into a pale orange. Strands of mycelium were common, as in No. 11. Spore formation continued to be profuse, and chlamydospores were numerous after two months.

14. Acid rice paste (a few drops of 5 % hydrochloric acid added to a small quantity of rice moistened with distilled water). —There was no difference between this culture and No. 13 save that the colour did not become so deeply red.

15. Alkaline rice paste (a few drops of a saturated solution of sodium carbonate added to a small quantity of rice as in No. 14). —The growth was not so profuse as in Nos. 13 and 14, and the colour was slightly paler than that of No. 14.

16. Boiled tapioca paste.—Growth was slow. Only one small, pinkish area of mycelium-bearing microconidia was noted.

The fungus had already been grown on banana plugs, prune agar, glucose, meat-extract agar, French-bean agar, rice agar and sterilised hypocotyls of cashew nut seedlings, and its general characteristics in these cultures have already been reported. Small differences between the cultures of Butler and the special cultures existed, *e.g.*, in the mycelial colours of Nos. 3, 4, and 5, in the formation of macroconidia in No. 5, in the lack of spores in No. 8, in the growth and formation of chlamydospores that took place in No. 9, in the occurrence of growth in concentric raised lines in Butler's standard solution and asparagin culture whereas the same formation occurred only in the standard solution and saccharose culture, and in the absence of the pink colouration of the sclerotoid bodies which Butler noted in his acid potato and plantain cultures. With regard to sclerotoid bodies, similar stromata consisting of pseudo-parenchyma were formed in a prune agar tube culture after eight months, but they were of a dull grey-pink rather than a pure pink colour. They gave rise to conidiophores bearing microconidia, and chlamydospores were associated with them in great numbers.

Van der Bijl noted the formation in culture of what he called wart-like bodies during his study of the same *Fusarium* on carnations,* but he said nothing about their having any apparent function. Coremial strand mycelial formation is not a constant character, but it occurred in Butler's and the present cultures although on different media. As for the diagnostic characters on which Dr. Butler lays stress, the bacterial-like surface streaks already mentioned were very evident, and the colourations were practically alike. The colour differences mentioned in Nos. 3, 4, and 5 do not seem worthy of weight, despite the present tendency to lay stress on cultural colours, for it was found in these studies that salmon-pink or a shade of yellow or cream might be associated with spore formation. In any case, a certain amount of all-round variation must be allowed for, so long as it is impossible to reproduce the exact environmental conditions employed by another worker at another time. Similarly, the differences noted in Nos. 5, 8, 9 and 2 have little or no importance when regarded as possible specific distinctions.

Morphologically, the *Fusarium* under investigation and *Fusarium udum* are identical in most points. Microconidial formation takes place early and is remarkably copious. The conidiophores may be simple (fig. 12) or whorled; the former

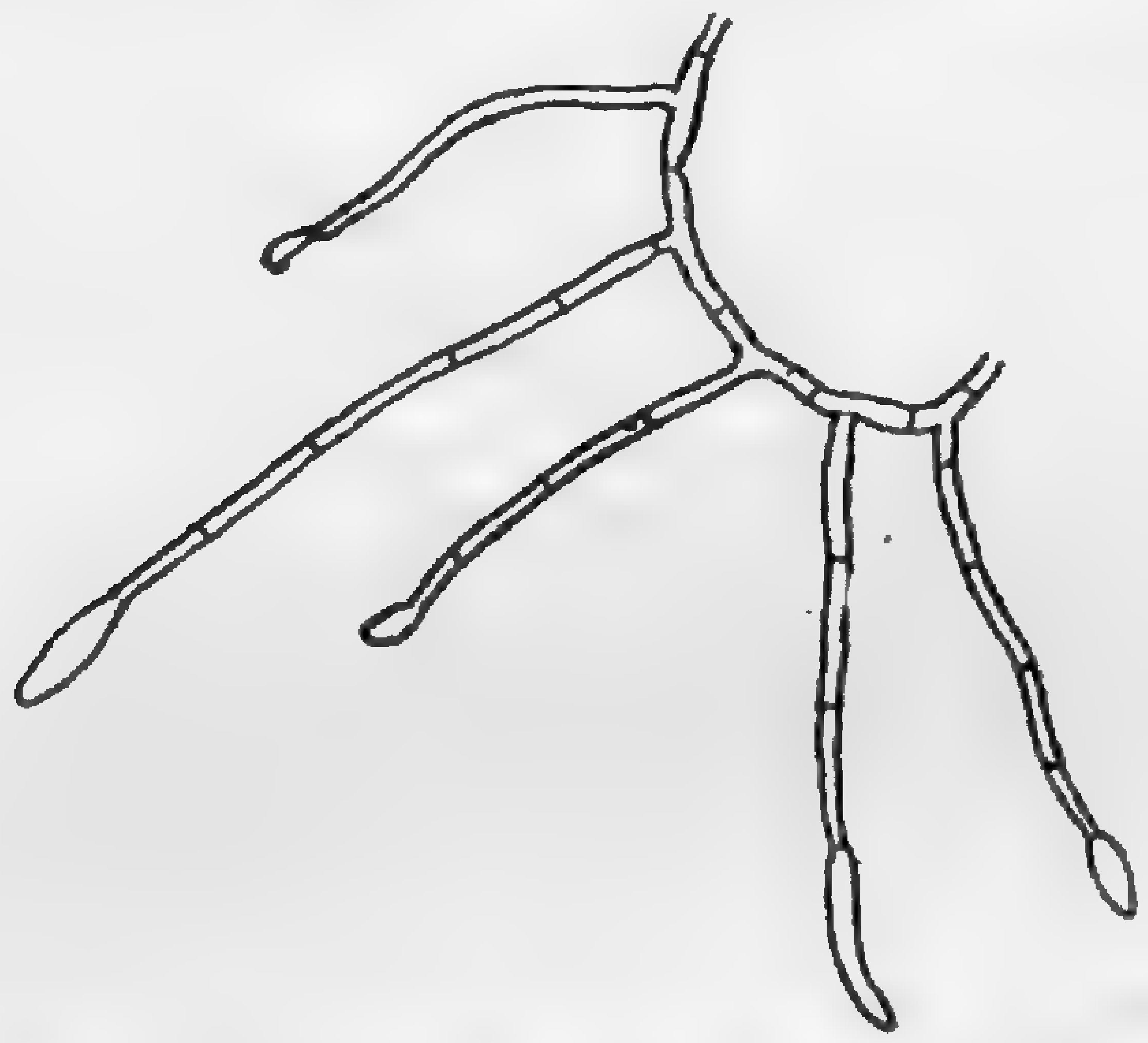

Fig. 12. Simple conidiophores arising from creeping mycelium in a boiled rice culture, 3 days (cashew nut), × 500.

were by far the more common; the latter were found in greatest abundance in the normal rice and acid potato cultures, as also were the characteristic bundles of microconidia (fig. 13). There occurred frequently an intermediate form of conidiophore in which the main axis of the simple conidiophore of fig. 12 gave rise to short lateral branches each bearing a conidium. The surfaces of all slant cultures became and remained moist with masses of spores. The microconidia germinated readily in hanging-drops of distilled water and gave rise to one or two stout filaments which took their origin from the ends of the conidium and were observed to produce only further microconidia

* *loc. cit.*, p. 276.

or chlamydospores. The *Fusarium* conidia, if they were formed, appeared fairly late, and were three- to five-septate. They were abjuncted before they were fully mature. Measurements have been

Fig. 13. Characteristic bundles of macroconidia from a cashew nut twig culture, 6 days. To the right is a younger stage of the same from an acid potato culture, × 500.

given. The three septate were, as a rule, more straight, shorter, broader in proportion, and more numerous than the five-septate spores. The larger multi-septate conidia have already been referred to. They were found only seldom, and they evidently did not occur in Butler's fungus. Such out-sized conidia are known to occur at times in species of *Fusarium* both in nature and in culture. Macroconidial production was noted only on single conidiophores. Conidial germination, as already described, corresponded with that of Butler's fungus, but there did not seem to be any difference in the chlamydospores or in the methods of their formation in culture. The morphological and cultural differences do not seem to justify the separation of the Uganda *Fusarium* from *F. udum*, and there is no doubt in the writer's mind that a careful comparison of Dr. Butler's details with the notes in this paper on the earlier cultures and the later special cultures will admit of the provisional reference of the Uganda *Fusarium* to *Fusarium udum*.

The second part of the special work undertaken to establish the exact identity of the *Fusarium* consisted of infection experiments with the Indian host of *F. udum*. Numerous seeds of pigeon-pea were sown in soil from which had been derived wilted cashew nut seedlings and which was presumably infected with the *Fusarium*, and in the laboratory tins of similar soil were inoculated with the *Fusarium* and afterwards sown with pigeon-pea. The laboratory experiments gave entirely negative results although they were repeated several times, but the plants grown in infected soil in the open contracted a wilt and died. The working of the fungus was slow, for the time which elapsed between the sowing of the seed and the deaths of the plants was eight to nine months. The percentage of deaths at the time of writing was fifty, but there were indications that more of the plants were in process of wilting. The symptoms of the disease of pigeon-pea were similar to those described from India, and the *Fusarium* was recovered from all the diseased plants and grown in culture. It was typical of former growths with cream-yellow and pink colouration, numerous microconidia, and macroconidia measuring when three-septate up to 30μ, and when five-septate up to 52μ long. Thus further evidence of the identity of the Uganda fungus with *Fusarium udum* was obtained, and it remains to add to the original diagnosis that the *Fusarium* has been found in South Africa on carnations and in Uganda on carnations, *Nigella*, *Delphinium*, *Cosmos* and cashew nut seedlings. Its occurrence on silky oak, rose apple and loquat seedlings and on *Antirrhinum* plants in association with *Heterodera radicicola*, Greef, has also been discussed. In those cases, the fungus may be said to be a facultative rather than an obligate parasite, and their study throws a little light on the conditions under which the *Fusarium* may pass from a purely saprophytic condition in the soil to one of parasitism, or on the conditions under which the original strain may give rise to new types under natural conditions. There is need for a closer study of the variations in the morphology and pathogenicity of the various strains of the *Fusarium* and for the pursuit of its higher forms, and it is hoped that further work will succeed in clearing up several points that are at present obscure.

XLIII.—A CONTRIBUTION TO THE FLORA OF THE NEARER EAST.

W. B. TURRILL.

Several small but interesting collections of plants from various parts of the Nearer East have been received recently at Kew. These have now been worked out and the specimens added to the Kew Herbarium. Since some of the plants have been collected in areas whose flora is almost unknown, it has been considered advisable to publish a list of species and localities, as a contribution to our knowledge of plant distribution in the area of the Nearer East—a convenient phrase which has been borrowed from Dr. Hogarth. The following particulars regarding the collections mentioned in this paper may be given here in tabular form :—

Lt. Col. F. R. Durham, O.B.E., M.C.*	34	Gallipoli, Macedonia, Asia Minor, Palestine.
Major G. W. Harris†	31	Greek Macedonia.
Mr. H. G. Butcher‡	11	Island of Lemnos.
Miscellaneous	5	Greek Macedonia.

* Director of Works, Imperial War Graves Commission.

† We are indebted to Major G. W. Harris for nearly 500 specimens of Macedonian plants, most of which have been quoted in the *Kew Bull.*, 1918, Nos. 8–9. Major Harris went through the Salonika campaign as an officer in the R.A.M.C.

‡ Mr. H. G. Butcher was formerly a student-gardener at Kew. During the war he served in the Navy, and whilst on patrol work in the Ægean Sea he visited Lemnos and brought away with him the plants mentioned in this list as collected by him.

Very little indeed is known of the flora of Gallipoli and it was not surprising to find in Col. Durham's collection several plants new to Europe and one species new to science (*Astragalus Durhamii*). It is hoped that further collections from the peninsula will be received next year.

The island of Lemnos was visited by Sibthorp and an account of his visit will be found in the Memoirs Relating to European and Asiatic Turkey and other Countries of the East, Edited from Manuscript Journals by Robert Walpole, M.A., 2nd ed., London, 1818. Plants collected by Sibthorp in Lemnos are quoted in his Florae Graecae Prodromus and in the Flora Graeca Sibthorpiana.

The Rev. H. F. Tozer also visited Lemnos, but though a small collection of plants collected by him in the Nearer East is preserved at Kew (*Kew Bull.*, 1920, p. 29), no plants collected in this island are contained in it. In his book The Islands of the Ægean, chapters xii. and xiii., there is an interesting account of the island with many references to older authors. The entire absence of trees, with the exception of a few fig-trees and other fruit-trees, is especially commented upon as giving the scenery an aspect of great desolation, though the soil is very fertile in many parts. The flora of the other islands of the Northern Ægean, with the exception of that of Imbros, is much better known. Dr. A. von Degen in the Oesterr. Bot. Zeitschr. 1891, pp. 301, 329, has given a valuable account of the flora of Samothrace and Halácsy (l.c. 1892, p. 412, 1893, p. 1) and Bornmüller (l.c. 1894, pp. 124, 173, 212) have dealt with the flora of Thasos. An interesting description of Imbros with a general account of the vegetation is given by Capt. A. G. Ogilvie in the Geographical Journal for August, 1916, p. 130.

Systematic List.

Anemone pavonina, *Lam.*, var. **purpureo-violacea,** (*Boiss.*) *Hal.*

Greek Macedonia: neighbourhood of Jera Karu (between Mt. Hortiach and Lake Langaza), *Harris* 425.

The plants often included under the Linnean name *Anemone hortensis* show a wide, and, with a sufficiency of specimens, a continuous range of variation. Most authors distinguish two extreme groups variously considered as species, subspecies, or varieties, namely *A. pavonina*, Lam., and *A. stellata*, Lam. However, variations of these have been named and described and certainly all kinds of intermediates exist, whatever may be their actual status. The specimen quoted above (*Harris* 425) has exceptionally broad obovate sepals. Specimens quoted previously by the writer as *A. stellata*, Lam., are now considered as mostly intermediates between typical plants of this species or subspecies (Briquet) and *A. pavonina*, Lam.

Helleborus cyclophyllus, *Boiss.*

Greek Macedonia: neighbourhood of Jera Karu, *Harris* 424.

Nigella arvensis, *L.*
Island of Lemnos : Mudros, *Butcher.*

Delphinium halteratum, *S. et S.*
Greek Macedonia : Struma Valley, *Durham* 1.

Paeonia peregrina, *Mill.* (*P. decora*, Anders., see Bot. Mag. t. 8742).
Greek Macedonia : mountains near Lake Doiran, *Durham* 2.

Glaucium corniculatum, *Curt.*, var. **rubrum,** *S. et S.*
Gallipoli : Suvla Bay and coast generally, in patches. Flowers reddish orange, *Durham* 3.

Hypecoum grandiflorum, *Benth.*
Greek Macedonia : neighbourhood of Jera Karu, *Harris*, 447.
Island of Lemnos : Mudros, *Butcher.*

Matthiola tricuspidata, *R. Br.*
Asia Minor : Nagava, sea shore. Very sweet smelling, *Durham* 4.

Cardamine graeca, *L.*
Greek Macedonia : neighbourhood of Jera Karu, *Harris* 441, 442.

Erophila verna, *L.*
Greek Macedonia : neighbourhood of Jera Karu, *Harris* 422, 450.

Lepidium spinosum, *L.*
Island of Lemnos : Mudros, *Butcher.*

Capparis sicula, *Duh.*
Gallipoli : Anafarta and Cape Hellas. Thorny, trailing habit, flowers white fading to bluish purple, *Durham* 5.

Dianthus pubescens, *S. et S.*, var. **glandulosopubescens,** *Hal.*
Island of Lemnos : Mudros, *Butcher.*
This species occurs in Attica and Eubœa and is also recorded from several places in the Peloponnesus. The variety, which is distinguished by the glandular-pubescent calyx, was described from a plant collected on Mt. Pateras in Attica.

Dianthus tenuiflorus, *Griseb.*
Greek Macedonia : neighbourhood of Jera Karu, *Harris* 444.

Hypericum olympicum, *L.*
Greek Macedonia : near Lake Doiran, *Durham* 6.
Island of Lemnos : Mudros, *Butcher.* A dwarf form.

Althaea cannabina, *L.*
Greek Macedonia : near Lake Doiran, *Durham* 7.

Linum flavum, *L.* (sensu lato).
Palestine : near Jerusalem, orange yellow flowers, *Durham* 8.

Linum tenuifolium, *L.*
Greek Macedonia : neighbourhood of Jera Karu, *Harris* 446.

Geranium lucidum, *L.*

Greek Macedonia: neighbourhood of Jera Karu, *Harris* 443.

Erodium cicutarium, *L. Her.*

Greek Macedonia: neighbourhood of Jera Karu, *Harris* 449.

Haplophyllum Buxbaumii, *Poir.*

Gallipoli: Cape Hellas, sandy sea beach. Bright light orange yellow flowers, *Durham* 9.

Paliurus Spina-Christi, *Mill.*

Gallipoli: fairly frequent. Bright yellow inflorescences and very attractive light fresh green foliage, much eaten by insect life, *Durham* 10.

Trifolium hirtum, *All.*

Greek Macedonia: grown from seed collected near Paprat, on the southern slopes of the Krusa Balkan, by *J. M. Russell*, 1918. Flowered at Richmond, Surrey, August 1920.

Astragalus Durhamii, *Turrill* (Leguminosae-Galegeae); *A. ajubense*, Bge., valde affinis sed foliolis saepissime minoribus, vexillo elliptico-ovato latiore differt.

Caules glabri, leviter longitudinaliter costati, teretes. *Folia* caulina usque ad 1·7 dm. longa, glabra vel fere glabra, pinnis circiter 30 elliptico-lanceolatis vel oblongo-lanceolatis apice obtusis saepe breviter apiculatis basi rotundatis petiolulatis petiolulis 1 mm. longis costa in pagina utraque prominente nervis lateralibus in pagina superiore impressis in pagina inferiore prominentibus; stipulae lanceolatae, apice attenuatae, usque ad 2·7 cm. longae, interdum pilis albis longis paucis instructae. *Inflorescentiae* axillares, multiflorae, globosae; pedunculi usque ad 5·5 cm. longi, pilis albis paucis dispersis praediti; bracteae lineari-lanceolatae, apice attenuatae, circiter 1 cm. longae, margine longe albo-ciliatae. *Calyx* longe albo-pilosus, tubo 9 mm. longo, dentibus lineari-acicularibus usque ad 9 mm. longis inter se subaequalibus. *Corolla* intense lutea, vexillo 2·2 cm. longo, lamina late elliptico-ovata apice leviter emarginata 1·5 cm. longa 1·2 cm. lata, alis 2·1 cm. longis 4 mm. latis, carina 2·1 cm. longa 6 mm. lata basi filamentorum tubo distincte adnata. *Filamenta* glabra. *Ovarium* longe denseque albo-pilosum; stylus inferne pilis albis dispersis instructus.

Gallipoli: fairly distributed. The plant grows about 3 feet high and has very handsome, deep yellow flowers and beautiful foliage, *Durham* 11.

The species of *Astragalus* described above belongs to a small group whose known distributional area has not hitherto included Europe. The affinity of our plant with the *A. ajubensis* of Bunge is undoubtedly very close. Indeed, a large series of specimens might make it advisable to consider them conspecific. At present *A. ajubensis* is known with certainty only from Mt. Ajub near the ruins of Persepolis in Southern Persia. The section *Alopecias*, to which our plant belongs, consists of two series, *A. Durhamii* being placed in the *Ebracteolati*, and in the subseries *Megalotropi*.

In this subseries it is further delimited by its globose and long peduncled inflorescences. From species, other than *A. ajubensis*, with similar characters (e.g., *macrocephalus*, *finitimus*, *hamadanus*) it is easily distinguished by its indumentum, the shape and teeth of the calyx and the details of corolla structure. The nearest affinity with a species occurring in Europe is that with *A. ponticus*, Pall., from which it differs in its glabrous stems and nearly glabrous foliage, its long peduncle, linear-acicular calyx teeth which are subequal and approximately as long as the calyx-tube, the larger corolla and broader vexillum, and in the lamina of the carina being broader than that of the wings.

Astragalus macedonicus, *Heldr. et Char.*

Greek Macedonia: Kireckoj, north of Salonika, *Durham* 12: neighbourhood of Jera Karu, *Harris* 438.

Hedysarum varium, *Willd.*

Gallipoli: only seen at Byick Tepe, Ulgar Dere. A very beautiful plant with lemon yellow flowers with deeper orange and purple blotches, *Durham* 13.

This is apparently a species new to Europe. It is widely spread through Asia Minor, from Bithynia and Lydia, to Transcaucasia and Mesopotamia.

Vicia dasycarpa, *Ten.*

Greek Macedonia: grown from seed collected on the southern slopes of the Krusa Balkan, probably near Paprat, by *J. M. Russell*, flowered at Richmond, Surrey, July 1920.

Vicia grandiflora, *Scop.*

Greek Macedonia: neighbourhood of Jera Karu, *Harris* 440.

Orobus sessilifolius, *S. et S.*

Greek Macedonia: neighbourhood of Jera Karu, *Harris* 436.

Potentilla micrantha, *Ram.*

Greek Macedonia: neighbourhood of Jera Karu, *Harris* 439.

Saxifraga graeca, *Boiss. et Heldr.*

Greek Macedonia: neighbourhood of Jera Karu, *Harris* 437.

Turgenia latifolia, *Hoffm.*

Greek Macedonia: neighbourhood of Jera Karu, *Harris* 434.

Valerianella olitoria, *Poll.*

Greek Macedonia: neighbourhood of Jera Karu, *Harris* 432.

Doronicum caucasicum, *M.B.*

Greek Macedonia: neighbourhood of Jera Karu, *Harris* 433.

Calendula arvensis, *L.*

Island of Lemnos: Mudros, *Butcher.*

Specularia pentagonia, *DC.*

Gallipoli: fairly frequent in dry valleys and on dry slopes. Creeping rather than erect, with bright mauve flowers, *Durham* 14.

Statice sinuata, *L.*

Island of Lemnos: Mudros, *Butcher.*

Erythraea Centaurium, *L.*
Greek Macedonia : neighbourhood of Jera Karu, *Harris* 421.

Symphytum bulbosum, *Schimp.*
Greek Macedonia : near Jera Karu, *Harris* 419.

Myosotis collina, *Hoffm.*
Greek Macedonia : near Jera Karu, *Harris* 453.

Lithospermum purpureocœruleum, *L.*
Greek Macedonia : neighbourhood of Jera Karu, *Harris* 420.

Echium plantagineum, *L.*
Island of Lemnos : Mudros, *Butcher.*

Verbascum Blattaria, *L.*
Greek Macedonia : grown from seeds collected to the south of Karamudli, June 29th, 1917, flowered at Richmond, Surrey, May 27th, 1920, *Turrill* (seed-number) 65.

One interesting morphological fact concerning the specimens quoted above seems worth recording. In one plant the lowest flower of the raceme, or apparent raceme, and the first to open, possessed only four stamens, all fertile, with no trace of the adaxial fifth. The remaining flowers, which opened later, possessed each five stamens, with the adaxial one frequently shorter and with a smaller anther.

The genus *Celsia* is closely related to the genus *Verbascum* and the only generic difference is in the number of the stamens, five in *Verbascum* and four in *Celsia*. The sections *Blattariae* and *Blattarioidea* (sensu Boissier, Fl. Or. iv.) of *Verbascum* consist of species having the same racemose, or apparently racemose, type of inflorescence as that found in the genus *Celsia*. It is also interesting to note that both genera show two similar divergent groups, the one with all the stamens having their anthers reniform and mediofixed, the other with the anthers of two of the stamens adnate-decurrent, and the anthers of the remainder reniform and mediofixed. It is probable that the existing classification which separates the two genera solely on the number of fertile stamens is very artificial.

Celsia Daenzeri, *Fauché et Chaub.*
Greek Macedonia : plants grown from seed collected near Salonika, received from the Rev. Canon Fowler and Miss A. Taylor, 1920.

This species extends from Messenia and Laconia to Macedonia. Halácsy (Conspect. Fl. Graec., ii., p. 397) quotes a specimen collected in Thessalia : prope Malakasi in Pindo (Sintenis it. thessal. n. 632), as *Celsia Boissieri*, Heldr. et Sart. In the Kew Herbarium the specimen under this number is *Celsia Daenzeri*, Fauché et Chaub., and not *C. Boissieri*, Heldt. et Sart., of which species the writer has seen authentic specimens only from Attica.

Digitalis lanata, *Ehrh.*
Gallipoli : white and brown flowers, *Durham* 15.
Greek Macedonia : cultivated from seeds, *J. Anderson.*

Trixago Apula, *L.*
Gallipoli : fairly frequent and grows in masses, *Durham* 16.

Orobanche Mutelii, *F. Sch.*
Gallipoli : Kelia, light " Cambridge-blue " flowers, *Durham* 17.

Vitex Agnus-castus, *L.*
Gallipoli : from the region by the British Cemeteries, *Durham* 18.

Thymus atticus, *Celak.*
Gallipoli : not frequent, white flowers, *Durham* 19.

Thymus capitatus, *Hoffm. et Lk.*
Gallipoli : from the region by the British Cemeteries, *Durham* 20.
Island of Lemnos : Mudros, *Butcher.*

Prunella alba, *Pall.*
Greek Macedonia : near Lahana, on roadsides, *Durham* 21.

Stachys angustifolia, *M.B.*
Greek Macedonia : Lahana, *Durham* 22.

Stachys italica, *Mill.*, forma.
Island of Lemnos : Mudros, *Butcher.*
This plant has not been exactly matched. It comes nearest to plants from Southern Bulgaria which belong to *Stachys italica* in a broad sense. The *italica-germanica* group of the genus *Stachys* is represented in the Eastern Mediterranean by a host of small species which are very often connected together by intermediates. On a provisional classification which has been worked out for the Balkan Peninsula material at Kew the Lemnos plant is regarded as a form of *S. italica*, Mill., sensu lato.

Ballota acetabulosa, *Benth.*
Island of Lemnos : Mudros, *Butcher.*

Teucrium Polium, *L.*
Gallipoli : all over the lower regions. It frequently grows in very neat bushes, *Durham* 23.

Thymelaea tartonraira, *All.*
Gallipoli : from the region by the British Cemeteries, *Durham* 24.

Euphorbia apios, *L.*
Greek Macedonia : neighbourhood of Jera Karu, *Harris* 423.

Quercus coccifera, *L.*
Gallipoli : from the region by the British Cemeteries, *Durham* 25.

Cephalanthera rubra, *Rich.*
Gallipoli : Byick Tepe, Ulgar Dere, about 900 feet altitude, on a dry spot, *Durham* 26.

Orchis hircina, *Crantz.*
Greek Macedonia : neighbourhood of Jera Karu, *Harris* 427.

Orchis romana, *Seb.*
Greek Macedonia: neighbourhood of Jera Karu, *Harris* 426, 430.

Ophrys mammosa, *Desf.* (*O. atrata*, Lindl.).
Greek Macedonia: neighbourhood of Jera Karu, *Harris* 429.

Iris Reichenbachii, *Heuffel.*
Greek Macedonia: neighbourhood of Jera Karu, *Harris* 428.

Allium margaritaceum, *S. et S.*
Greek Macedonia: near Lake Doiran, *Durham* 27.

Allium maritimum, *Raf.*
Greek Macedonia: Kirechkoj, near Salonika, *Durham* 28.

Allium pulchellum, *Don.*
Greek Macedonia: Kireckoj, near Salonika, *Durham* 29.
Palestine: Gaza, *Durham* 30.

Allium rotundum, *L.*
Gallipoli: Suvla Bay, fairly frequent, 18 to 24 inches high, flower deep purple, *Durham* 31.

Muscari pyramidatum, *Vel.*
Greek Macedonia: neighbourhood of Jera Karu, *Harris* 431.

Ornithogalum pyrenaicum, *L.*
Gallipoli: fairly frequent, *Durham* 32.

Imperata arundinacea, *Cyril.*
Greek Macedonia: neighbourhood of Jera Karu, *Harris* 435.

Stipa pennata, *L.*
Greek Macedonia: Kireckoj, near Salonika, *Durham* 33.

Aegilops triaristata, *Willd.*
Gallipoli. *Durham* 34.

XLIV.—DUNN'S WATTLE.

Complete specimens of the remarkable Acacia known by the above name, and having phyllodes up to $1\frac{1}{2}$ feet long, have just been received at Kew from Mr. E. J. Dunn who discovered it in N.W. Australia. Mr. J. H. Maiden had previously described the tree as *A. sericata* A. Cunn. var. *Dunnii*, (Ewart and Davies, Flora of the Northern Territory, p. 336) and Mr. Dunn therefore sent leaves and pods of what he considered typical *A. sericata* to Kew for comparison with the supposed variety. The specimens received as *A. sericata*, however, prove to be different in their winged pods and glabrous phyllodes from Cunningham's type at Kew. They agree exactly with *A. platycarpa*, F. Muell. (Journ. Linn. Soc. III. p. 145) the type of which is also in the Kew Herbarium. Bentham placed the two together in his revision of the genus (Trans. Linn. Soc. XXX. p. 483) under the name of *A. sericata* which he described as having glabrous or puberulous phyllodes. The ripe fruit now received proves that there are two species, one with glabrous leaves and winged pods (*A. platycarpa*, F. Muell.) the other with puberulous leaves and obtuse-edged pods (*A. sericea*, A. Cunn.). Dunn's Wattle combines characters of both, having glabrous phyllodes and wingless pods. It constitutes in fact a distinct and very interesting species. A description of the plant is as follows :—

A. Dunnii, *Turrill*, sp. nov., affinis *A. platycarpae*, F. Muell. sed phyllodiis multo majoribus glandulis excurrentibus et leguminibus exalatis differt.

Arbor glauca, glaberrima, in ramos plures erectos simplices teretes 4-5m. altos basi 2-3 cm. diam. apice florigeros divisa. *Phyllodia* pendula, ovato-falcata, dimidiata, coriacea, lucida, 20-50 cm. longa, distanter adpresse serrata, apice obtusa, in petiolos breves angustata, 4-nervia, crebre reticulato-venosa, nervis cum margine confluentibus, glandulis marginalibus dentes terminantibus. *Capitula* flava, circiter 20-flora, paniculas 20-40 cm. longas caules terminantes formantia, 1-2 cm. diam., pedunculis 1-4-nis 1-2 cm. longis. *Flores* flavi, 4 mm. longi. *Calyx* in lobos 5 divisus, lobis 3 mm. longis ligulatis apice hirsutis incrassatis. *Corolla* calyce paullo longior, in lobos 5 oblanceolatos divisa. *Stamina* ∞, 4 mm. longa. *Legumen* oblongum, complanatum, falcatum, inter semina paullo contractum, suturis obtusum, exalatum, apice basique acutum, 9-11 cm. longum, valvis lignosis reticulato-venosis. *Semina* 12-14, transversa, 1.2 cm. longa, 5 mm. lata, brunnea, lucida, basi strophiolo breviter tecta, endocarpio membranaceo inclusa. *Acacia sericata*, A. Cunn., var. *Dunnii*, Maiden, in Ewart and Davies, The Flora of the Northern Territory, p. 336.

N.W. Australia.—From fissures in hard quartzite rock near Victoria River, Northern Territory; flowers May, fruit June, 1922. *E. J. Dunn*.

XLV.—MISCELLANEOUS NOTES.

Pear Wood.—The wood of *Pyrus communis, L.* and its cultivated varieties the garden pears, is rarely seen in quantity in merchants' yards and the reason is easily found, for trees are not cut in large numbers except at the clearance of old orchards, and even then they are often disposed of as firewood, not as useful timber. The trunks of well grown trees however, if sound, 8 inches and upwards in diameter and clear of branches for at least five feet, are worth offering for sale, while the trunks of some of the large perry pears from the orchards of Herefordshire, Worcestershire and Gloucestershire are valuable. The wood has very small pores and fine medullary rays, is heavy, firm, close grained, even in texture, and pinkish or pale reddish-brown, with little distinction in colour between sap-wood and heart-wood except in very old trees. It finishes with a very smooth surface in whichever way it is worked, hence its value for carving and turnery. The wood is also very popular for the manufacture of instruments and is widely used for T squares and set squares. Another use for the wood is the manufacture of camera shutters and for this purpose it is stained black. Treated in a similar way it is sometimes used as a substitute for ebony in the manufacture of cabinets and small fancy articles. The wood, however, requires very careful seasoning, otherwise it twists. As a rule persons who have a few trees to dispose of would do better by offering them to firms who specialise in cameras or scientific instruments rather than to a local timber merchant.

W. D.

The Douglas Fir Chermes.*—During the last few years foresters have been alarmed at the rapid spread of the Douglas Fir Chermes (*Chermes cooleyi*), and in view of the fact that closely allied insects make it difficult to cultivate certain silver firs and the Weymouth pine, the Forestry Commission decided to investigate thoroughly the life-history of the Douglas Fir Chermes, in order that an idea could be formed of the injury it is likely to cause. The work was entrusted to Mr. R. N. Chrystal, B.Sc., under the direction of Dr. Munro, the Commission's Entomologist, and by arrangement with the Director the laboratory work was conducted at Kew. *Chermes cooleyi* was imported into this country from Western N. America and Mr. Chrystal entered upon his investigations with previous knowledge of his subject as he has undertaken similar research work in Stanley Park, Vancouver, for the Canadian Entomological Service. The work was commenced in November and was continued throughout 1921 and the summer of 1922. The result of the 1921 work has just been published in bulletin form by the Forestry Commission, and both they and the author are to be congratulated upon the production of a very clear and well illustrated contribution to the life history of *Chermes cooleyi* in Britain compared with its more fully known life history in British Columbia. As is the case with other species of Chermes, *C. cooleyi*, in order to complete its life cycle, requires species of two different genera of trees, and in this case one is the Douglas fir (*Pseudotsuga Douglasii*), the other a Western N. American spruce preferably *Picea sitchensis*. In British Columbia all the stages of the life history of the insect are present, but in Britain the most injurious stage, which causes galls on *Picea sitchensis*, is absent, although other stages occur on that species. Fortunately the insect confines its depredations to the leaves, therefore there is much less injury caused than by allied species that attack young shoots and bark. Although the investigations are not

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* Forestry Commission Bulletin, No. 4, The Douglas Fir Chermes (*Chermes cooleyi*), 1922, price 2*s*. net. (Obtainable from H.M. Stationery Office, Imperial House, Kingsway, W.C. 2).

completed it would appear that they have gone far enough to warrant the investigator in concluding that the Douglas Fir Chermes is not causing very serious injury to its hosts in this country, and that it is not likely to have such a disastrous effect upon Douglas fir as was at one time feared. The bulletin indicates a vast amount of painstaking work and it has laid the foundation for what we hope will result in a complete investigation into the allied species that are so prevalent upon some of our trees. Such a work proves how necessary it is for science and practice to work hand in hand. The time of the practical forester is fully employed upon cultural work, he has not been trained to a critical knowledge of entomology neither has he time for organised research, therefore it is to the trained entomologist that he must turn for his knowledge of the life history of injurious forest insects and the necessary methods of control. On his side the economic entomologist should present his work in such a manner that it is easily understood by those responsible for the practical work of the forest and the suggested methods of control should be of a practical nature, and, whenever possible, such as may be put into practice by ordinary forest workmen. Such ideas seem to dominate the work of Dr. Munro and it is towards this end that he appears to have directed the work of Mr. Chrystal.

W. D.

List of Botanical Papers by the late Mr. J. R. Drummond.— The following list was held over from the obituary notice of the late Mr. J. R. Drummond which was published in *K.B.* 1921, p. 123.

On a new *Scirpus* from Baluchistan and certain of its allies. (Journ. Asiat. Soc. Bengal, lxxiii. pt. ii. pp. 137–148, 1904.)

Notes on *Agave* and *Furcraea* in India [with D. Prain]. (Bengal, Dept. Land Records and Agriculture, Bulletin 8, 1905, 195 pp., Calcutta, 1906; reprinted in The Agricultural Ledger, 1906, No. 7, pp. 77–271.)

The literature of *Furcraea* with a synopsis of the known species. (Report, Missouri Bot. Gard., 18, pp. 25–75, pl. 1–4, 1907.)

Chlamydites: a new genus of Compositae. (Kew Bulletin, 1907, pp. 90–92.)

Agave Wrightii, J. R. Drummond. (Bot. Mag. 1909, t. 8271.)

Agave lurida. [with references to other species, and a key to their identification]. (Kew Bulletin, 1910, pp. 344–349.)

Native habitat of *Aster Falconeri*. (Gard. Chron. 1910, xlviii, p. 2.)

The Grewias of Roxburgh. (Journal of Botany, 1911, pp. 329–337, 357–363.)

Saussurea Veitchiana, J. R. Drummond & Hutchinson. (Bot. Mag. 1911, t. 8381.)

Obituary notice of R. H. Beddome. (Proc. Linn. Soc., cxxiii. 1911, pp. 32–34.)

Agave disceptata, J. R. Drummond. (Bot. Mag. 1912, t. 8451.)

Asiatic species of Sageretia [Note]. (With T. A. Sprague.). (Kew Bulletin, 1914, p. 175.)

Miliusa and Saccopetalum (Family Anonaceae). (Journ. Indian Botany, i. pp. 162–168, 1920.)

A revision of *Isopyrum* (Ranunculaceae) and its nearer allies [with J. Hutchinson]. (Kew Bulletin, 1920, pp. 145–169, ff. 1–8.)

"In 1888 . . . Mr. J. R. Drummond, then Deputy Commissioner of Karnál, was invited to draw up a report on the Panjáb saltworks actually in use in the manufacture of barilla, and this was furnished to the Madras Government." (Watt, Commercial Prod. of India, p. 113.)

Several descriptions of new species in the Kew Bulletin.

Mr. Drummond presented to the Library the last ten volumes of the Journal of the Bombay Natural History Society.

In 1910 he presented a transcript of the lists of determinations, localities and other information, contained in Mr. J. F. Duthie's Field Books relating to the collections in the herbarium formed by Mr. Duthie for the Botanical Department of Northern India. This transcript fills 8 quarto volumes, each of about 300 pages, and was made under Mr. Drummond's supervision and entirely at his expense.

An Alpine A B C.*—This is a simple guide for the amateur and beginner in rock-gardening. It consists of some general introductory notes on the cultivation of rock and alpine plants, followed by an alphabetical list of species relatively easy to grow. Short notes regarding treatment and propagation are given for most species, together with the height of the plant and the colour of the flowers. W. B. T.

The Imperial Department of Agriculture, West Indies.—With the establishment of the West Indian Agricultural College at St. Augustine's, Trinidad (see *K.B.*, 1920, p. 81; 1922, p. 255), the headquarters of the Imperial Department of Agriculture have been transferred from Barbados to Trinidad.

It will be remembered that the Committee appointed by the Secretary of State for the Colonies to consider the advisability of founding an Agricultural College in the West Indies recommended that "an intimate relationship should be established between the Imperial Department of Agriculture and the Tropical Agricultural College" (see *K.B.*, 1920, p. 89); a proposal which met with the approval of the Secretary of State.

It was also recommended and approved that Sir Francis Watts, Imperial Commisioner of Agriculture, should become the first Principal of the new College and should continue to act as Imperial Commissioner.

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* An Alpine A B C and List of Easy Rock Plants, by A. Methuen. Methuen & Co., Ltd. London, 1922. 1*s.* 6*d.* net.

The Royal Botanic Gardens, Kew, have been so closely associated with the establishment of the Imperial Department of Agriculture since 1898 (see *K.B.*, 1898, pp. 234-237) when Dr. (now Sir Daniel) Morris, then Assistant Director of Kew, was appointed Commissioner, that we take pleasure in publishing the following copy of the letter from the Acting Governor of Barbados written to Sir Francis Watts, Principal and Commissioner of Agriculture, on the occasion of the transfer of the headquarters of the Imperial Department, following upon its amalgamation with the West Indian Agricultural College:—

"As your departure will mark the close of the long association of this Colony with the Headquarters of the Imperial Department of Agriculture, I cannot let the occasion pass without an expression of regret at the termination of this association between the Colony and a Department whose work has been a landmark in the history of the West Indian Colonies. I beg also to be allowed to express the cordial gratitude of the Government of Barbados for the valuable and ready assistance which the Imperial Department has rendered the local Government on numerous occasions, as well as for many personal courtesies from yourself. In bidding farewell to the Imperial Department, may I also assure you of the warm good wishes of the Barbados Government for the success and prosperity of the Agricultural College in which the Department will now be merged, and of our confident hope that the establishment of the College will prove to be a great step forward in the development of scientific tropical agriculture not only in the West Indies but also in a wider field."

The West Indian College was opened on October 16th by Sir Samuel Wilson, Governor of Trinidad and Tobago. Eighteen students have been enrolled, three being post-graduates.

Museum No. 4.—The Forestry needs of the Empire so clearly demonstrated at the British Empire Forestry Conference in 1920 and more particularly the critical stage reached in deforestation in the British Isles as a result of the demands for timber during the war, have directed attention to the urgent necessity of providing for the future timber supply in the British Isles. The public generally have very little conception of the problems connected with British Forestry and but limited opportunity of becoming acquainted with them. Visitors to Kew are afforded in Museum No. 4, an opportunity of studying the diversity of problems which are embraced under "Forestry." For the majority such visits to a museum are their only means of obtaining a knowledge of the subject, and it is for this reason that this comprehensive collection of British Forestry exhibits has been got together. The collection contains specimens typical of British grown timber; many examples of the almost unlimited uses to which home grown timber is put in every-day life and exhibits of the various stages of manufacture of the articles made from timber; examples of the principal fungus and insect pests that demand the forester's attention, and photographs of forest scenery and individual trees. Descriptions of the exhibits are provided in an Official Guide which has been prepared more with the idea of providing a text-book than a mere catalogue. The Guide was published in 1919 at 2*s.*, but the Controller of H.M. Stationery Office recognising that full information about the collections should be made available to as large a section of the public who visit Kew as possible, has agreed that the Guide may now be sold at 1*s.* The price of the Official Guide to Museum No. 1 is also 1*s.*, that of Museum No. 2, 6*d.*, and the Catalogue of Portraits of Botanists, 6*d.*

The University Botanic Garden, Cambridge.*—A systematically arranged list of the plants growing in the University Botanic Gardens, Cambridge, has recently been published, which contains many interesting notes on their history, habits, and economic uses. The distribution and chief points of the more important genera are given and well reproduced plates accompany the more interesting and important species. A key plan to the Gardens is provided, with references to the page on which the description of the plant occurs, and by it a visitor can easily find any particular plant or genus. The botanical explanations provided in the Introduction, Glossary, and Notes on Leaves permit the book being used by those not intimately acquainted with botanical terminology, whilst an alphabetically arranged Index assists those unfamiliar with the systematic arrangement adopted.

Botany of Bihar and Orissa.†—We welcome Pt. 4 of Mr. Haines' Botany of Bihar and Orissa. It is paged 419-754 and completes the account of the flora up to the end of *Labiatae.* Pts. 2 and 3 have already been issued Pt. 3 this year, Pt. 2 last. Pt. 1, which will appear later, is reserved for the "Introduction and General Remarks on the Botany of the Province." The size is small 8vo. The order of families adopted in the Flora of British India has been followed in the main, but a few exceptions will be found as noted on p. 1 (Pt. 2), e.g., the *Euphorbiaceae* are described immediately after *Tiliaceae.* The book is remarkably well printed. This makes the use of rather small type not only unobjectionable but actually useful, for it enables a large quantity of information to be included. Keys for each family and each genus have been drawn up on a simple plan made possible by the author's intimate acquaintance with the living flora. In addition to the information thus given a short description of each species is added, with supplementary notes in smaller type printed below as in the Flora of British India.

S. T. D.

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* Guide to the University Botanic Garden, Cambridge, by H. Gilbert-Carter, Director of the Garden. Camb. Univ. Press, 1922.

† Botany of Bihar and Orissa, Part IV., by H. H. Haines, C.I.E., F.C.H., F.L.S. Adlard & Son & West Newman, Ltd., London, 1922, Rs. 13 As. 8.

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ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 10] [1922

XLVI.—EFWATAKALA GRASS.

(*Melinis minutiflora*, Beauv.)

An interesting discovery that may prove of economic importance was reported by Mr. M. T. Dawe when, in 1921, he made an agricultural survey of Angola. The subject of stock raising has always proved difficult in western Tropical Africa and Mr. Dawe was consequently devoting much of his attention to this object. In the course of his travels he noticed a grass which was sought after by domesticated animals for fodder and yet at the same time appeared to be inimical or at any rate distasteful to the tsetse fly, a scourge against which little headway has so far been made in West Africa. This grass Mr. Dawe recognised as being similar to, if not identical with, the "Gordura" of Brazil or the "Yaragua" fodder grass of Colombia, in which country he had had practical experience of its utility for fattening stock.*

In both South American countries it is considered an excellent green fodder and appears to have the further property of being distasteful to ticks probably owing to the volatile oil exuded by the hairs on its leaves.

A previous notice of this grass appeared in *Kew Bull.*, 1900, p. 31, where, under the heading of "Brazilian Stink Grass" its introduction to the Botanic Gardens, Sydney, with a view to its distribution as a fodder grass, is described. It had been hoped that its property of supplanting forest and scrub by its thick mat-like growth would render it as valuable to Australia as it had proved in South America, but no further reports have come to hand as to any experiments which may have been made.

The specimens from the Lower Congo, submitted to Kew in 1921 by Mr. Dawe under the African names of "Lakamboma" or "Efwatakala," the latter name being in more general use inland, were determined as *Melinis minutiflora*, f. *inermis*. From the field notes accompanying the collections the grass is shown to be widely distributed in Portuguese Congo, not only on the plains but more especially on the higher ground from 2500 to

* For comparative analysis as a fodder *see* Bull. Imp. Inst. Vol. XX, No. 3, p. 300.

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3000 ft. altitude. Some collectors report that its presence can be detected at once by the characteristic odour emitted, which is not unpleasant, other collectors state that they have always detected it first by sight, whilst in one report the odour of the grass, when grown in any quantity, is stated to be so offensive that human beings cannot live near it.

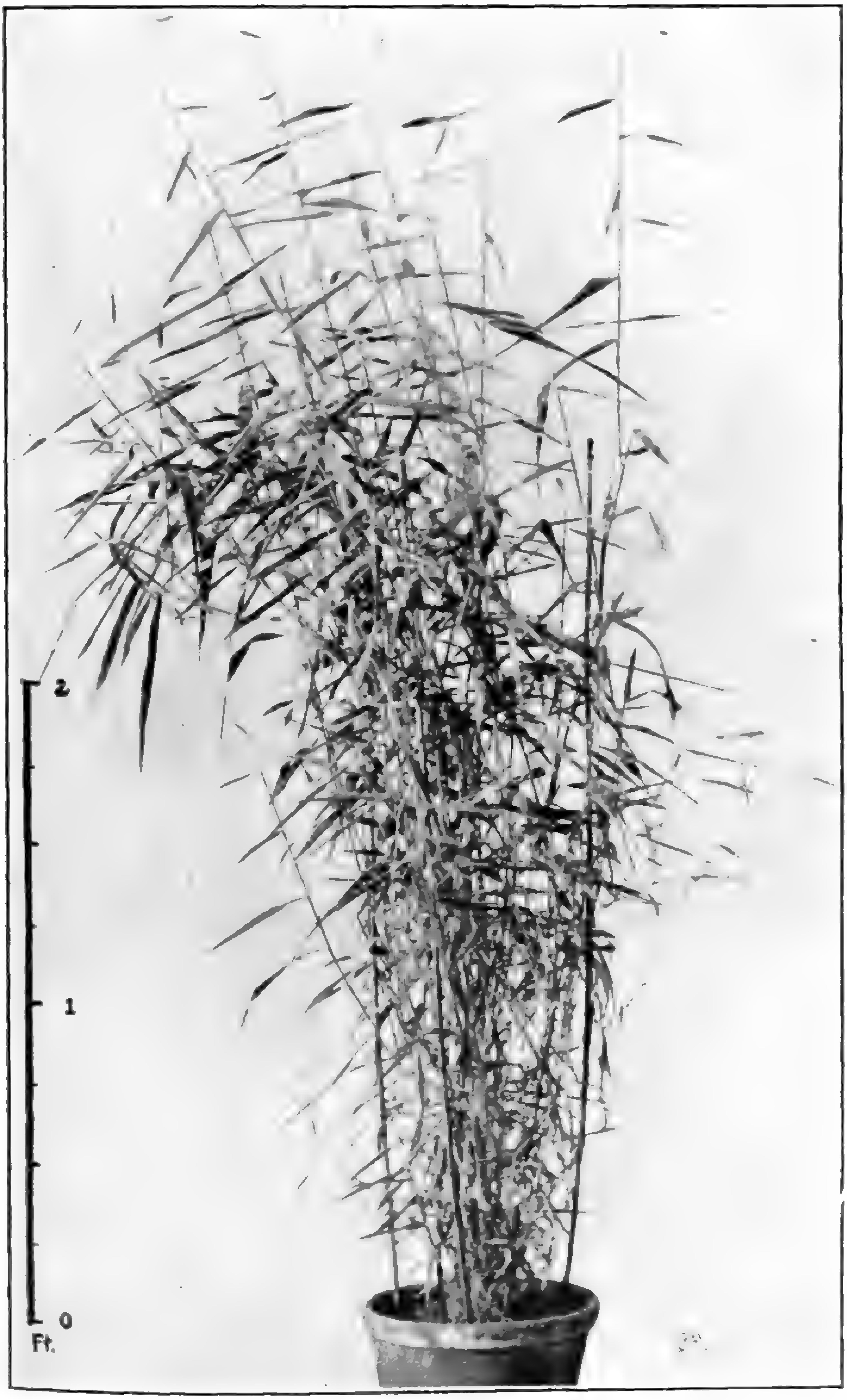
It is found growing with other and coarser grasses in virgin country, but on abandoned farm land Efwatakala rapidly spreads and establishes itself almost to the exclusion of all other vegetation. There seems no doubt that horses, mules and cattle prefer this grass, especially when it is young and tender, to the other grasses growing in association with it. In Angola from October to the end of May it forms an excellent pasture, and Mr. Dawe reports that in August, which is the dry season, it is often the only grass that retains its verdure on open and exposed dry lands.

But apart from this grass providing a pasturage, Mr. Dawe considers its bearing on the tsetse fly problem to be of even more importance, and it is mainly on this account that it has seemed desirable to give as full an account of it as possible in the *Bulletin*. He fully appreciates that it would not be a practical proposition to recommend dealing with heavily wooded areas or swamp forest, but in those areas which are less heavily wooded, the removal of scrub and trees and the initial planting of the grass will enable it to establish and maintain itself naturally in almost pure stretches. Such districts are found in the uplands of San Salvador do Congo, Canda and Damba, and there there would seem to be a definite possibility for converting fly-infested areas to cattle raising lands of first importance. There are suitable areas in Nigeria, the Gold Coast and Sierra Leone which, could the tsetse fly be eradicated, would enable the cattle industry to be developed to an important degree, not only as regards local consumption, but also in supplying steamers and even an export trade to Europe, whilst the employment of horses in areas, where they cannot live at present, would assist in the difficult problem of internal transport.

The method advocated for introducing Efwatakala is through a rotation of maize, cotton, beans or groundnuts, after which a sowing of the grass will enable it to be established; isolated trees and palms need not be cleared but the grass could be sown around them.

That the natives of the Portuguese Congo have a knowledge of its insecticidal and preventive properties is shown by their practice of making nests for their sitting fowls and using it as bedding for dogs when about to give birth to young, as it prevents the fowls and dogs being attacked by fleas. They also use the fresh grass for cleaning their clothes made from the fibre of the Raphia palm. In South America, as has been stated above, the grass is known to be repugnant to ticks, and cattle fed on this grass are reported to be much less subject to ticks although

PLATE I.

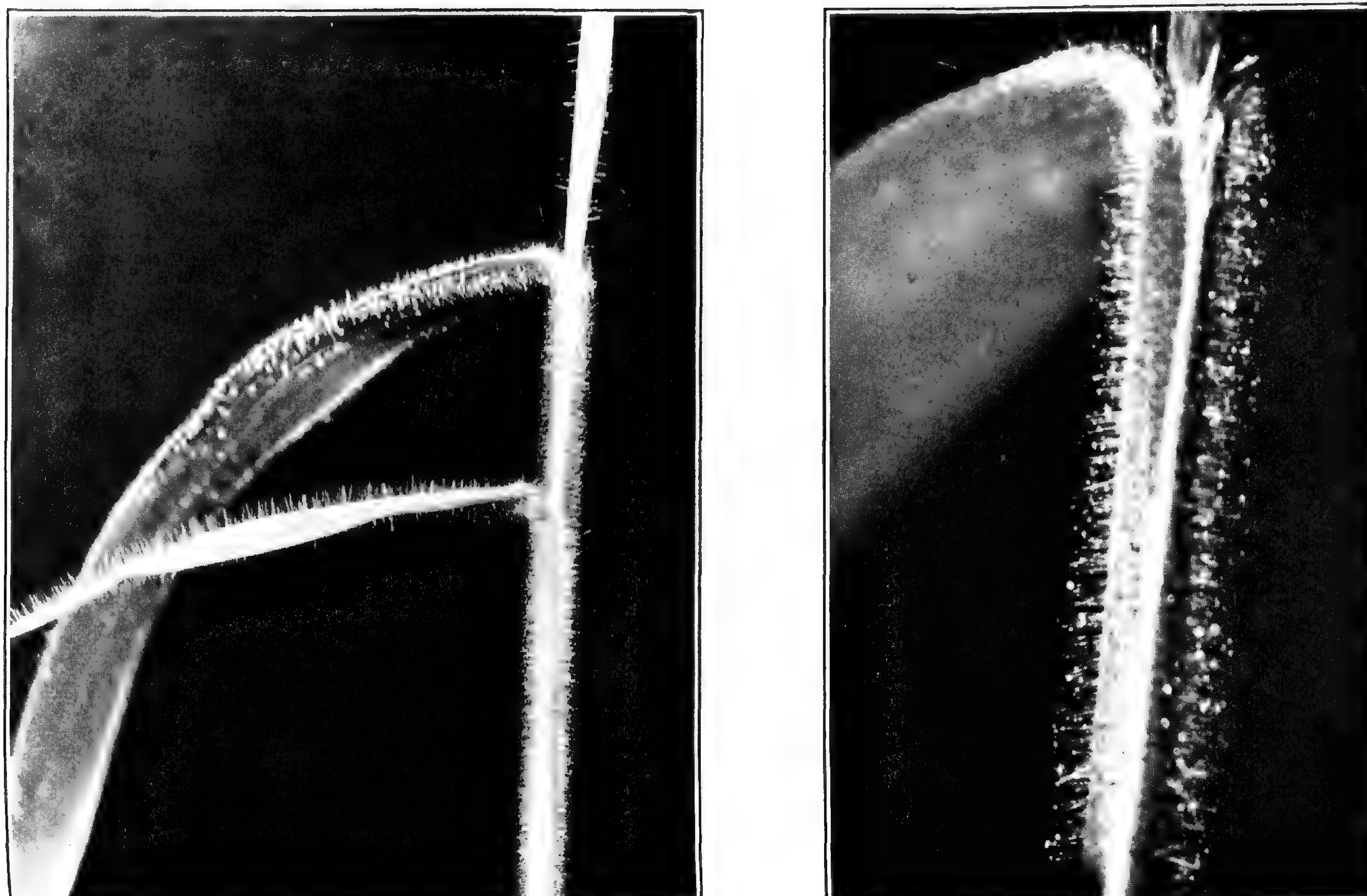


MELINIS MINUTIFLORA

[*To face page* 306.

To face page 307]

PLATE II.



MELINIS MINUTIFLORA
Stem and leaf-sheath enlarged.

the meat and milk of such cattle has not any taint or suggestion of the characteristic odour of the grass, which is not unlike that of curry powder. The properties which render it objectionable to the tsetse fly are not only the strong odour of the viscid drops of oil exuded by the hairs on the leaf sheaths but also that they act in the capacity of a "fly-catcher," and as Mr. Dawe remarks if a big fly like the tsetse be ensnared, how much more would smaller flies be entangled, such as the mosquito, which would tend to shelter in the shady nooks of the grass tufts during the day time.

In contrasting the effect of Efwatakala with Citronella grass Mr. Dawe refers to the experiments he carried out in Uganda, where the planting of this grass, but perhaps more especially the clearing of the ground concomitant with the planting, did appreciably diminish the tsetse fly, and again in Ceylon where animals working among and feeding on Citronella grass escaped an epidemic of rinderpest which spread over a large part of the Island. Since Citronella grass, whose aromatic and oily properties are only noticeable when the leaves are bruised, has proved of service, he maintains that experimental planting of Efwatakala, in which the aromatic and viscid oil is exuded and exposed, is well worthy of serious consideration.

At Mr. Dawe's request, the Rev. R. H. Graham, of San Salvador, forwarded seeds of Efwatakala to Kew and from the plants raised the structure of the oil-containing hairs has been examined and the oil has been analysed. (Plate I.) Mr. Dawe also procured a small quantity of seed from Colombia,* some of which he took with him to Sierra Leone, the remainder, at the instance of Kew, was forwarded through the Secretary of State for the Colonies to Nigeria and Uganda, where it is hoped a sufficient stock of grass will be raised so that a series of experiments as to its efficacy may be carried out.

Dr. Stapf has examined the grass critically and has supplied the following notes :—

M. minutiflora, Beauv. became first known from Brazil. The earliest records from tropical Africa were supplied by Welwitsch's collections of 1854–1857, but they were not published until 1899. Welwitsch discovered the grass in the districts of Golungo Alto and Pungo Andongo in Central Angola. Next it was found on Kilimanjaro (first record 1884), on Ruwenzori (1893) and near. Yaunde in the Cameroons (1890–1894). Quite recent records established its occurrence on the Ivory Coast, in Lagos, the Portuguese Congo and in or near the Mabira Forest in Uganda Welwitsch describes it as growing in dense masses in Golungo, and Dawe found it to be very common on the Nkanda plateau

* Seed supplied by Mr. Dawe was sown in the open at Kew this year in June and attained a height of nearly two feet before it was killed off by the autumn frosts. At times its characteristic odour was very noticeable.

in the Portuguese Congo, whilst Scott Elliott points out that it is common in the forests of Ruwenzori between 6000 and 8000 ft.

The area inhabited by *M. minutiflora* in continental Africa may be described as consisting of two sub-areas, one in the West extending from Central Angola through the Portuguese Congo to the Cameroons with outposts in Lagos and on the Ivory Coast, the other in the East comprising the grassland on the slopes of Ruwenzori and Kilimanjaro and parts of the intervening country.

It was found in Ascension Island growing in great quantity between 1500 and 2500 ft. in 1889 and again in 1895, probably the result of casual introduction. A similar origin may be attributed to its occurrence in Central Madagascar, where it has been collected repeatedly since 1880.

In America the grass ranges at present, as far as we know, over the greater part of eastern Brazil (from Bahia and Goyaz to Rio Grande do Sul) and also occurs as a cultivated fodder grass in Colombia.

The genus *Melinis* consists of about a dozen species, all, except *M. minutiflora*, confined to tropical continental Africa. As to *M. minutiflora*, the question arises whether it is really indigenous in America or introduced. The problem was discussed many years ago by A. St. Hilaire, Martius and Gardner, who knew the grass in the field in Brazil. St. Hilaire and Gardner came to the conclusion that it was, at any rate in Minas Geraes and Goyaz, an intruder, whilst Martius considered it as native there. In the southern states it is either known to be cultivated (S. Paulo) or suspected as an alien (S. Catharina and Rio Grande do Sul). Engler more recently in his memoir on the affinity of the American and African floras admitted it as indigenous in Brazil. Its claim to being a genuine African grass has never been doubted, and its close affinity with most of the other species —all exclusively African—and the conditions of its occurrence in Africa afford sufficient proof. The problem has some bearing on the facility with which the grass spreads and establishes itself in certain circumstances and therefore on the chances of its introduction into regions not yet occupied by it or its cultivation. For this reason I may be permitted to quote from some of the authors mentioned above :—

M. minutiflora was first collected over 100 years ago somewhere in the neighbourhood of Rio Janeiro where it is common enough to-day. Subsequently in 1816, A. S. Hilaire came across it in the mining districts of Minas Geraes where it spread with great rapidity. This is what he says in "Aperçu d'un voyage dans l'intérieur du Brazil," 1823, pp. 8 and 9 (reprint) :— "au bout de très-peu de temps enfin les arbres et les arbrisseaux ont disparu, et le terrain se trouve entièrement occupé par une graminée grisâtre, velue et uniflore, qui souffre à peine quelques plantes communes au milieu de ses tiges serrées, et qu'on appelle 'capim melado' ou 'capim gordura,' parce qu'elle transsude un suc abondant et visqueux. Plusieurs habitans désignent avec raison, sous le nom de 'campos artificiaes,' les pâturages dont je viens d'indiquer l'origine, et ils les distinguent ainsi de ceux du Rio-das-Mortes, qu'ils appellent par opposition 'campos naturaes.'" Gardner who visited Minas Geraes in 1840 also discussed the problem and came to the same conclusion ("Travels in the Interior of Brazil," p. 364), I quote from him :—"The hills around the Cidade de Serro are covered with a grass which the Brazilians call Capim gordura (*Melinis minutiflora*, Nees ab E.). It is covered with an oily viscous matter, and universally makes its appearance in those tracts which have been cleared of virgin forest for the purposes of cultivation; both cattle and horses are very fond of it, but although they soon fatten on it, the latter get short-winded, if they feed on it for any length of time. Martius* considers this plant to be truly a native of Minas Geraes, while St. Hilaire is of a different opinion; as it is now everywhere so common in this province, it is a difficult matter to say which of those excellent botanists is in the right; all the agriculturists that I have spoken with on the subject agree with St. Hilaire, although they differ in opinion in regard to the place of its original growth. It is only on the mountains that it is found covering large tracts, and at present it is rapidly extending northwards. St. Hilaire during his travels did not observe it beyond 17° 40′ of south latitude; but while crossing the Serra Geral from Goyaz to Minas, I met with it many degrees to the north of that parallel.† I noticed it only near houses, and there is little doubt that in the course of a few more years it will overrun that chain in the same manner that it has done those of Minas. The seeds have evidently been brought from the latter country by troops, which pass that way into Goyaz; it is not to be met with at all in the Sertao."

Bunberry (Botanical Fragments, p. 103) has the same tale to tell. "The way in which this grass covers the ground (*i.e.* in Minas Geraes) continuously for leagues together to the exclusion of everything else, is very extraordinary." I may finally add a passage from Van Delden Laerne's "Brazil and Java," p. 261 :—"Lands like these (that is, lands exhausted by rank grasses, as *Andropogon bicornis*, *Trachypogon plumosus* or by the bracken)

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* I have not been able to trace in Martius a statement to that effect, unless it is taken to be implied in the following passage in his "Reise in Brasilien," vol. i, p. 401 :—Unter den Pflanzen, welche auf diesem Gebirge wachsen, und besonders der Formation des Eisensteinflötzes anzugehören scheinen, bemerkt man auch in grosser Menge das Honiggras (Capim mellado), das in Minas Geraës häufig vorkommt, und wegen seines zarten Baues und der öligen Haare, die es bedecken, das Lieblingsfutter der Pferde und Maulthiere ist, aber zu lange fortgenossen, sie dämpfig machen soll.

† Burchell collected the grass in 1827 in various places in the State of Goyaz between 19° and 16° S. Lat. and in 1828 as far north as Arrayos about 14° 40′ S. Lat.).

then are sown with the capim gordura (*Tristegia glutinosa**) a grass very much relished by cattle, which grows so dense and luxuriant that even the stubborn sape (*i.e. Andropogon bicornis*) must literally quit the field in this struggle for existence." It is clear from these extracts that in Brazil at any rate, this grass shows extreme aggressive powers on soil which has been disturbed and deprived of its natural vegetation, and there is no apparent reason why it should not behave in tropical Africa in the same manner whenever it gets a chance to do so, although it may be powerless among a vegetation in a state of established equilibrium.

In connection with the above Dr. Stapf considers the following remarks on two other species of *Melinis* worthy of notice.

Melinis effusa, Stapf.—This species is so far known only from Angola and the Lower Congo region. It was discovered by Welwitsch in "sandy wooded places" in Pungo Andongo and in "poor soil in sunny places" in Golungo Alto in 1857 and 1855 respectively. Then in 1900 J. Gillet found it near Kisantu and R. P. Butaye in the neighbourhood of N'Lemfu, both localities in the Stanley Pool Division of the Belgian Congo, and according to Dawe it is common in the Portuguese Congo. Nothing is known about its ecology or economic value, but in general appearance it is so much like *M. minutiflora* that it might be expected to behave similarly.

Melinis tenuinervis, Stapf.—Although this grass is not included under the general term Efwatakala as illustrated by Mr. Dawe's specimens, it may yet be useful to call attention to it, as it has apparently been mistaken by various authors for *M. minutiflora*—I myself described it originally as a variety under the name *pilosa*† —and replaces that species over a very large area extending from Southern Angola through the Southern Congo (Katanga) and Rhodesia to Natal and Nyasaland, whilst it resembles it sufficiently to suggest similar properties although the hairiness and viscosity of the plant is much less pronounced than in the two Efwatakala grasses. At any rate it might be taken into consideration as a possible substitute of *M. minutiflora* in districts which are not suitable for that grass. Unfortunately nothing is known about the ecology of *M. tenuinervis*.

The structure of the hairs has been worked out in the Jodrell Laboratory at Kew, by Mr. S. Dickinson, of the Imperial College of Science, with a view to ascertaining in what manner the oil was secreted. He reports as follows :—

"An examination by the naked eye shows the leaf sheaths enclosing the stem to be covered with hairs most of which, under a pocket lens, can be seen to have a drop of oil at the apex. The hairs are most numerous on the leaf sheath, but they also occur on both sides of the lamina. On the young sheaths whilst they

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* A synonym of *Melinis minutiflora*.

† Flora Capensis, VII. p. 447.

Fig. I.

Fig. II.

Fig. III.

Fig. IV.

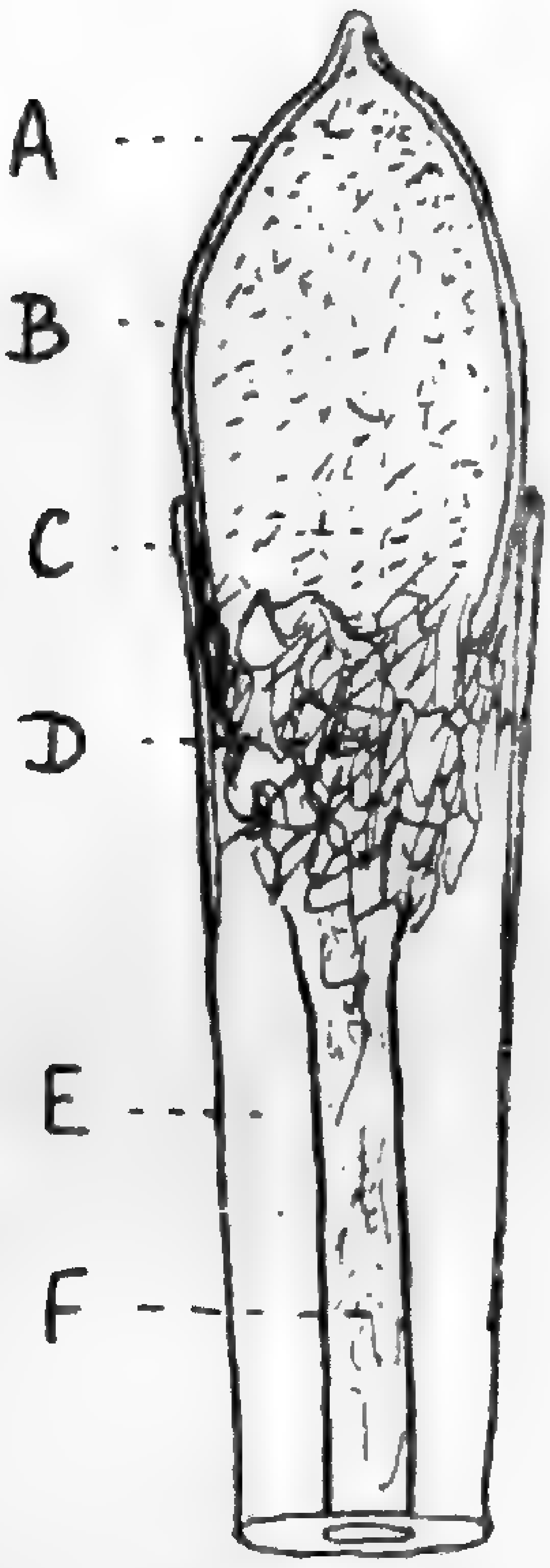


FIG. V.

FIG. VI.

FIG. VII.

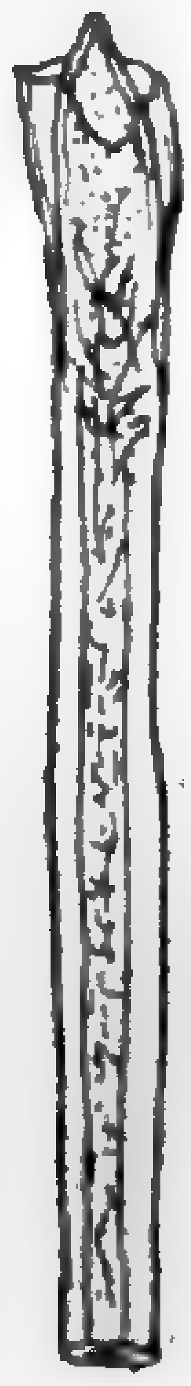


FIG. VIII.

FIG. IX.

FIG. X.

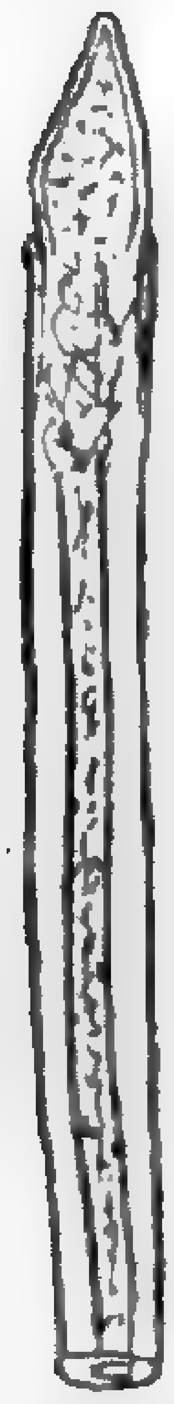


FIG. XI.

FIG. XII.

Fig. I. Transverse section of fresh material of leaf-sheath, A blunt hair, B rosette, C pointed hair. Oil drops appear on the outside of each hair and inside the blunt hair towards the base.

Fig. II. Normal base of pointed hair.

Fig. III. Base of uninjured pointed hair showing constriction and oil globules.

Fig. IV. Base of blunt hair showing constriction and thin wall.

Fig. V. Head of blunt hair.

Fig. VI–XI. A series of the blunt type of hair showing how the continuous cuticle layer is broken by the extrusion of the plug.

Fig. XII. The apex of a pointed hair.

Fig. I × 160. Figs. II–IV. and VI–XII × 600. Fig. V diagrammatic.

are still enclosed by the older ones the hairs are directed upwards or adpressed, but after exposure they point downwards; those on the blade are at right angles to the leaf surface. (Plate II.)

"The hairs, which are hyaline and unicellular, are of two types, one with a blunt or rounded apex, the other being sharp pointed (fig. i A and C). In both types the base of the hair is embedded in a cushion or rosette (fig. i B). The blunt hairs are more numerous than the others on the young sheaths whilst on the older ones only pointed hairs are found. At the first the pointed hairs are on the whole not quite so long as the blunt hairs which measure 1·15mm., but later they slightly exceed them. In the young stage the two types of hairs cannot be distinguished, but when mature, so far as can be ascertained, they are distinct. In all the blunt hairs a constriction of the wall occurs near the base, giving the latter a somewhat bulbous form. the wall being thinner below the constriction (fig. iv). The pointed hairs may or may not have a bulbous base (figs. ii and iii), and in the latter case the base is less deeply embedded (fig. i C).

"The apices of the hairs of these two types are distinct, the wall of the pointed hairs being thickened so that the lumen is obliterated for some distance from the top, while the apex of the blunt hairs is swollen and ends in a small knob. In fig. v is depicted the apex of a mature blunt hair. In the lower part is seen the thick cell wall E, and lumen with content F. Higher up the contents and the wall, except for an outer sheathing layer C, become merged into a granular mass, above this a more homogeneous part A is seen which resembles the cork of a bottle whose neck is formed by the wall C. At this stage the structure can be determined by staining with Schultz's solution

"The 'cork' or plug is stained a cellulose blue, it has a clear blue outer layer B, and from its appearance is mucilaginous; while the wall C stains yellow, and the mass D passes from blue at the top to yellow below. The cell wall lower down E, is yellow except for the innermost layer which is blue. At the base of the hair where the wall is thin (fig. iv) a blue colour is obtained.

"The reactions of the pointed hairs to stains agree with those of the blunt hairs, the base staining yellow and the apex blue with Schultz's solution.

"The wall is not lignified in either type of hair. With iodine it stains yellow throughout, and on the addition of sulphuric acid the inner layer becomes blue and thus appears to consist of cellulose. With ferric chloride the lower and outer parts of the wall were stained red-brown. With the xanthoproteic reaction, an orange colour was obtained in the walls from the base up to $\frac{2}{3}$ of the length of the hair, and the same part was stained red with Millon's reagent. This reaction must be due to some infiltrating substance, the nature of which has not been determined.

"On treating a mature hair (fig. vi) with concentrated sulphuric acid and also by staining with Sudan III there is found to be a layer of cutin on the outside, this was not observed below the constriction at the base nor on the plug, but as far up as the base of the latter. The stage in fig. vi. shows this cutinous layer covering the apex and in figs. vii.-xi. the plug is shown being pushed through the terminal cap of cutin, thus the blunt hairs start with a complete covering of cutin, and later, just before or just after they are exposed by the growth of the leaf sheath on which they are seated, this cap is broken through, and the plug projects. It is not till this stage is reached that any external oil is found. After this stage oil is to be seen both on the blunt and pointed hairs. There is nothing to indicate that oil is excreted from the pointed hairs, and the oil occurring on them is regarded as having come from the blunt hairs during inclosure by the next older leaf sheath. In the mature blunt hairs oil is seen in the cavity at the base in the form of globules, and also towards the apex, and in the lumen from about $\frac{2}{3}$ of the length to near the top of the hairs there is a refractive substance whose nature was not determined. In the mature pointed hairs a certain amount of oil was found (fig. iii.), but in no other part of the plant was any oil detected.

"It cannot be supposed that the oil escaping from the hairs would pass through the lateral walls, and it is questionable whether the oil escaping from the blunt hairs could permeate the plug at the top of the hair, it seems more likely that the plug may act like the loose stopper of a bottle and allow the oil to ooze out between it and the wall. It was found in staining the contents of the mature uninjured hairs, that the stains were able to penetrate through the base of the hairs faster than through the apex.

"From the foregoing it would appear that the oil is secreted only in the two types of hairs, and that it is from the blunt hairs only that it escapes just after the continuous cutinous cap is broken and the plug extruded. The cap appears to be broken just before or just after the hairs become exposed and it is conjectured that the oil is enabled to pass out by the temporary lifting of the plug."

The oil of the grass was examined at the Wellcome Chemical Research Laboratories by Dr. T. A. Henry, who kindly supplies the following results of his investigations :—

"The material examined consisted of fresh plants grown at the Royal Botanic Gardens, Kew, and included the following samples.

a. grass grown in pots or boxes under cover, 12 pounds.
b. grass grown in the open, 30 pounds.

"Both samples have a characteristic aroma, recalling that of cumin seed, which is no doubt the odour which Mr. Dawe, in his memorandum on the grass, describes as similar to that of curry. The aroma seemed to be much stronger in the plants grown under cover than in those grown outdoors.

"The substance to which the odour is due is exuded as a yellowish oil from glandular hairs, which are easily visible on the stems of the fresh plant and as the number of these is not great, it was realised that the yield of oil would be small. An attempt was made to collect the oil on absorbent cotton wool, and then to recover it from the latter by steam distillation. This answered well for small quantities of plant, but it took up too much time and led to serious loss by volatilisation when quantities of more than 50 to 100 grammes of plant were worked up.

It was therefore arranged that the two supplies of plant should be received from Kew as early as possible in the day and steam-distilled the same day. The distillation waters from the two lots of plants were again steam-distilled next day to concentrate the oil as far as possible but even then the distillation waters were only faintly cloudy and there was no actual separation of oil. They were therefore saturated with salt and extracted with ether, the ethereal solution dried, the solvent distilled off, and the residue, after drying in a vacuous chamber at atmospheric temperature, weighed as oil. The yield of oil from lot *a* was 0·06 grammes and from lot *b* 0·11 grammes, equal respectively to 0·001 and 0·0008 per cent. expressed on the plant as received.

"The oil was brown in colour, had a consistence similar to that of soft paraffin, showed a tendency to crystallise when the vessel containing it was placed in ice and salt, and had the characteristic odour of the fresh plant. It was acid to litmus, and required 1·18 per cent. of its weight of caustic soda to neutralize it. The soluble sodium salt so formed was washed out with distilled water and the residual oil collected. It still had the characteristic odour of the fresh plant and was now boiled for one hour with alcoholic soda, the alcohol removed under a low pressure and the soluble sodium salt taken out by water as before. The residual oil was now a limpid yellow liquid which still had the characteristic odour of the plant but the amount remaining, 0·02 grammes, was too small to examine further. The solutions of sodium salts, removed as described above, when acidified deposited a crystalline solid and some resin; both of low melting point but too small in amount to examine. The portion remaining in solution was converted into a silver salt and on ignition yielded 42·6 per cent. of silver. As the quantity of silver salt only amounted to a few milligrammes, this figure can only be a rough approximation but it may perhaps be taken as indicating the presence of lower fatty acids of about the complexity of octoic acid.

"These results may be summarised as follows. The fresh plant yields about 0·001 per cent. of volatile oil, which so far as can be judged from the results of the experiment possible with so minute an amount of oil, consists largely of free acids and esters with possibly some phenolic substance. The constituent to which the characteristic odour of the plant is due is not an acid ester or phenol since it persists after these constituents have been removed or decomposed."

The magnitude of the subject and the importance Mr. Dawe attaches to it are summed up in the two following extracts taken from Mr. Dawe's paper in *Tropical Life*, May 1922, where he also shows a photograph of the grass in its natural habitat :—

" It is, however, quite obvious that a project of such magnitude and importance as this could not be effectively carried out in any part of Africa without the sympathetic support and liberal assistance of the Government of the country. It is, further, a scheme that would have to be carried out on a very big scale to be effective."

" If the results of planting this grass as is herein outlined came up to the writer's expectations in such regions of Africa as those referred to, a work of the highest humanitarian importance will have been achieved for the people; for in the place of a decreasing population and vacant lands will grow up a healthy and thriving people, as well as a cattle industry which should contribute materially to the economic development and prosperity of the country. It is therefore that the writer considers this grass worthy of the fullest investigation and trial."

LXVII.—THE GOVERNMENT GARDENS, SOKOTO, NIGERIA.

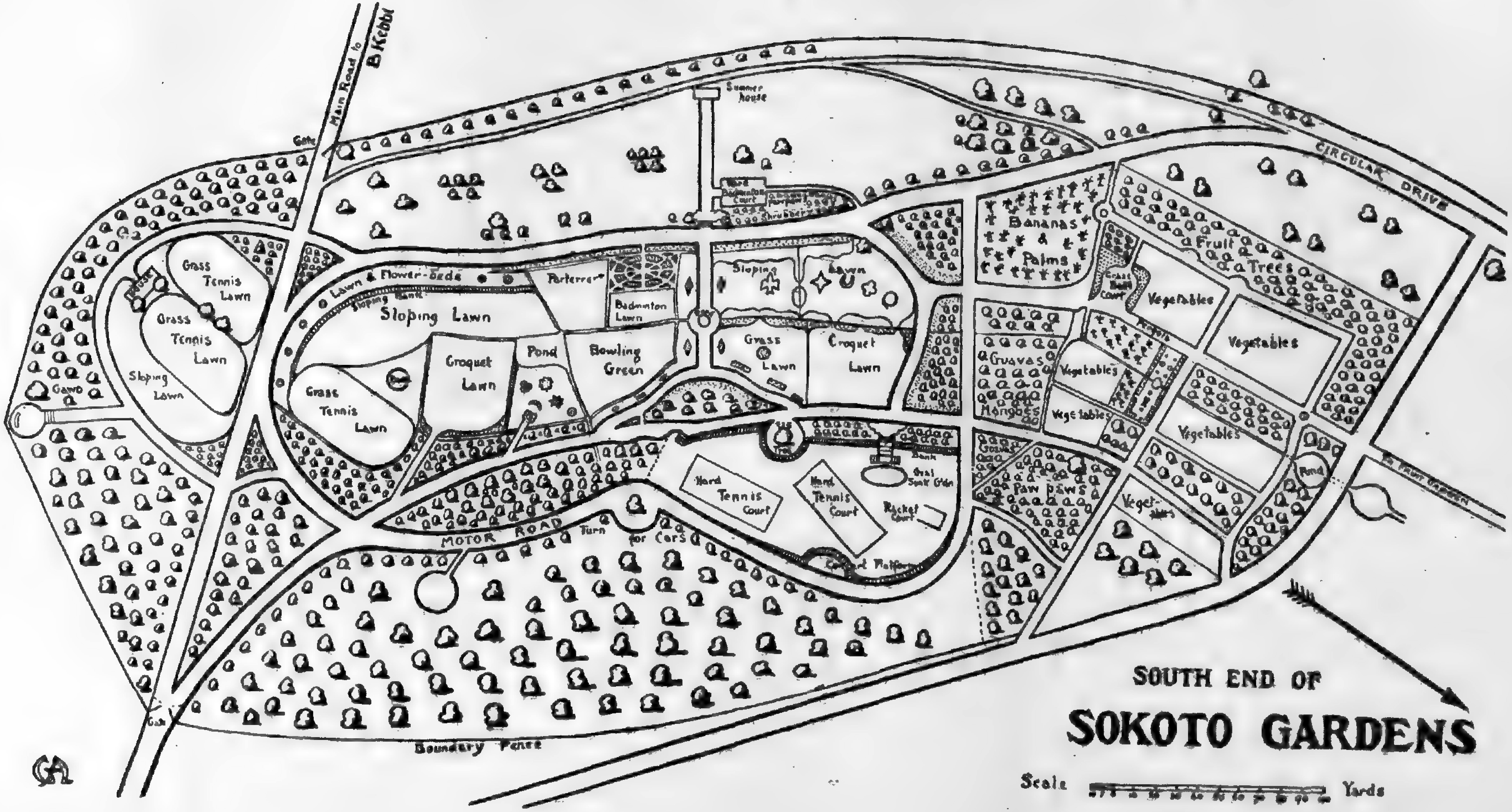
In *Kew Bulletin*, 1921, p. 238, reference was made to the remarkable and valuable achievement of Dr. Bernard Moiser, Principal Medical Officer, Sokoto, in establishing the foundation of a botanic garden in so arid and unpromising a place as Sokoto, in the Northern Territories of Nigeria. It was hoped that Dr. Moiser would have been able to furnish an account of his work for publication in the *Bulletin*, but time has not permitted him to do so and therefore this brief notice has been compiled from notes he has supplied and from other sources.

His Excellency Sir Hugh Clifford, G.C.M.G., Governor of Nigeria, visited the Sokoto Gardens in the spring of this year and was very greatly impressed with the important results of Dr. Moiser's untiring efforts. So much was he convinced of the value of the undertaking that he addressed a minute on the gardens to the Chief Secretary to Government, Nigeria. His Excellency has been pleased, at the request of the Director, to permit his minute to be published in the Bulletin.

Copy of His Excellency the Governor's Minute on the Sokoto Gardens.

" Chief Secretary to Government,

" During my recent stay at Sokoto I was very greatly struck by the really beautiful gardens which Dr. R. Moiser, the Senior


Main Road to B. Kebbi
Gate
Summer house
Circular Drive
Grass Tennis Lawn
Grass Tennis Lawn
Sloping Lawn
Gawo
Lawn & Flower-Beds
Sloping Bank
Sloping Lawn
Parterre
Badminton Lawn
Grass Tennis Lawn
Croquet Lawn
Pond
Bowling Green
Sloping Lawn
Grass Lawn
Croquet Lawn
Shrubbery
Bananas & Palms
Fruit Trees
Vegetables
Vegetables
Vegetables
Vegetables
Vegetables
Guavas
Mangoes
Paw Paws
Pond
Hard Tennis Court
Hard Tennis Court
Racket Court
Oval Sunk Gdn
Bank
Motor Road
Turn for Cars
Boundary Fence
SOUTH END OF
SOKOTO GARDENS
Scale
Yards

Medical Officer, has brought into existence at that Station. These gardens are, and are intended to be, pleasure gardens, rather than botanical gardens; and though, therefore, they cannot compare, if regarded from the latter point of view, with the gardens at Victoria in the Cameroons Province, they are, in my opinion, much more charming and very much more pleasing and restful to the eye.

"2. Taking full advantage of a natural hollow, or long rather narrow valley, where the subterranean water-level is near to the surface of the soil, and which was already ornamented by a number of fine trees, Dr. Moiser, by means of some fairly elaborate landscape gardening, and by the most skilful and painstaking horticulture, has converted what must have been a patch of rank, green scrub, set in the midst of a sandy, straw-coloured wilderness, into one of the most charming gardens that I have seen anywhere in the Tropics. I cannot understand how it is that the fame of this really notable achievement, and of the horticultural enthusiast whose patience, skill and devotion to his task have accomplished it, has not spread broadcast throughout Nigeria; and it is with shame that I record the fact that I first received a detailed account of what Dr. Moiser had done from Sir David Prain, the Director of the Royal Botanic Gardens at Kew, in the Athenæum Club a week or two before I sailed for West Africa in November last. Dr. Moiser has here performed precisely the sort of service to Nigeria which is so very rarely rendered to the countries in which they serve by officers living in West Africa. He has, by his unassisted efforts, succeeded in adding immeasurably to the amenities and *agréments* of a station which, but for his horticultural work in it, would have possessed no special attractions. He has thereby raised the standard of comfort and of general living conditions for every European dweller in Sokoto; has given to each of them a really beautiful and shady place in which to congregate during their leisure hours; and has supplied them with something lovely and refreshing for eyes to rest upon that have grown weary with staring through the glare at the dusty, parched country that surrounds them. Incidentally he has shown what enterprise and skill and energy can achieve in West Africa, as in other parts of the tropical world, in the direction of rendering an unpromising environment as agreeable and pleasure-giving as the comfort and the well-being of Europeans dwelling in it demand.

"3. I shall be glad if you will cause a copy of this minute to be sent in due course to Dr. Moiser, through the D.M.S., together with an official expression of the thanks of the Government of Nigeria for the very notable work which he has done.

"4. I shall be glad, if you will be so good as to ask the Director of Forests to issue standing instructions to the Conservator of Forests for the time being having his headquarters at Sokoto, to assume personal charge of and responsibility for these gardens whenever Dr. Moiser is absent on leave. At present, I understand, no permanent arrangements exist to insure Dr. Moiser's work being automatically carried on during his absence from the country.

"5. Before proceeding on leave, Dr. Moiser should be asked to draw up detailed instructions for the management and maintenance of the gardens for the guidance of the officer of the Forestry Department who is about to assume charge of them, and the latter should be instructed strictly to abide by them.

"6. I understand that during 1921–22 the sum of £100 was granted by the Lieutenant-Governor of the Northern Provinces to the Resident of Sokoto for the maintenance of these gardens from Head 8, Item 19—Miscellaneous Services, Assistance to Games Clubs. I think that in future a sum of not less than £150 *per annum* should be provided as a separate item under this head of the estimates, and named 'Upkeep of Government Gardens, Sokoto.' During the coming financial year this sum should be allocated from N.P. Head 8, Item 19, and I will, if necessary issue a Special Warrant later in the year to cover this expenditure.

"7. I feel justified in approving this special expenditure, in spite of the straitened state of the finances of this Government, because I regard Sokoto, mainly owing to the existence of this garden, as one of the best places that it will be possible to select as a site for one of the recreation camps which this Government will have to bring into existence in Nigeria in order to afford to officers who are doing long tours of service under the new Leave Regulations the change of scene, &c., of which, from time to time, they stand in need. As Dr. Moiser has pointed out to me on the spot, it would be possible, for an expenditure of less than a thousand pounds, to lay out an almost perfect 18-hole golf-course, to make a large number of grass tennis-courts, and to supply a swimming-bath, the water in which would be as clear as crystal. It would also be possible for a very moderate sum to build and equip a large mud building for the accommodation of officers on local leave. When the road from Zaria to Sokoto, now under construction, has been completed, the journey to Sokoto will be easy of accomplishment by *char-à-banc* motor vehicles at all seasons of the year; and though for a few weeks during the dry season the midday heat is said to be intense, the nights are generally cool and often cold; and, as I can testify from personal experience, the change of climate from the muggy, damp atmosphere of the coast districts is exceedingly invigorating.

"8. I do not regard this project as in any sense chimerical, and indeed, if the financial position to-day were other than it is, I should lose no time in giving immediate effect to it. The new Leave Regulations impose upon the Government certain well-defined obligations in the matter of providing facilities for officers desiring to take local leave; and, thanks to Dr. Moiser's successful demonstration of the potentialities of Sokoto, I find in this place a satisfactory means of satisfying some of them.

(Sgd.) Hugh Clifford,
Governor."

Funtua, Katsina Emirate,
Kano Province.
March 3rd, 1922.

The recognition afforded by His Excellency to Dr. Moiser's pioneer work at Sokoto will be welcomed by botanists and horticulturists throughout the Empire and nowhere more than at Kew, the centre of botanical enterprise in the British Empire. Of more importance is the assurance that the gardens, which represent the devotion and care of one man, are to be maintained, and it is to be hoped that the Government of Nigeria in the future will not only continue Sir Hugh Clifford's far-seeing policy, but will endeavour to develop and increase the value and importance of this Tropical African Garden, which is pregnant with such great possibilities. The gardens were made in the first instance by Dr. Moiser, from the point of view of public health, and thanks to the skill and knowledge of their founder they have not only amply realised this primary object but almost imperceptibly have become potential Botanic Gardens.

Were it possible to reproduce the many excellent photographs of the gardens sent by Dr. Moiser, it would be seen that the landscape effect has in no way been sacrificed to the more scientific aspects of the gardens and skilful use has been made of the existing trees to make the whole place not only "pleasant to the eye," but also "good for food," both to mind and body.

Dr. Moiser has made good grass lawns, which give the gardens a fine spacious effect, and despite the dry climate they are kept green without overhead watering. The sound expedient has been adopted of damming up the stream so that the water percolates through the soil and the grass is watered from below with most satisfactory results. (Plate III.)

The garden, which was started in 1916, is fortunate in including the heads of two narrow valleys, in which the sub-soil water lies within a couple of feet of the surface, even at the driest time of the year, and in which some magnificent old *Vitex* and fig trees, as well as *Acacia* and locust-bean trees, not only lend their grandeur and grateful shade, but serve to keep out the scorching winds of the desert.

When making the garden, water-holes and swampy patches had to be drained, ditches dug, rank grass and weeds cleared away, and in so doing the place was cleared of snakes and mosquitoes, for it was the home of both.

Then a few gravelled walks were laid out, and a primitive bridge or two was put across the meandering stream, of crystal-clear water, cool and fresh from the springs.

The first object was to ensure a constant supply of English vegetables and to quote Dr. Moiser's words in "West Africa" of

PLATE III.

SOKOTO GARDENS. Grass lawn.

PLATE IV.

To face page 321]

SOKOTO GARDENS. Flower beds.

July, 1922, p. 743: "Soon great white heads of cauliflowers, as much as 22 inches across, huge firm cabbages, glorious crisp lettuces, tomatoes by the 100, spinach, beetroot, carrots, beans, potatoes, marrows, cucumbers, melons, artichokes, parsley, endive, etc., bananas and guavas began to appear at table. The foregoing by no means exhausts the list, but they are sufficient to show what a variety can be grown. How easily and at what a pace they spring up and grow, and how jolly fit they keep one!" . . .

"But the garden was not to end with vegetables! That long open stretch of evergreen grass, never scorched or parched, was too good to let alone. The 'Dumpy' level was borrowed from the office, pegs put in, and a small army of labourers got on the job. The ground was simply dug up, and the soil moved, until a series of level lawns was created, badminton and croquet being the first games to be played. There was no sowing of grass seed required, the native 'dhub' and other varieties of grass simply sprang up through the bare soil from their old roots; rollers and lawn mowers had soon to be requisitioned, and in a few months we had beautiful smooth turf that would have put a lawn at home to shame. More bridges were constructed, ornamental ponds dug out and filled with water lilies, curving paths laid out, edgings of *Alternanthera* planted and kept neatly trim and clipped." (Plate IV.)

The present gardens cover about 35 acres, but there still remain some 200 or 300 acres of precisely similar ground, untouched, that at present serve no better purpose than grazing for cattle.

Various seeds were sent out from Kew last year to Dr. Moiser, by way of experiment, and it is interesting to learn that *Delphinium grandiflorum*, *Hunnemania fumarifolia*, *Phlox Drummondii* and Helichrysums were highly successful introductions, and produced sheets of colour.

This account, which betrays the spirit of the enthusiast who has made the desert blossom, represents, however, only one side of the work Dr. Moiser has so far achieved.

Throughout his enterprise, a Botanic Garden has been the goal of his aspirations, and the dream is undoubtedly becoming an actual fact. Here can be gathered together the economic and medicinal plants suitable for the country, and it should be possible to initiate and carry out experiments and researches which could not fail to prove of great benefit to the community generally.

Not only is the garden a place of refreshment from toil, but it has also great educational possibilities both for officials and natives. Among the latter, from enlightened Emirs to their intelligent Hausa subjects, there are many who would profit from the lessons which a garden of this sort can teach.

The Garden proper is not the culmination of Dr. Moiser's aspirations, for he writes :—

"I should dearly love to have a small Herbarium down in the Garden arched over the N. end of the Terrace, built in English style with mullioned windows and red tiles. It would fit in there admirably, and be really useful. Something of the sort is badly wanted, and away on the slope between the two valleys would stand the Museum and Laboratories, where science could be at work, and one could rest wearied eyes on cool spreading sward all round!"

A charming but no impossibly ideal picture in this otherwise barren and dry land.

We have learnt so much of the knowledge of plants possessed by the Hausa peoples from the labours of another distinguished medical officer, Dr. J. M. Dalziel, the author of the Hausa Dictionary, as well as from Dr. Moiser, and other collectors in Northern Nigera, that it is easy to realise that a small local Herbarium with a Museum and Laboratories, would be of very great value.

Dr. Moiser in his work at Sokoto is only repeating the old story of botanical enterprise, and teaching us, as in times past, how closely the sciences of Botany and Horticulture are linked with the sister science of Medicine.

XLVIII.—NEW OR NOTEWORTHY SOUTH AFRICAN PLANTS.*—V.

J. Burtt Davy.

61. **Brassica arvensis,** (*L.*) *O. Ktze.* in Act. Hort. Petrop. x. 164 (1887); and Rev. Gen. 19 (1891) non Linn. *Sinapis arvensis*, Linn.

South Africa. Transvaal: Pretoria, Aapjes River, occasional weed in grain-fields, *Leendertz* 3723!

The "Charlock," adventive from Europe, where it is a noxious weed.

62. **Brassica juncea,** (*L.*) *Coss.* in Bull. Soc. Bot. Fr. vi. 609 (1859).

South Africa. Transvaal: Zoutpansberg Distr.; Louis Trichardt, *Dr. Breijer* in 1919, in *Transv. Mus. Herb.*

Adventive from Asia. Cultivated in Egypt and Asia as an oil seed.

63. **Brassica pachypoda,** *Thell.* in Viert. Zurich Naturf. Gesell. Jahr. 56, Heft iii. 257 (1911). *Sinapis pendula*, E. Mey., Plant. Drèg. pp. 47, 48 (1843) nom. nud. *Sinapis retrorsa*, Sond. in Fl. Cap. i. 32, as regards the Natal plant, not of Burchell.

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* Continued from *Kew Bulletin* 1921, p. 335.

South Africa. Transvaal: "Batlapin Country" (Bloemhof Distr.) *Holub*! ; Pretoria, *Leendertz* 416! Louis Trichardt, *T.M.H.* 20872; Rustenburg, *T.M.H.* 9795; Johannesburg, *T.M.H.* 6159; Vereeniging, *T.M.H.* 10919; Standerton, *T.M.H.* 9935; Volksrust, *T.M.H.* 9933; Bethal, *T.M.H.* 9354. Natal: Phoenix, *Schlechter* 3146 (type); Port Natal, *Krauss* 412! Isipingo, "in cane fields," *J. M. Wood* 1004. Cape Province: Transkei; Bazeia, "weed in cultivated lands," 600 m. alt., *Baur* 375; Albany Div.; *Bolus* 1948; Fish River Heights, *Hutton*; *MacOwan* 955; Queenstown Div.; between Table Mt. and Zwartkei River, 1150–1400 m. *Drège*! (co-type of *Sinapis pendula*, E. Mey.)

Sonder, l.c., appears to have overlooked Meyer's name and to have confused the plant with *Sinapis retrorsa*, Burch.; the pods of the latter are quite different.

64. **Eruca sativa,** *Mill.*, Gard. Dict. ed., viii, No. 1 (1768); *Brassica Eruca*, Linn.

South Africa. Transvaal: Pretoria, *Burtt Davy* 3076! Bloemhof Distr.; *Burtt Davy*! Vereeniging Distr.; *Burtt Davy* 15179! Sporadic in lucerne lands, introduced about 1904 with exotic agricultural seeds.

Cultivated in South Europe and Northern India as an oil seed, and in Europe as a salad under the name of "Roquette"; the young leaves are said to have somewhat the flavour of horseradish. It is eaten by pigs, and ostriches seem very fond of it. Reported as being hardy against frost in the Bloemhof District. Sometimes mistaken for *Raphanus sativus*, Linn. but differs in the more distinctly veined petals and the broad ensiform beak of the pod.

65. **Raphanus sativus,** *Linn.*, Sp. Pl. 669 (1753).

South Africa. Transvaal: Pretoria, Aapjes River, *Leendertz* 974! Cultivated, and occasionally met with as a garden escape.

Sometimes confused with *Eruca sativa*, Mill.

66. **Arabis perfoliata,** *Lam.*, Encyc. i. 219 (1783).

South Africa. Cape Province: Aliwal North Div.; Wittebergen *Drège* 7537 (type) in herb. Sond.; Somerset East Div.; Boschberg, 1000 m. alt., Dec. 1886, *MacOwan* 702! "Kaffraria," on mountains, *Mrs. Barber* in 1867! Natal: Banks of the Mooi River, 1150 m. alt. *J. M. Wood* 4069! Transvaal: Ermelo Distr.; Goede Hoop Farm, *Mrs. Pott* 5134 *in T.M.H.*!

Apparently rare; found in the early days of settlement in Cape Colony, locally scattered over the eastern mountain region, but whether then alien or indigenous is not stated on collector's labels.

67. **Sisymbrium capense,** *Thunb.*, Prod. Pl. Cap. 109 (1800).

South Africa. Transvaal: a common weed of roadsides, vacant "erven" and gardens, in 1904, evidently adventive! Standerton, *Burtt Davy* 896! Pretoria, *Burtt Davy* 5557!

68. **Sisymbrium exasperatum,** *Sond.* in Linnaea xxiii. 3 (1850).

SOUTH AFRICA. Transvaal: Bloemhof Distr.; near Christiana, *Burtt Davy* 12471!

69. **Sisymbrium Turczaninowii,** *Sond.* in Fl. Cap. i. 26 (1859–60) ex descr.

SOUTH AFRICA. Transvaal: Bloemhof Distr.; *Burtt Davy* 11216! Standerton, *Rogers* 14805! Wakkerstroom Distr.; *Burtt Davy* 5356!

I have not seen the type, which is at Trinity College, Dublin.

70. **Silene pendula,** *Linn.*, Sp. Pl. 418 (1753); Bot. Mag. t. 114.

SOUTH AFRICA. Transvaal: Witwatersrand; Bocksburg, Jan. 1916, *Dr. Breijer in T.M.H.* 15015! probably a "garden escape."

Native of Italy, Sicily and Crete. Cultivated in English gardens in 1790, and recommended for rock gardens.

71. **Acacia ataxacantha,** *DC.*, var. **australis,** *Burtt Davy*, var. nov.; a forma typica foliis majoribus, pinnis multioribus differt; a *A. eriadeniae*, Benth. pinnis multioribus, foliolis minoribus, petiolis rhachidibusque saepe aculeatis, et habitibus differt.

SOUTH AFRICA. Transvaal: Pietersburg Distr.; Magoobas Kloof, Houtboschberg, *Burtt Davy* 5231 *type*! Barberton Distr.; near Barberton, *Burtt Davy* 292! 2770! *Pott* 5302! *Rogers* 23886! Swaziland; Forbes' Reef, outskirts of bush, *Burtt Davy* 2730.

A scrambling or trailing shrub climbing with the aid of its prickles. *Stipules* deciduous. *Leaf-rhachis* 10–13 cm. long, armed or unarmed with prickles, usually without any gland above the petiole. *Pinnae* usually 5–20 pairs, about 3 cm. long. *Leaflets* 40–50 pairs, 3–6 mm. long, 0·5–1 mm. broad, somewhat falcate, obtuse, obliquely truncate at base, thinly pilose with scattered, appressed hairs, especially in the margins. *Legumes* bright purplish-red, produced in large clusters, conspicuous.

72. **Acacia Benthamii,** *Rochebr.*, Tox. Afr. ii. pl. xix. f. 15. *A. arabica* var. *kraussiana*, Benth. in Hook. Lond. Journ. Bot. i. 500 (1842).

NATIVE NAMES: Maawka (*Sesutu*); isi-Ngau or isi-Gnau (*Zulu*).

SOUTH AFRICA. Natal: (type locality), a dominant species in the thorns country near Camperdown, *Burtt Davy* 10431! Transvaal! Delagoa Bay! Bechuanaland Protectorate! N'Gamiland.

The ripe pods smell sugary and are sweetish to the taste; though astringent, they are eagerly eaten by livestock. They contain about 20 per cent. of tannin, which is found suitable for certain kinds of work (*Sim*). According to Rochebrune, this species contributed, at one time, a large part of the "gomme du Cap" of commerce; Sim states that this gum has occasionally been collected in the Tugela Valley, Natal, and sold . . . . for the manufacture of confectionery. Tree up to 12 ins. in diameter; wood reddish, close-grained, hard, in Natal locally used for fuel (*Sim*); in the Waterberg District, Transvaal, the timber is found to be "extremely hard and durable, termite proof, and makes excellent fencing posts, equal to sneezewood" (*E. E. Galpin*).

73. **Acacia Borleae** *Burtt Davy*, sp. nov.; affinis *A. permixta*, Burtt Davy, sed ramulis rhachisque glandulosis nec hirsutis, foliolis multioribus brevioribus angustioribus minute mucronulatis pustulatis differt.

South Africa. Portuguese East Africa: Lourenco Marques, 18 Jan. 1920, *Mrs J. Borle* 271!

Shrub? with glutinous branchlets, petioles and peduncles. Spines straight, spreading 0·4–2·2 cm. long, grey with brownish tips, dotted with minute dark dots (glands?). *Leaves* and peduncles arising from reduced branchlets forming axillary cushions; petioles 0·5–1·5 cm. long; rhachis channelled, with 1 or 2 peltate glands at the base of the uppermost pinnae; pinnae 2–5 pairs, 2 cm. long; rhachilla channelled, leaflets about 2 mm. apart on the rhachilla, 2·5 mm. long, about 1 mm. broad, 6–13 pairs, oblong obtuse with a minute mucro, glabrous, the surface apparently pustular when fresh. *Peduncles* $2\frac{1}{2}$–$3\frac{1}{2}$ cm. long, the involucel above the middle and apparently glandular; flowers capitate, yellow; receptacle, calyx and corolla glabrous; bracteoles 0; legume not seen.

74. **Acacia Burkei,** *Benth.* in Lond. Journ. Bot. v. 98. pl. xviii. fig. 4 (1846); *A. ferox*, Benth., l.c. p. 97 pro parte, non Mart. & Gal. (1843).

Aapjes-doorn, or Haak-doorn.

Native name: mKwarimpi (*Sesutu*).

South Africa. Transvaal: Pretoria Distr.; Magaliesberg, *Burke* 126! (type), 523 pro parte! *Zeyher* 570 pro parte! Waterberg Distr.; Potgietersrust, *Burtt Davy* 5239! Nylstroom, *T.M.H.* 2983; between Nylstroom and the Springbok Flats, *Burtt Davy* 1731!

As Miss Glover has pointed out (Ann. Bolus Herb. i. 151, 1915), the type specimens of *A. ferox*, Benth. are composed of specimens of *A. Burkei*, Benth. and *A. detinens*, Burch., mounted on the same sheets; as representing a composite species, therefore, the name *A. ferox*, Benth. becomes a synonym; it is also antedated by *A. ferox*, Mart. & Gal.

75. **Acacia campylacantha,** *Hochst.* in A. Rich. Fl. Tent. Abyss. i. 242; Schweinf. Pl. Nil. t.l.; *A. Catechu*, Oliv. in Fl. Trop. Af. ii. 344, non Willd.; *A. Suma*, Benth., Monog. Mimos. in Trans. Linn. Soc. xxx. 519 (1874), non Ham.

Range: Tropical Africa, from Abyssinia to the Northern Transvaal.

S. Rhodesia: Bank of the Zambesi River near Victoria Falls, 900 m. alt. *Rogers* 5120!; Zambesi River bank, "a large tree 40 to 68 ft. high, when in flower can be smelt half a mile off," native name "Mowphonfwe," *C. E. F. Allen* 68!

N.W. Rhodesia: Kafue River, 6 miles below Kafue Bridge, 900 m. alt. (Chilenga name "Chombwe") *Rogers* 8658! Kasungula, a large shrub, fls. and frt. March, *Miss A. E. Gairdner* 430! Sesheke, Sept. 1860, *Dr. J. Kirk*!

Nyasaland: M'lange, 2500 ft., "tree 20–30 ft. high, flowers pale yellow, Oct." *Purves* 216!

Portuguese E. Africa: Mozambique Territory; Shupanga on the Zambesi River, 1869 *Dr. Stewart*! Chibabava on the Buzi River, a large tree, bark hard, corrugated; fls. white *W. H. Johnson* 82! Zambesi River, N'Kueza, 12/4/1860, between Tette and the sea coast, and near Senna, *Dr. J. Kirk*! *Swynnerton* 1242, from Gazaland, may also belong here.

South Africa. Extra-tropical Transvaal: Pietersburg Distr.; Middle Letaba River, at Buffels Road Drift, a large tree, June 9, 1906, *Burtt Davy* 2547! Thabina River, June 15, 1906, known as "White Thorn," *Burtt Davy* 2636!

In his Revision (Trans. Linn. Soc. xxx. 519, 520), Bentham observes that *A. Catechu*, Willd., *A. Suma*, Kurz, *A. hecatophylla*, Steud. and *A. caffra*, Willd., "are very difficult to distinguish from each other in dried specimens, and the synonymy is much confused. . . . It might be better, perhaps, to consider *A. Catechu* as a collective name, and to include in it *A. Rovumae*, *A. Sundra*, *A. Suma*, *A. hecatophylla* and *A. caffra*." He decided, however, to limit the use of the name *A. Catechu* to one of the tropical Asiatic species, excluding from it all the African material which he placed under *A. Suma* and *A. caffra*.

In a MSS. note at Kew under *A. campylacantha*, Hochst., Prof. Craib notes that "the African plant comes very near to the Indian *Catechu* group, and in that group comes nearest to *A. Suma*, Ham. (vide Prain, Journ. As. Soc. Beng. lxvi. 508, for Key to group), but is distinguished by its curved spines (the upper margin of spines in the Indian plant is *straight*, but in the African *curved*). The Nigerian plant is rather more robust than the Abyssinian, but intermediates are found in the Nyasa region. The Rhodesian plant agrees with some Nyasa specimens in being rather densely glandular."

On the Blue Nile, opposite Singa, the tree yields a good timber and is known as "Kakamut," in Arabic (*Muriel*).

In Bornu, Northern Nigeria, it yields the gum known as "Kolkol" (*K. F. Rae*) or "Kalkara"; in Yola the tree is known as "Cumbanchahon" and yields a "gum of good quality" (*B. E. B. Shaw*); according to Mr. G. C. Dudgeon, the tree is not uncommon on the Rogo road between Kano and Zaria, where it is known as "Massasagi."

76. **Acacia Galpinii,** *Burtt Davy*, sp. nov.; affinis, *A. kwebense*, N.E. Br., sed foliis majoribus glabrescentibus glaucescent-

ibusque, pinnis 10–12 jugis, foliolis 17–27 jugis 7–8 mm. longis 1·5–2 mm. latis, leguminibus 20–22 cm. longis 2·7 cm. latis subfalcatis subcoriaceis differt.

Aapjes-doorn.

South Africa. Transvaal: Waterberg Distr.; banks of Bad-zyn-loop River, Mosdene Estate, Naboomspruit, 19 Sept., 1920, *E. E. Galpin* 483M, (type)!

Large tree, 40 ft. high, 4 ft. diam. at 6 ft. from the ground. *Spines* sharply hooked, in pairs at the base of the leaves. *Rhachis* with petiole 9–14 cm. long, glabrous, with a small raised gland below the lowest pair of pinnae; pinnae 3·5–5 cm. long, 8–10 mm. apart; leaflets ± 2 mm. apart, obtuse, glabrous, glaucescent. *Spikes* 4–6 cm. long, racemosely fascicled on short pubescent axillary branches. *Calyx-tube* shallow, purplish, subglabrous; flowers light yellow. *Pod* subcoriaceous, flat with a conspicuous margin.

77. **Acacia giraffae,** *Burch.*, Travels ii. t. 5 (1824).

The true Kameeldoorn.

Native Name: Mokáala (*Sechuana*).

South Africa: Griqualand West; Griquatown, *Burchell* 1952; Klaarwater, *Burchell* 2402–3, (types)! Orange Free State! Transvaal! Bushmanland! Bechuanaland Protectorate! Damaraland!

The freshly dug roots give off a powerful urinous smell. The so-called "wooden flowers" of the Bechuanaland Protectorate—it is said—are sometimes produced on this tree (as well as on *Burkea africana*) by the haustoria of a parasitic *Loranthus* or *Viscum*. The pods are eaten by cattle and large game.

78. **Acacia heteracantha,** *Burch.*, Travels i. 389 (1822).

Umbrella-thorn, Bastard Kameel-doorn.

Native Name: Maawsu (*Sesutu*).

South Africa. Griqualand West: Spuigslangfontein; between the Orange River and Griquatown, *Burchell* 1710! (type). Herbert Division; western bank of the Vaal River, north of Backhouse, near Douglas, *J. Shaw*! Transvaal?

A flat-crowned tree about 20 ft. high, with "thick, clear single stem (frequently crooked)," up to 1½ ft. diameter. Flowers dirty whitish. Bracts medial or between the middle and base of the peduncle. Pod linear-falcate, "like that of *A. capensis*," (Burchell mss.). (*A. karroo*, Hayne.)

Closely allied to *A. litakunensis*, Burch., differing principally in the linear-falcate pods and medial bracts. This may be the "Zwaart Haak-doorn" or "Rooi wacht-'n-bietje" of the Springbok Flats, Waterberg District, Transvaal, which is described as having a medium-dark, furrowed bark, and a red heartwood, the wood becoming very hard after drying, and making excellent durable posts; it is further said to be uncommon in black-turf soils.

I have not seen a single fruiting specimen of *A. heteracantha* and good fruiting material is much desired in order to ascertain whether it is more than a mere form or condition of *A. litakunensis*, Burch.

79. **Acacia karroo,** *Hayne*, Gewaechse x, t. 33 (1827); *A. horrida*, Harv. in Fl. Cap. ii. 281 (1861–62), non Willd.; *A. capensis*, Burch., Travels i. 195 (name only) 189 (figure) (1822).

Karroo-thorn, Doorn-boom, Zoet-doorn, Wittedoorn, "Mimosa."

NATIVE NAME: um-Nga.

SOUTH AFRICA. Cape Province: Central, Eastern and South-western Regions. "Karroo," *Lichtenstein*, (type); Richmond Div.; *Drège*! Griqualand West; *Burchell* 1953–1! Orange Free State! Transvaal! S. Rhodesia: Salisbury, *Eyles* 1908!

All the Natal material referred to *A. horrida*, Willd., which I have seen, belongs to *A. natalitia*, E. Mey., a closely allied species which differs in the more numerous pinnae (4–7 pairs), narrower and more numerous leaflets, very pubescent rhachis and light-coloured (yellowish) bark.

The most widely-distributed species in South Africa, chiefly riparian (forming the outer zone of arborescent vegetation) or found where water occurs near the surface.

Acacia karro is troublesome to eradicate from agricultural land as it coppices freely, forming clumps which flower and fruit freely at about 3 ft. high. On the Springbok Flats, Waterberg District, Transvaal, I have seen extensive patches of this coppice, but only on "black turf" soils, probably where the natives had abandoned old "gardens" for clean new "braks" (i.e. newly broken veld), which they do as soon as the lands become so weedy as to involve much labour for cleaning. Goats and other livestock eat the young foliage in early spring, before green grass is plentiful. The bush is cut for making dry hedges for kraals. The wood makes excellent fuel, but though hard and tough is now seldom used for other purposes than the roughest of farm uses (*Sim*); it is subject to attack by a borer, but according to Mr. Tudor J. Trevor, if soaked in water for six months it is not liable to attack. The gum (Hlaga) has been exported by the ton as Cape Gum, and is also used locally in confectionery (*Sim*). The bark is used for domestic tanning; the bast of young branches is tough and is used on farms in place of twine or rope. The flowers are very fragrant, hence the name "Zoet-doorn."

var. **transvaalensis,** *Burtt Davy*, comb. nov.; *A. horrida*, var. *transvaalensis*, Burtt Davy in Kew Bull. 1908, p. 158.

SOUTH AFRICA. Endemic to the Transvaal.

Approaches *A. natalitia*, E. Mey., but the rhachis and rhachilla are less densely pubescent; leaflets less numerous and broader. Most of the Transvaal specimens of *A. karroo*, Hayne, are slightly pubescent, (as is also some of the Cape material), but much less prominently so than var. *transvaalensis*.

80. **Acacia litakunensis,** *Burch.*, Travels ii. 452 (1824); *A. spirocarpoides*, Engl. in Engl. Bot. Jahrb. x. 23 (1888).
Umbrella-thorn, Haak-en-steek or Wit-haak-doorn.

NATIVE NAMES: Sassani (*Sesutu*), Moshu (*Sechuana*).

SOUTH AFRICA. British Bechuanaland: Litakun, 1812, *Burchell* 2205, (type)! 1912, *Burtt Davy*! Griqualand West: Barkly Div.; near Espach's Drift, *Burtt Davy* 9643. Bechuanaland Protectorate! Transvaal! N'Gamiland?

A somewhat gregarious, flat-crowned tree 15–20 ft. high, with smooth bark, closely allied to *A. heteracantha*, Burch., but with spirally-twisted pods, and bracts close to the base of the peduncle. Flowers creamy-white, "very sweetly scented." The tree yields a gum; the wood is considered to be fit only for fuel. In the Waterberg District of the Transvaal, the 'steenbok' are said to be very fond of the pods and also to eat the leaves; but cattle do not appear to eat the pods, as far as my observation goes, though very fond of those of *A. giraffae*, Burch., and *A. Benthamii*, Rochebr.

In the winter of 1912, the centenary of Burchell's visit, I went to Litakun, partly with a view to re-collecting *Acacia litakunensis*, Burch., in the type locality.

Three species of Acacia were common there, including the well-known *A. giraffae*, Burch. and *A. robusta*, Burch. There were also large, old trees of a flat-crowned species with dimorphic spines and much twisted pods which agrees with Burchell's description and figure and with the scrappy type-specimen of *A. litakunensis*, so there can be no doubt that it is the tree described by Burchell. It agrees also with *A. spirocarpoides*, Engl., which therefore becomes a synonym.

81. **Acacia natalitia,** E. Mey., Comm. Pl. Afr. Aust. 167 (1835 or 36).
Natal Thorn.

SOUTH AFRICA. Natal: umGeni, 100 m. alt., *Drège* (type!). Transvaal! Delagoa Bay!

Closely allied to *A. karroo*, Hayne, but distinguished by the narrower, more numerous leaflets, more numerous pinnae, and characteristically pale, yellowish bark, as compared with the dark brown, almost black bark of *A. karroo*.

Harvey's Key in Fl. Cap. ii. 279, classes *A. natalitia*, E. Mey., with *A. robusta*, Burch., as having "pods lanceolate-oblong, broad," though the specimens cited by Meyer, Bentham and Harvey, were not in fruit. The pods now available do not show affinity with *A. robusta*, Burch., but rather with *A. karroo*, Hayne.

Specimens from Shiloh, Queenstown Division, *Baur*! and Fish River, Albany Division, *Schlechter* 6107! may belong here, though apparently somewhat intermediate in character, but more complete material is required in order to assign the specimens from these localities to their right place.

As is often the case with common plants, there is a scarcity in herbaria of material of the common "Doorn-boom" of the coastal region of the Cape, and this is required to delimit the range, and more clearly define the differences between the two species.

82. **Acacia permixta,** *Burtt Davy* sp. nov.; affinis *A. Nebrownii*, Burtt Davy, sed ramulis hirsutis, pinnis foliolisque multioribus, foliolis angustioribus, pedunculis longioribus et involucello sub medio posito, leguminibus distincte venosis differt.

SOUTH AFRICA. Transvaal: Waterberg District; Potgietersrust, April 12, 1906, a common shrub on low kopjes, *Burtt Davy* 5230! (type).

Shrub branchlets stoutish, chestnut-brown, hispid with short spreading white hairs. *Spines* 0·5–2 cm. long, straight, slender, white with brownish tips, pubescent when young with scattered hairs. *Leaves* 2·5–3·5 cm. long, arising from abortive branchlets forming axillary cushions; cushions clothed with light-brown persistent spinulose stipules about 1 mm. long; petiole 0·5 cm. long, rhachis and rhachillae pilose, and with scattered blackish glands; pinnae 2–4 pairs; leaflets 5–8 pairs, about 2 mm. apart on the rhachilla, 4–5 mm. long, 1·5–2 mm. broad, with a distinct mucro, sparsely ciliate, thick, glabrescent, the veins not prominent. *Flowers* capitate. *Peduncle* (of mature fruit) 3–3·5 cm. long, pilose with white, spreading hairs, glandular; involucel $1\frac{1}{2}$–2 cm. from the base, about 2 mm. long, cupular, lobed, sparsely pubescent, about 2 mm. long. *Legume* 3·5–4 cm. long, 1·2–1·4 cm. broad, slightly falcate, obuse; valves subcoriaceous, shining, prominently nerved towards the margins, sparsely glandular with dark, raised glands. *Seeds* circular, margin 1 mm. broad.—Confused with *A. glandulifera*, Schinz.

var. **glabra**, *Burtt Davy*, var. nov.; a forma typica ramulis, petiolis, pedunculisque, glanduliferis nec hirsutis, leguminibus minoribus (3 cm. longis) angustioribus (6 mm. latis), differt.

Fijn-doorn.

SOUTH AFRICA. Transvaal: Waterberg District; Hoogbult farm, Naboomspruit, forming low thickets 3 ft. high, *Galpin* 475 M! (type). This may prove to be a distinct species when more complete material is available.

Acacia Nebrownii, Burtt Davy, is based on *A. glandulifera*, Schinz, 1900, (not of S. Watson, 1890), the types of which are *Fleck* 484a from Great Namaqualand, and *Fleck* 480a from Tsoaxaub, Hereroland. In the Kew Bulletin for 1921, p. 50, writing in the absence of Transvaal and Swaziland material, I referred the plants there named *A. permixta* and *A. swazica*, to *A. Nebrownii;* specimens courteously lent by the Director of the Union Botanical Survey, show that three species and a variety have been confused under the name *A. glandulifera*, Schinz.

83. **Acacia Rogersii,** *Burtt Davy*, sp. nov.; affinis *A. swazicae*, Burtt Davy, sed petiolis brevioribus, foliolis minoribus, pedunculis tenuioribus glabris vel parce glandulosis, involucellis minoribus ad pedem pedunculorum positis, calycibus corollisque brevioribus, et staminibus longioribus differt.

South Africa. Transvaal: Messina, *Rogers* 21843! (type).

Shrub? with slender glabrous dark brown branchlets. *Spines* 0·6–6 cm. long, somewhat arcuately spreading, slender, white, glabrous. *Leaves* 1·5–2 cm. long, arising from abortive branchlets forming axillary cushions; cushions clothed with light brown, persistent, spinulose stipules about 1 mm. long; petiole 0·5 cm. long, sparsely glandular; rhachis and rhachilla glabrous, winged; pinnae mostly 1 (rarely 2) pairs; leaflets 4–5 pairs, about 2 mm. apart, 2–5 mm. long, 2–3 mm. broad, obtuse or minutely mucronulate, glabrous, drying green; veins and veinlets not conspicuous. *Flowers* capitate, the heads about 1 cm. diameter when in flower. *Peduncle* (of flower) 1·2–1·5 cm. long, glabrous or minutely sparsely glandular with pale glands; involucel hidden at the base of the peduncle, about 1 mm. long. *Legume* not seen.

84. **Acacia stolonifera,** *Burch.*, Travels ii. 241 (1824); *A. hebeclada*, DC., Prodr. ii. 451 (1825).

Native Name: Siki (*Sechuana*).

South Africa. Griqualand West: Ongeluk's-fontein, between Griquatown and Kuruman, *Burchell* 2138! (type of *A. stolonifera*, Burch.). British Bechuanaland: between New Litakun and the Moshowing River, *Burchell* 2267! (type of *A. hebeclada* DC.). Cape Province: Kimberley Division! Orange Free State! Transvaal! Great Namaqualand! N'Gamiland?

A very characteristic bush of the South Bechuanaland Region, forming a clump of coppice 1½–3 ft. high, and some yards in diameter. Burchell observes, l.c., that it is "remarkable from the circumstance of its trunk or stems running just beneath the surface of the earth, and from which arise a multitude of shoots or branches."

The name *A. hebeclada*, DC., being based on Burchell 2267, which was distributed by Burchell as his *A. stolonifera*, was from the first an unnecessary synonym.

A. stolonifera, Burch., also occurs as a shrub 4–6 ft. high, with a stout stem, and devoid of 'coppice,' a form so different in habit that Burchell himself entered his No. 2397, from Chue Spring, and No. 2402–1 ("a shrub 5 ft.") from British Bechuanaland, in his MSS Catalogue, as *A. heteracantha*, Burch., though these specimens are very different from his type of that species (i.e. *Burchell* 1710, from Klaarwater, Griquatown). As there does not appear, from the available material, to be any other difference between them, and as the ranges of the two forms overlap, it seems not unlikely that the coppice-like growth may be the result of the cutting down of the main stem of trunk-forming specimens of one and the same species.

85. **Acacia swazica,** *Burtt Davy*, sp. nov.; affinis *A. permixtae*, Burtt Davy, sed ramulis tenuioribus sparse glandulosis nec hirsutis, petiolis longioribus, pinnis foliolisque paucioribus, foliolis majoribus remotioribus, venis venulisque prominentibus, rhachide et pedunculo sparse glanduloso, nec hirsuto differt; a *Acacia glandulifera*, Schinz, foliolis multioribus et majoribus pedunculis longioribus mucronatis, et pedunculo bracteato differt.

South Africa. Swaziland: near Bremersdorp, 66 m. alt., Jan. 5, 1905, a common bush, *Burtt Davy* 3045! (type) in National Herb., Pretoria. Transvaal: Barberton Distr.; Singerton near Hectorspruit, 400 m. alt., Aug. 18, 1908, *Burtt Davy* 8002! Barberton, *Pott* 5305! Komatipoort, *Schlechter* 11868! Consort Valley, *Galpin* 631!

Dwarf bush with slender glabrous sparsely glandular brown branchlets. *Spines* situate at the base of the leaves, 0·4–4 cm. long, very straight, slender, white, sometimes with brownish tips, glabrous. *Leaves* 2·5–4·5 cm. long, arising from abortive branchlets forming axillary cushions; cushions clothed with light-brown, persistent, spinulose stipules about 1 mm. long; petiole 1–1·5 cm. long sparsely glandular; rhachis and rhachilla glabrous, winged; pinnae 1–2 pairs; leaflets 4–6 pairs, about 4 mm. apart, 3–11 mm. long, 2·5–4·5 mm. broad, mucronulate, glabrous, drying brownish; veins and veinlets prominent or not conspicuous. *Flowers* capitate. *Peduncle* of fruit 3–3·5 cm. long sparsely glandular; involucel about 1·5 cm. from the base, about 2 mm. long, cupular, toothed rather than lobed, glabrous, sometimes glandular ciliolate. *Legume* 2·5–4 cm. long, 1 cm. broad, slightly falcate and beaked; valves subcoriaceous, somewhat dull, prominently reticulate throughout, sparsely glandular with dark, raised glands. *Seeds* nearly circular, 5–6 mm. in diameter, including a margin 1–1·5 mm. wide.

Has been referred to *A. horrida forma*, from which it is at once distinguishable by the glandular petiole and rhachis, the smaller leaves, and the axillary peduncles which are either solitary or in pairs, not in terminal racemes.

86. **Acacia Woodii,** *Burtt Davy*, sp. nov.; arbor magna, affinis *A. rehmannianae*, Schinz, sed leguminibus 14–15 cm. longis 1·7–2·5 cm. latis ligneis juvenis griseo-viridis maturatis fulvobrunneis nec reticulatis, differt.

South Africa. Natal: between Estcourt and Colenso, *J. Medley Wood* 3528! (type); near Ladysmith, *Burtt Davy in Trans. Dep. Agric. Herb.* 4821! Cato Ridge, *Burtt Davy* 10437? without precise locality, *Gerrard* 1700! Transvaal: Barberton Distr.; White River Settlement, *Burtt Davy* 1502? (neither flowers nor pods; bark rugose, yellowish, corky, flaking off in rregular pieces).

Large widely branching tree with yellowish, flaking bark. *Branchlets* densely pubescent with yellowish spreading hairs, the young parts somewhat golden-tomentose. *Spines* short (4 mm. long) ascending, straight, subulate with a thickened base, pubescent. *Leaf-rhachis* 3·5–6·5 cm. long, pubescent; petiole 4 mm. long. *Pinnae* 8–25 (rarely up to 35) pairs, 2 cm. long; leaflets 25–40 pairs, silky ciliate, 3–5 mm. long, 1–1·5 mm. broad. *Peduncles* 2·5–3 cm. long, pubescent, axillary and solitary or in pairs, often collected in terminal racemes on short lateral branchlets; involucel usually rather above (rarely below) the middle, prominent, persistent. *Receptacles* without golden-yellow hairs; bracteoles of receptacle 2 mm. long, cucullate, pale coloured, glabrous within, hairy with a tuft of usually golden-yellow hairs; claw linear, ciliate. *Calyx-lobes* whitish-tomentose. *Pod* 14–15 cm. long, 1·7–2·5 cm. thick, with rounded margins, woody, dehiscent, grey-green when young, yellowish-brown when mature, glabrous.

87. **Kissenia spathulata,** *R. Br.* ex *Harv. et Sond.*, Fl. Cap. ii. 503. *Fissenia capensis*, R. Br., Harv. Thes. i. t. 98.

Harvey, l.c., cites the Aapjes River, Transvaal, as one of the localities for this species, on the strength of a specimen collected by Dr. Atherstone. The plant is a native of Bushmanland, Namaqualand and Arabia (if the reference of the South African plant to the Arabian species is correct), a distribution which renders it unlikely that such a very distinct desert type should occur in the vicinity of the Aapjes River, in the relatively well-watered Pretoria District. Atherstone is known to have collected along the Aapjes River, near Pretoria, which fact probably misled Harvey, but the label on Atherstone's Kew specimen of *Kissenia* reads :—" From sandy flats near the An Aap River which runs into the Orange R., Namaqualand "; the Aapjes River does not flow into the Orange, and it is not in, nor near Namaqualand. We may therefore eliminate *Kissenia spathulata*, R.Br., and with it the Family *Loasaceae*, from the list of Transvaal plants.

88. **Flaveria contrayerba,** *Pers.*, Syn. ii. 489 (1807).

South Africa. Griqualand West: Barkly Div.; Fourteen Streams Railway Station, a few plants by the railway track near the goods shed, April 1, 1920, *Burtt Davy* 18966 !

Native of South America (Peru and Chile). An interesting addition to the South African flora, and one which may possibly become a troublesome weed if allowed to spread.

89. **Gomphrena decumbens,** *Jacq.*, Hort. Schoenbr. t. 482.

South Africa. Transvaal: Heidelberg Distr., Vereeniging, a common weed of roadsides, railway tracks, and waste places, 1908, *Burtt Davy* ! Burttholm, a garden weed, 1914, but not common *Burtt Davy* ! Pretoria Distr.; Haaman's Kraal, 1903, *Burtt Davy* 1099 ! Waterberg Distr.; Potgietersrust, *Leendertz* 1888 ! Rustenburg Distr.; Rustenburg, *Nation* 180 ! Barberton Distr.; Barberton, in 1903, *Burtt Davy* 274 !

Tropical Africa. Southern Rhodesia: Salisbury Distr.; Makabusi Valley, *Eyles* 590! Salisbury, *Mrs. O. Craster* 182! Umtali Distr.; Odzani River Valley, *Teague* 418! Belgian Congo: Katanga Province; Mokambo Station, on the railway track, Aug. 1919, *Burtt Davy* 18086!

Native of Mexico, the West Indies and Tropical America, now widely distributed in the Transvaal Province and rapidly spreading along roads and railways to Rhodesia and the Katanga Plateau.

It keeps fairly green late in the winter, and is closely eaten by stock in late autumn and early spring. Either green or dry, it is a favourite with horses, mules and donkeys, but the yield of pasturage is low and it is somewhat inaccessible, owing to the decumbent habit of the plant.

It differs from *G. globosa*, Linn.—with which it has been confused—in habit and the much smaller, less globose heads which elongate during flowering, and by its usually white bracts. The true *G. globosa*, Linn., with larger, more globose heads and tawny bracts, has been found in Natal and tropical Africa, but does not appear to occur in the Transvaal, the specimens so named (Fl. Cap. v. 1. 433) from the Transvaal proving to be *G. decumbens*, Jacq.

Jacquin's figure is not quite characteristic of our plant, which, however, agrees exactly with tropical American material so named in the Kew collections, and I have no doubt that they are conspecific.

90. **Cryptocarya transvaalensis,** *Burtt Davy* sp. nov.; (Lauraceae-Cryptocaryeae]; *C. liebertianae*, Engl., affinis, sed petiolis brevioribus, foliis longioribus angustioribusque, nervis lateralibus infimis adscendentibus margine approximatis vel confluentibus, venulis minute reticulatis utrinque prominentibus, costis tenuioribus nec vel paullo prominentibus, inflorescentibus multifloris, floribus latioribus, perianthium lobis erectis, receptaculis latioribus, differt.

Large tree the leaf-buds and petioles fulvo-pubescent when young, soon becoming glabrous. *Leaves* 6–9·5 cm. long, 2–3 (rarely 4·5) cm. broad, oblong-lanceolate to ovate oblong, tapering at both ends or rounded below, abruptly obtuse to subacuminate, coriaceous, green above, glaucescent beneath, minutely and somewhat prominently punctulate-reticulate on both surfaces; midrib very prominent above; lateral nerves faint, not prominently elevated beneath, 5–7 on each side, the lowest pair very oblique, arising at the base close to the margin and sometimes merging with it, the second pair also very oblique. *Petiole* 3–5 mm. long, channelled above. *Panicles* terminal and axillary at the ends of the branchlets, densely many-flowered; pedicels 1–2 mm. long. *Flowers* when open, 3·3–3·5 mm. long, 2 mm. broad, pubescent; receptacle 1·5–2 mm. long; perianth-lobes 1·5–2 mm. long, erect, not incurved, finely pubescent within. *Fruit* 1·75 cm. long, 1·5 cm. in diameter crowned by the short persistent cylindrical neck of the receptacle, not ribbed, glabrous when dry wrinkled and dark red-brown.

Wild Quince.

NATIVE NAMES: Mootagoola-sode or Moozagu (*Modjadjies* Natives), Moeqwequlipala (*Sesutu*).

SOUTH AFRICA. Transvaal: Pietersburg Distr.; a common tree of the Mist-belt forests of the Houtboschberg, 1200–1700 m. *Burtt Davy* 5096! (type), 5094! 5209!; *A. J. O'Connor*, Nov. 1913, in flower, 1465, and Oct. 1916, in ripe fruit, 2081, both in Forest Dept. Herb.; Modjadjes Mt., *Burtt Davy* 5272!: Lydenburg Distr.; Pilgrim's Rest, in Van der Merwe Bush, *Burtt Davy* 5210!; Sabie-hoek Forest, *Burtt Davy* 5290! in For. Dept. Herb. 353; Forest near Pilgrim's Rest, *Grenfell*, Forest Dept. Herb. 352!

The wood is said to be "useful."

XLIX.—LIST OF PUBLICATIONS BY THE LATE G. MASSEE.

In the last paragraph of the obituary notice of the late Mr. G. Massee, published in *K.B.* 1917, p. 85, a reference is made to the preparation of a list of his papers to be published at a later date. The list which has had to be held over for some time has now been completed.

1867.

British Woodpeckers (*Picus*). Intellectual Observer, xi. pp. 321–325, 1 col. pl.

1877.

Phyllotaxis. Nature, xvi., p. 208.

1880.

Notes on some of our smaller Fungi. Science Gossip, 1880, pp. 7–9, 84–86, 224–226, 6 text-figs.

On the germination of the spores of *Spumaria alba*. (Notice of a communication to the Liverpool Microscopical Society.) Amer. Monthly Microsc. Journ., i. p. 240.

1882.

Notes on *Puccinia graminis*. Naturalist, vii. pp. 191–195.

Note on the germinating sporidia of *Valsa leiphemia*, Fr. Journ. Bot., xx. pp. 310–311.

1883.

A gossip about Fungi. Science Gossip, 1883, pp. 227–229, 252–256, 23 text figs.

1884.

Description and life-history of a new Fungus, *Milowia nivea*. Journ. R. Microsc. Soc., ser. 2, iv. pp. 841–845, 1 pl.

On the formation and growth of cells in the genus *Polysiphonia*. Journ. R. Microsc. Soc., ser. 2, iv. pp. 198–200, 1 pl.

1885.

New British Micro-Fungi. Journ. R. Microsc. Soc., ser. 2, v. pp. 757–760, 1 pl.

1886.

Notes on the structure and evolution of the *Florideae*. Journ. R. Microsc. Soc., ser. 2, vi. pp. 561–573, 1 pl.

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Edible and poisonous Fungi. Journ. Bd. Agric., xv. pp. 431–432, 600–601, 839; xvi. pp. 919–921, 1009–1010; xvii. pp. 45–46, 126–127, 217–218, 301–302, 387–388, 475–476. 25 col. pl. (1908–10). Also issued as a separate pamphlet, 8vo, pp. 28 25 col. pl.

The South African Locust Fungus. Kew Bull., 1908, pp. 197–198, 1 pl.

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New or critical British Fungi. Journ. Bot., xlvi. pp. 151–155.

Hollow Potatoes. Kew Bull., 1908, pp. 139–140, 1 text fig.; Journ. Bd. Agric., xv. pp. 287.

Economic Mycology. Naturalist, 1908, pp. 28–29.

Polymorphism in Fungi (*Thielavia basicola*). Naturalist, 1908, pp. 235–238, 1 text-fig.

Black Scab of Potatoes. Proc. Linn. Soc., 1908–9, pp. 6–7.

The enemies of the Rose (by G. M. and F. V. Theobald). Croydon, small 8vo. Diseases caused by Fungi (by G. M.), pp. 13–28, 4 col. pl.

Gooseberry Black Knot. Journ. Bd. Agric., xiv. pp. 680–681, 1 text-fig.

1909.

The structure and affinities of British *Tuberaceae*. Ann. Bot., xxiii. pp. 243–263, 1 pl.

On a new genus of *Ascomycetes* (by J. Harvey Gibson and G. M.). Ann. Bot., xxiii. pp. 335–336, 1 text-fig.

A *Funtumia* disease (*Nectria Funtumiae*, Mass.). Kew Bull., 1909, pp. 147–148.

Dry Scab of Potatoes. Journ. Bd. Agric., xvi. pp. 31–32. (Abstract from Kew Bull., 1909, pp. 16–18.)

Cucumber and Tomato Canker (*Mycosphaerella citrullina*, Grossenb.). Kew Bull., 1909, pp. 292–293, 1 pl.; Journ. Bd. Agric., xvi. pp. 579–581.

Coffee diseases of the New World. Kew Bull., 1909, pp. 337–341, text-fig.

Spraying for Fungus pests. Journ. R. Hort. Soc., xxxiv. pp. 306–312, 2 text-figs.

Economic Mycology. Naturalist, 1909, pp. 28–29.

Polymorphism in Fungi. Naturalist 1909, pp. 235–238.

Report on "Sprain" in Potato tubers. Journ. Bd. Agric., xvi. pp. 647–648.

Fungi in "The Subantarctic Islands of New Zealand," edited by Chas. Chilton, vol. ii, pp. 528–529.

Evolution of parasitism in Fungi. Proc. Linn. Soc., 1909–10, pp. 51–52.

The "Greening" of Potatoes. Journ. Bd. Agric., xvi. pp. 177–189, 1 pl.

Varieties of Scab in Potatoes. Journ. Bd. Agric., xv. pp. 749–751, 2 pl.

Injury to plants due to hail and frost. Kew Bull., 1909 pp. 53–55, 1 pl.

1910.

Diseases of cultivated plants and trees. London, 1910, 8vo, pp. xii and 602, 171 text-figs.; 2nd edition, 1916, pp. xii, 602 and 16*, 173 text figs.

Fungus on Para rubber tree [*Eutypa caulivora*, Mass.]. Agric. Bull. Straits and Fed. Malay States, ix. p. 217.

Fungi from Penang (collected by W. Fox). Agric. Bull. Straits and Fed. Malay States, ix. p. 135.

The origin and tendencies of parasitism in Fungi. Naturalist, 1910, pp. 289–292.

Trinidad Fungi. Proc. Agric. Soc. Trinidad and Tobago, x. pp. 87–90. (Reprinted from Kew Bull., 1910, pp. 1–6.)

On the occurrence of " Crown Gall " in England. Journ. Bd. Agric., xvii. pp. 617–620.

Witches' Brooms of Cacao. Kew Bull., 1910, p. 68.

A disease of *Pterocarpus indicus*. Kew Bull., 1910, pp. 95–96.

Die-back of *Hevea brasiliensis*. Kew Bull., 1910, p. 172.

Crown-Gall (*Dendrophagus globosus*, Toumey). Kew Bull., 1910, pp. 309–312, 1 pl.

Shot-hole Fungus (*Cercospora circumscissa*, Sacc.). Journ. Bd. Agric., xvii. pp. 211–214, 1 pl.

Tomato and Potato Bacteriosis. Journ. Bd. Agric., xvii. pp. 297–299, 1 pl.

Powdery Mildew of Peach and Cherry. Journ. Bd. Agric., xvii. pp. 652–653, 1 pl.

1911.

Abstract and practical Mycology. (Abstract.) Naturalist, 1911, pp. 26–27.

A disease of the Lilac (*Helminthosporium Syringae*, Klebahn). Kew Bull., 1911, pp. 81–82, 1 pl.

Die-back of Cacao and of Para rubber (*Diplodia cacaoicola*, P. Henn.). Kew Bull., 1911, p. 120.

The use of carbon bisulphide [in destroying Eelworms, and its effects on plants]. Kew Bull., 1911, pp. 169–170, 3 text-figs.

Crown-Gall and Hairy Root. [Note on American researches.] Kew Bull., 1911, p. 176.

A new paint-destroying Fungus (*Phoma pigmentivora*, Mass.). Kew Bull., 1911, pp. 325–326, 1 col. pl.

British Fungi, with a chapter on Lichens. London, 8vo, pp. 551, 42 pl. (40 col.), 19 text-figs.

Root tumours of Sugar-Beet. Journ. Bd. Agric., xvii.. pp. 830–831, 1 pl.

1912.

Mycology, new and old. Naturalist, 1912, pp. 366–367.

A disease of Sweet Peas, Asters and other plants (*Thielavia basicola*). Kew Bull., 1912, pp. 44–51, 1 pl.

" White-heads " or " Take-all " of Wheat and Oats (*Ophiobolus* graminis). Kew Bull., 1912, pp. 345–439, text-fig.: Journ. Bd. Agric., xix. 1913, pp. 1020–1025, 1 pl.

Diseases of Raspberry and Loganberry. Journ. Bd. Agric., xix. pp. 124–125, 1 pl.

The presence of tubers on Potato haulms. Journ. Bd. Agric., xix. pp. 560–563, 1 pl.

1913.

A new grass parasite (*Cladochytrium graminis* Büsgen). Kew Bull., 1913, pp. 205–207, text-fig.; Journ. Bd. Agric., xx. pp. 701–703, 1 pl.

A disease of Narcissus bulbs. Kew Bull., 1913, pp. 307–309, 1 pl.; Journ. Bd. Agric., xx. 1914, pp. 1091–1093, 1 pl.

Nematodes or Eelworms. Kew Bull., 1913, pp. 343–351, 1 pl., 1 text-fig.

On the discoloured spots sometimes present on chilled beef, with special reference to "Black Spot." Journ. Hygiene, xii. pp. 489–496, 2 col. pl.

Miles Joseph Berkeley, in F. W. Oliver, "Makers of British Botany." Cambridge, 8vo, pp. 225–232, 1 pl.

Diseases caused by Fungi, in E. Brown and H. H. Hunter, "Planting in Uganda.—Coffee—Para Rubber—Cocoa." London and Dublin, 8vo, pp. 151–167, 1 pl.

Mildews, Rusts, and Smuts (by G. M. and I. Massee). London, 8vo, pp. 229, 5 pl. (1 col.).

Clover Sickness. Journ. Bd. Agric., xix. pp. 928–930, 1 pl.

1914.

The evolution of the *Basidiomycetes*. Naturalist, 1914, pp. 47–50.

Füngi from various standpoints. Naturalist, 1914, pp. 387–388.

Bad germination of Wheat seed. Journ. Bd. Agric., xx. pp. 894–896, 1 pl.

How saprophytic Fungi may become parasites. Kew Bull., 1914, pp. 190–191.

Black-knot of Birch. Kew Bull., 1914, p. 322, 5 text-figs.

Diseases of Peas. Journ. Bd., Agric. xxi. pp. 418–423, 1 pl.

1915.

Some observations on the study of plant pathology. Journ. Econ. Biol., x. pp. 29–48.

Blister disease of fruit trees. Kew Bull., 1915, pp. 104–107, 1 pl.

1916.

Note on the occurrence of a veil in *Ithyphallus impudicus*. Naturalist, 1916, p. 19.

Neucaledonische Pilze (by E. M. Wakefield, G. M., and A. D. Cotton). Vierteljahrsschr. Naturforsch. Ges. Zurich, lxvi. pp. 628–631.

L.—MISCELLANEOUS NOTES.

Mr. Gerald Atkinson has been appointed by the Minister of Agriculture and Fisheries, as from 11th September 1922, Artist in the Herbarium at Kew, in succession to Mr. Arthur Kellett. Mr. Atkinson received his training at the School of Art, Hull.

We record with great regret, as this number goes to the printers, the deaths of Sir Isaac Bayley Balfour, F.R.S., late Regius Keeper of the Royal Botanic Gardens, Edinburgh, and Henry John Elwes, F.R.S. Notices of their contributions to botanical science will appear in the next number of the Bulletin.

The Botanical Magazine.—After the lapse of nearly two years we welcome the new issue of Curtis's Botanical Magazine, which has for so long been closely associated with the Royal Botanic Gardens.

The termination of the Fourth Series with the final part of Vol. XVI. was announced in the Bulletin for 1920, pp. 373, 374, and now after a long and anxious period it is being issued once more in its familiar cover, but under the auspices of the Royal Horticultural Society who have become the new Proprietors.

The Editorship has passed from the hands of the Director into those of Dr. O. Stapf, F.R.S., the late Keeper of the Herbarium and Library, and the Society is to be congratulated on having secured the services of so eminent a botanist for this important scientific undertaking. To Kew also the choice of Editor is a welcome one, since the long connection between Kew and the Magazine will continue much as in the past.

The new part—Part I. of Vol. CXLVIII., published by Messrs. H. F. & G. Witherby—is in every way excellent. The Plates as in former years are very well drawn, but the reproduction and colouring are greatly improved and the Plates are now comparable to those of the Magazine at its best.

The figures are the work of three artists, Miss Smith, Mr. Kellett, lately artist at Kew, and Miss Snelling, artist to the Magazine. They show both beauty of design and great accuracy of detail. The plants figured are *Jasminum rex*, Dunn (t. 8934) a remarkable pure white Jasmine from Siam; the dwarf *Rhododendron Williamsianum*, Rehder & Wilson (t. 8935), from Western China; *Podanthum floribundum*, Stapf (t. 8936), an interesting new species, here described for the first time, from Asia Minor which promises to be a garden plant of value; *Mesembrianthemum fragrans*, Salm Dyck (t. 8937) from South Africa; *Aeschynanthus sikkimensis*, Stapf (t. 8938) from India, also a new species. The plant figured was collected by Mr. Elwes near Darjeeling, and has brilliant flowers.

The next subjects are *Primula Sinolisteri*, Balf. f. (t. 8939) allied to *P. Listeri*, King and *P. obconica*, Hance, a native of South Western China; *Stapelia tsomoensis*, N. E. Brown (t. 8940), a remarkably good figure of this fine S. African succulent; *Philadelphus sericanthus*, Koehne (t. 8941) from Central China; *Rhododendron Baileyi*, Balf. f. (t. 8942) found by Capt. F. M. Bailey in 1913 in the upper Nyamjang Valley, South Tibet; *Bulbophyllum triste*, Reich. f. (t. 8943) from India; *Symphytum grandiflorum* D.C. (t. 8944) an interesting and hardy pale yellow symphytum from the Caucasus, and *Phellodendron Lavallei*, Dode (t. 8945) a deciduous nutaceous tree with panicles of black grape-like fruits from Japan.

It is interesting to learn that there will be no break in the continuity of the series of the Magazine. The volume for the year 1921 is being prepared by private enterprise and will be issued in the same style as the old and present numbers, and will it is hoped shortly be published.

The Ferns of Bombay.*—A small octavo volume forming a convenient pocket guide to the wild and cultivated ferns of Bombay. The sequence followed is that of Hooker & Baker's Synopsis Filicum. It should not be difficult with the aid of the synopsis of the 54 genera, which comes at the end of the volume, and of the keys to the species which are found with each genus, for anyone, even without a previous botanical training, to find out the names of the local ferns. The systematic part is preceded by an introduction dealing shortly with the structure and life history of ferns. The letterpress is clearly printed and the figures should prove useful.

S. T. D.

Food of the Gold Coast People.†—It is not often that the scientist living and working in little-known countries devotes his attention to the everyday practices of the native. It is therefore all the more interesting that we find in Dr. Dalziel's observations and analysis of the daily food of the native races of the Gold Coast a well reasoned report which may prove of great assistance to those whose duty it is to administer to the personal welfare of the natives and to the whiteman seeking to discover what is of value in the native foodstuffs. After a few introductory remarks on the general nature and variety of the foodstuffs employed, Dr. Dalziel cites typical diets of different local races and then proceeds to discuss relative and actual values of the foods in use. Of these the chief Cereals are Rice, Maize and Guinea-corn. In commenting on the food values of Peas and Beans he mentions that the general prejudice against pulses or leguminous seeds is well established on the Gold Coast. The crops discussed are Cow-pea (*Vigna Catjang*),

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* The Ferns of Bombay pp. viii, 228, with 2 coloured, 15 black and white plates and 43 text figures, by E. Blatter and J. F. d'Almeida. Taraporevala Sons & Co., Bombay. Price Rs. 7/8/–.

† J. M. Dalziel, M.D., B.Sc., F.L.S., Deputy Director, Sanitary Services, Gold Coast, *in* The Journal of the Gold Coast Agricultural and Commercial Society; vol. i. No. 4, 1922. Published by the Society, Accra: price 6*d*.

the Bambarra Ground-nut or Round Single-seeded Earth Pea (*Voandzeia subterranea*), the Pigeon or Congo Pea (*Cajanus indicus*), Soya Beans (*Glycine Soja*), and Ground-nuts (*Arachis hypogaea*). Of other vegetables used as food he refers to the Tiger-nut (*Cyperus esculentus*), Yams and Coco-yams, Okros, Spinach, Garden Eggs, Sweet Potato and the introduced *Sechium edule* and *Cucurbita moschata*, but though the use of vegetables is so general he states " that it is by no means certain that they form a sufficient proportion, or that their properties are not largely lost in cooking." His criticism of the few fruits in cultivation and their poor variety indicates perhaps a larger field for improvement than in respect to any other kind of diet. In his conclusions he considers the relative value of introduced foods such as bread and comments on the surprising indifference to eggs and milk. The relation of the diet as a whole to deficiency diseases and stomach and bowel disorders so prevalent in the country, is discussed with the comment that " Gold Coast diets are, for most individuals, not deficient in quantity, but there is much reason to believe that in quality, or in lack of some one or more essential elements, there may be tissue starvation, to which many of the gastro-intestinal disorders, which afflict the people are due." He summarises the chief defects of the present diets and deplores the increasing consumption of tinned food which, " with the increasingly popular white bread, without admixture of local foodstuffs, would be the ruin of the people." His recommendations are that " reliance on the country's own Cereals, Maize Guinea-corn and home-grown rice, to the exclusion of imported polished kinds, is to be developed. Fruit and Market Gardening and the more abundant use of fresh vegetables should be inculcated. These, along with more attention to the production of larger quantities of poultry are to be commended in the interests of the people themselves, whether living on the land or labouring for others."

Spartina Townsendii at Clevedon, Somerset.*—A further report from Miss Ida M. Roper after a visit to Clevedon on the 28th September of this year leaves little doubt that the experiment of planting *Spartina* as a mud-binder in the hope of raising the river flats below Clevedon has not proved the success that had been anticipated. The tidal race has proved too strong and although the original clumps have continued to hold out in some places they have been swept away elsewhere and, except in a few sheltered spots, failed to unite. Miss Roper remarks as follows.

" It is much to be regretted that this trial planting of *Spartina* must be considered to have become derelict. Whilst the individual clumps at the North East part appear this season to be healthy and bearing flowers well, they have not increased either in number or in size, and there is a broken or ragged

* For previous accounts see *Kew Bull.*, 1918, p. 26, and 1919, p. 391.

appearance in the bands and outer line that shows the mud is not being retained on the shore. The big rise and fall of the tides produce a distinct hollow round each clump, whereby the young shoots mostly perish before reaching across to take root in the mud. The scattered clumps nearer the bank suffer in a similar way and do not join up.

"Close to the mouth of the River Kenn there is an increase in the number of separate clumps, but they were washed to that part originally, and the first severe storm is likely to carry all of them away.

"Over the remainder of the flats to the South West for over a mile there is scarcely a clump left, except a few in the three sheltering bights, and as this is the stretch which it was intended chiefly to benefit by the planting of *Spartina* for shore raising purposes, the experiment must be regarded as a failure."

Malay Poisons and Charm Cures.*—The greater part of the recent edition of Dr. Gimlette's book deals with methods of poisoning, of charms, medicine men and the origin of poisons from animal and inorganic sources. Chapters VIII. and IX. and Appendix II. are devoted to plants. In Chapter VIII. nineteen of the principal jungle plants and trees are described with notes on their administration as poisons and, in many cases, the effects actually observed. The best known of these are the Rengas tree (*Stagmaria* and *Melanorrhora* spp.), so often noticed as the solitary standing tree on jungle clearings, and whose juices are reported to have a blistering effect similar to that of the "mustard gas" used in the war; the Upas climber, species of *Strychnos*, and the Upas tree, *Antiaris toxicaria*, both so well known as furnishing the principal poison for darts and arrows.

Chapter IX. contains descriptions of twelve groups of plants cultivated in and around villages for their medicinal and poisonous properties. The uses of *Datura* and Tuba, in particular, are described at length and amongst the others used in compounding poisons it is interesting to note the Papaya, Pepper, Pinang, Pineapple and Ginger.

The value of the book as a work of reference to be consulted is considerably impaired by the abbreviation of the Index in which botanical names and economic uses are only occasionally given. In this respect it cannot be considered to be an improvement on the first edition. It is, however, a work that should find a place in every scientific library, as so many sciences are reviewed in connection with the practices of an interesting people well versed in jungle lore, and from whom we may well expect to learn some of the secrets of nature.

* Malay Poisons and Charm Cures, by John D. Gimlette, M.R.C.S., L.R.C.P. J. and A. Churchill, London, 1923. 2nd Ed., 8*s*. 6*d*.

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ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

APPENDIX I.—1922.

LIST OF SEEDS OF HARDY HERBACEOUS PLANTS AND OF TREES AND SHRUBS.

The following is a select list of seeds of Hardy Herbaceous Plants and of Hardy Trees and Shrubs which, for the most part, have ripened at Kew during the year 1921. These seeds are available only for exchange with Botanic Gardens, as well as with regular correspondents of Kew.

HERBACEOUS PLANTS.

Abronia arenaria.
umbellata.

Acaena argentea.
glaucophylla.
laevigata.
Novae-Zealandiae.
ovalifolia.
Sanguisorbae.

Acantholimon glumaceum.

Acanthus longifolius.
Schottii

Achillea argentea.
Clavennae.
conjuncta.
decolorans.
lingulata.
macrophylla.
moschata.
nana.
odorata.

Achillea—*cont.*
pyrenaica
sarracenica.
serbica.
sibirica.
Wilczekii.

Aconitum barbatum.
chinense.
moldavicum.
Napellus.
— var. tauricum.
orientale.
uncinatum.
volubile.
Vulparia.
Wilsonii.

Actaea alba.
spicata.

Adenophora denticulata.
ornata.

x (78)16633 Wt 31—P 20 1000 12/21 E & S Items 7

Aethionema amoenum.
cappadocicum.
iberideum.
pulchellum.

Agropyron acutum.

Agrostis alba.
elegans.

Allium caeruleum.
carinatum.
grande.
Heldreichii.
hymenorrhizum.
karataviense.
montanum.
neapolitanum.
odorum.
pulchellum.
roseum.
siculum.
sikkimense.
sphaerocephalum.
Stellerianum.

Alonsoa linifolia.

Alstroemeria aurantiaca.
haemantha.

Althaea armeniaca.
cannabina.
ficifolia.
kurdica.
officinalis.
pallida.
rosea.

Alyssum argenteum.
minimum.
saxatile.
scardicum.
spinosum.
Wulfenianum.

Amarantus caudatus.
chlorostachys.
hypochondriacus.
polygamus.
retroflexus.

Amethystea caerulea.

Ammi majus.

Ammobium alatum.

Ammophila arundinacea.

Amsonia angustifolia.

Anacyclus officinarum.
Pyrethrum.

Anaphalis cinnamomea.

Anchusa capensis.
myosotidiflora.

Androsace lactiflora.
occidentalis.

Anemone angulosa.
coronaria.
decapetala.
Halleri.
multifida.
pratensis.
Pulsatilla.
rivularis.
sylvestris.

Angelica ampla.

Anthemis austriaca.
macedonica.
montana.
tinctoria.

Anthericum Liliago.

Antirrhinum glutinosum.
hispanicum.
Orontium.
sempervirens.

Apera arundinacea.

Aquilegia caerulea.
canadensis.
chrysantha.

Aquilegia—*cont.*
flabellata.
formosa.
glandulosa.
olympica.
pyrenaica.
Skinneri.

Arabis arenosa.
bellidifolia.
verna.

Arctotis stoechadifolia.

Arenaria austriaca.
balearica.
Bertolonii.
foliosa.
graminifolia.
gypsophiloides.
grandiflora.
juniperina.
laricifolia.
montana.
pinifolia.
purpurascens.
sajanensis.
saxatilis.

Argemone alba.
hispida.
mexicana.
ochroleuca.

Armeria canescens.
chilensis.
fasciculata.
latifolia.
majellensis.
plantaginea.
setacea.

Arnica latifolia.
longifolia.
montana.
sachalinensis.

Artemisia parviflora.
procera.

Asperula azurea.
galioides.
tinctoria.

Asphodeline liburnica.
lutea.

Asphodelus albus.

Aster alpinus.
brachytrichus.
Farreri.
foliaceus.
himalaicus.
laevis.
lichiangensis.
linariifolius.
Lipskyi.
Piccolii.
Prescotii.
pyrenaeus.
sibiricus.
subcaeruleus.
vestitus.

Astilbe koreana.
rivularis.
simplicifolia.

Astragalus alopecuroides.
baeticus.
chinensis,
frigidus.
pentaglottis.
Siversianus.
stipulatus.
sukiensis.
sulcatus.

Astrantia carniolica.
helleborifolia.
pauciflora.

Athamanta Matthioli.

Atropa Belladonna.
var. lutea.

Axyris amarantoides.

Baeria coronaria.

Ballota Pseudo-dictamnus.

Baptisia australis.
— var. minor.

Barbarea arcuata.

Beckmannia erucaeformis.

Bellium bellidioides.

Berkheya purpurea.

Beta maritima.
trigyna.

Bidens ferulaefolia.
pilosa.

Biscutella auriculata.
didyma.

Biserrula Pelecinus.

Blumenbachia insignis.
muralis.

Brachycome iberidifolia

Brachypodium caespitosum.
japonicum.
pinnatum.
sylvaticum.

Brassica Cheiranthos.
dissecta.
Erucastrum.
juncea.
napus var. dichotoma.
oleracea.
rugosa.
turgida.

Brickellia grandiflora.

Briza maxima.

Brodiaea lactea.
pedunculata.

Bromus breviaristatus.
brizaeformis.
ciliatus.
erectus.
japonicus.
maximus.
rubens.
sterilis.
unioloides.

Bulbine annua.

Bulbinella Hookeri.

Buphthalmum salicifolium.

Butomus umbellatus.

Caccinia strigosa.

Cakile maritima.

Calamagrostis Epigeios.
lanceolata.
varia.

Calamintha alpina.
chinensis.
grandiflora.

Calandrinia grandiflora.
speciosa.

Calla palustris.

Callirhoë lineariloba.

Callistephus hortensis.

Camassia Fraseri.
Leichtlinii.
montana.

Camelina foetida.
sativa.

Campanula Erinus.
glomerata.
Grosseckii.
Imeretina.
kewensis.
lactiflora.
lanata.
latifolia.
linifolia.
longistyla.
Loreyi.
macrostyla.
michauxioides.
patula.
persicifolia.
phyctidocalyx.
primulaefolia.
pulla.
punctata.
Raddeana.
rhomboidalis.
sarmatica.
serotina.
speciosa.
spicata.
versicolor.
Waldsteiniana.

Capsella grandiflora.
Heegeri.

Carbenia benedicta.

Carduus cernuus.
Kernerii.
nutans.
tenuiflorus.

Carex binervis.
laevigata.
tomentosa.
tribuloides.

Carlina acaulis var. caulescens.

Carrichtera Vella.

Carthamus tinctorius.

Catananche coerulea.
— var. alba.

Cathcartia villosa.

Celmisia Lindsayi.
Sinclairii.
spectabilis argentea.

Celsia pontica.

Centaurea axillaris.
Calcitrapa.
dealbata.
depressa.
macrocephala.
montana.
moschata.
phrygia.
pulchra.
rupestris.
ruthenica.

Centranthus macrosiphon.

Cephalaria alpina.
transsylvanica.

Cerastium alpinum.
Biebersteinii.
grandiflorum.
tomentosum.

Chaerophyllum aromaticum.
aureum.
nodosum.
roseum.

Charieis heterophylla.

Chelidonium Franchetianum.

Chelone obliqua.

Chenopodium ambrosioides.
Bonus-Henricus.
Nuttallii.
Quinoa.
urbicum.

Chlorogalum pomeridianum.

Chorispora tenella.

Chrysanthemum Aucherianum.
carinatum.
caucasicum.
ceratophylloides.
cinerariaefolium.
coccineum.
coronarium.
corymbosum.
lacustre.
macrophyllum.
maximum.
myconis.
pallens.

Chrysopon Gryllus.

Chrysopsis villosa.

Cicer arietinum.

Cicuta maculata.
virosa.

Cimicifuga cordifolia.
dahurica.
foetida.
racemosa.

Cladanthus proliferus.

Cladium mariscus.

Clarkia elegans.
pulchella.

Cnicus arachnoideus.
eriophorus.
ochroleucus.
syriacus.
tuberosus.

Codonopsis ovata.
sylvestris.

Coix Lacryma-Jobi.

Collinsia bicolor.
grandiflora.

Collinsonia canadensis.

Collomia gilioides.
grandiflora.

Conringia orientalis.
perfoliata.

Convolvulus siculus.
undulatus.

Coreopsis auriculata.
tinctoria.
verticillata.

Coriandrum sativum.

Corispermum hyssopifolium.

Corydalis capnoides.
rosea.

Cortaderia argentea.
conspicua.

Cosmidium Burridgeanum.

Cousinia Hystrix.

Crepis aurea.
blattarioides.
Dioscoridis.
rubra.

Cuphea lanceolata.

Cuscuta Gronovii.

Cyananthus lobatus.

Cynodon Dactylon.

Cynoglossum cheirifolium.
nervosum.

Dactylis Aschersoniana.

Danthonia calycina.

Datura inermis.

Delphinium Brunonianum.
cardiopetalum.
caucasicum.
decorum.
Delavayi.
elatum.
grandiflorum.
nudicaule.
occidentale.
pictum.
puniceum.
speciosum.
viscosum.

Deschampsia caespitosa.
calycina.
flexuosa.
tenella.

Deyeuxia Langsdorfii.

Dianthus arenarius.
Caesius.
Carthusianorum.
Caryophyllus.
chinensis.
cruentus.
deltoides.
fragrans.
furcatus.
gallicus.
giganteus.
hirtus.
inodorus.
leptopetalus.
Lereschii.
monspessulanus.
Pancicii.
pelviformis.
pubescens.
Requienii.
Seguieri.
sinensis.
subacaulis.
superbus.
Waldsteinii.

Diarrhena americana.

Dictamnus albus.
—var. purpureus.

Digitalis ambigua.
laevigata.

Dimorphotheca hybrida.
pluvialis.

Dipsacus asper.
Fullonum.

Dodecatheon Lemoinei.
Meadia.

Draba Athoa.
Bertolonii.
hirta.
incana.
rupestris.

Dracocephalum Moldavica.
nutans.
parviflorum.

Dryas Drummondii.
octopetala.

Ecballium Elaterium.

Eccremocarpus scaber.

Echinacea purpurea.

Echinops bannaticus.
echinacea.
Tournefortii.

Elymus giganteus.
virginicus.

Emilia flammea.

Epilobium Dodonaei.
luteum.
rosmarinifolium.
sericeum.

Eragrostis abyssinica.
  elegans.

Eremostachys laciniata.

Eremurus robustus.
  — var. Elwesianus.

Erigeron bellidifolius.
  Coulteri.
  glabellus.
  glaucus.
  macranthus.
  mucronatus.
  multiradiatus.
  Rusbyi.
  salsuginosus.
  uniflorus.

Eriophyllum caespitosum.

Eriogonum racemosum.
  subalpinum.

Erodium amanum.
  Botrys.
  gruinum.
  macradenum.
  petraeum.
  romanum.

Eryngium alpinum.
  Bourgatii.
  palmatum.
  planum.
  Serra.

Erysimum linifolium.
  rupestre.

Eschscholzia caespitosa.
  californica.

Eucharidium concinnum.

Fedia Cornucopiae.

Ferula glauca.

Festuca ampla.
  Myuros.

Fragaria indica.

Francoa ramosa.
  sonchifolia.

Galega officinalis.
  patula.

Galeopsis ochroleuca.

Galium thymifolium.

Gaudinia fragilis.

Gaura coccinea.

Gentiana asclepiadea.
  crassicaulis.
  Cruciata.
  dahurica.
  decumbens.
  Fetissowii.
  Freyniana.
  Grombezewskii.
  lutea.
  macrophylla.
  phlogifolia.
  septemfida.
  straminea.
  tibetica.

Geranium albanum.
  anemonæfolium.
  Fremontii.
  grandiflorum.
  macrorrhizum.
  nodosum.
  rivulare.

Gerbera Anandria.

Geum album.
  bulgaricum.
  chiloense.
  Heldreichii.
  intermedium.
  montanum.

Geum—*cont.*
parviflorum.
pyrenaicum.
rhaeticum.

Gilia achilleaefolia.
aggregata.
androsacea.
capitata.
densiflora.
dianthoides.
liniflora.
multicaulis.
squarrosa.
tricolor.

Gillenia trifoliata.

Glaucium corniculatum.
flavum var. tricolor.

Globularia cordifolia.
vulgaris.

Glyceria maritima.
plicata.

Gomphrena globosa.

Guizotia oleifera.

Gypsophila acutifolia.
elegans.
Gmelinii.
Steveni.
viscosa.

Hablitzia tamnoides.

Halenia elliptica.

Hebenstreitia comosa.

Hedysarum esculentum.
elongatum.
flavescens.

Helianthemum Brewerii.
canum.
Tuberaria.

Helichrysum bracteatum.
saxatile.
Stoechas.

Helipterum Manglesii.
roseum.

Hemerocallis citrina.
flava.
minor.

Hibiscus Trionum.

Hieracium aurantiacum.
amplexicaule.
Bornmülleri.
cappadocicum.
foliosum.
Heldreichii.
Jankae.
lanatum.
maculatum.
pannosum.
villosum.

Hilaria rigida.

Horminum pyrenaicum.

Hosackia oblongifolia.

Hunnemannia fumariaefolia.

Hyacinthus azureus.
romanus.

Hymenophysa pubescens.

Hyoscyamus albus.

Hypecoum procumbens.

Hypericum confertum.
Coris.
delphicum.
nummularium.
olympicum.
polyphyllum.
tomentosum.

Hypochaeris glabra.

Hysterionica pinifolia.

Iberis Amara.
Lagascana.
pinnata.
Tenoreana.

Incarvillea Delavayi.
grandiflora.

Inula barbata.
ensifolia.
hirta.
racemosa.
salicina.
squarrosa.

Iris bucharica.
chrysographis.
foetidissima.
laevigata.
missouriensis.
ochroleuca.
tenax.
tingitana.
versicolor.

Isatis glauca.
tinctoria.

Isopyrum fumarioides.

Iva xanthifolia.

Jasione perennis.

Juncus alpinus.
Chamissonis.
compressus.
Gerardii.

Jurinia alata.

Kitaibelia vitifolia.

Kochia trichophila.

Koeleria albescens.
setacea.

Lactuca Bourgaei.
macrophylla.

Lagurus ovatus.

Lallemantia canescens.
iberica.

Lamarckia aurea.

Laserpitium Siler.

Lasthenia glabrata.

Lathyrus angulatus.
Aphaca.
articulatus.
cirrhosus.
Clymenum.
filiformis.
hirsutus.
Jordani.
luteus.
maritimus.
montanus.
Nissolia.
Ochrus.
palustris.
pannonicus var. Smithii.
pisiformis.
polyanthus.
rotundifolius.
sativus.
setifolius.
tingitanus.
tuberosus.
undulatus.
variegatus.
venosus.

Lavatera cachemiriana.
thuringiaca.
trimestris.

Layia elegans.

Leontopodium alpinum.

Lepachys pulcherrima.

Leptarrhena amplexifolia.

Leptosyne Douglasii.
maritima.

Leucojum aestivum.

Ligusticum pyrenaicum.

Lilium pardalinum.
pyrenaicum.

Limnanthes Douglasii.

Linaria dalmatica.
Elatines.
multipunctata.
saxatilis.
triphylla.
tristis.

Linum grandiflorum.
monogynum.
nervosum.
usitatissimum.

Loasa vulcanica.

Lobelia cardinalis.
ramosa.
syphilitica.

Lotus Requienii.
Tetragonolobus.

Lupinus Menziesii.
micranthus.
mutabilis.
nanus.
onustus.
subcarnosus.
varius.

Luzula albida.
nivea.

Lychnis alpina.
chalcedonica.
Flos-jovis.
fulgens.
Githago.
Preslii.
Sartorii.

Lycurus phleoides.

Lysichiton camtschaticum.

Lysimachia clethroides.
davurica.

Lythrum alatum.

Madia elegans.
sativa.

Malcomia maritima.

Malva Alcea.
moschata.
parviflora.

Malvastrum campanulatum.
lateritium.
limense.

Martynia proboscidea.

Matricaria Tchihatchewii.

Meconopsis heterophylla.
paniculata.
Prattii.

Medicago Murex.
orbicularis.
turbinata.

Melanthium virginicum.

Melica altissima.
ciliata.

Mentzelia Lindleyi.

Meum athamanticum.

Mirabilis divaricata.
  Jalapa.

Molinia caerulea.

Monarda didyma.
  fistulosa.

Monolepis trifida.

Morina longifolia.

Muscari Argaei.
  armeniacum.
  comosum.
  compactum.
  Maweanum.
  neglectum.
  paradoxum.

Myosurus minimus.

Narcissus Bulbocodium.

Nardus stricta.

Nemophila insignis.

Nepeta concolor.
  discolor.
  nuda.

Nemisia versicolor.

Nicandra physaloides.

Nicotiana Langsdorffii.
  rustica.
  Tabacum.

Nigella damascena.
  hispanica.
  sativa.

Notobasis syriaca.

Nycterinia capensis.

Oenothera acaulis.
  amoena.
  fruticosa.
  odorata.
  pumila.
  rosea.
  speciosa.
  tenella.

Omphalodes linifolia.

Onosma albo-roseum.

Orchis foliosa.
  latifoliax maculata.

Ornithopus sativus.

Origanum Majorana.
  pulchrum.

Ornithogalum arcuatum.
  narbonense.

Oxytropis argentea.
  baicalensis.
  ochroleuca.
  pilosa.
  strobilacea.

Paeonia lutea.
  microcarpa.
  paradoxa.
  peregrina.

Panicum capillare.
  obtusum.

Papaver apulum.
  commutatum.
  laevigatum.
  lateritium.
  nudicaule.
  orientale.
  pavoninum.
  rupifragum.
  somniferum.

Parnassia mysorensis.
  palustris.

Patrinia villosa.

Pennistum latifolium.

Penstemon acuminatus.
arizonicus.
barbatus.
confertus.
deustus.
diffusus.
glaber.
glaucus.
heterophyllus.
humilis.
laevigatus.
ovatus.
Palmeri.
Scouleri.
secundiflorus.
virgatus.

Perowskia atriplicifolia.

Peucedanum coriaceum.
graveolens.
Ostruthium.

Phacelia campanularia.
viscida.

Phaecasium pulchrum.

Phalaris tuberosa.

Phlomis agraria.
cashmiriana.
pratensis.
Herba Venti.
umbrosa.
viscosa.

Phygelius capensis.

Physalis Alkekengi.
edulis.
Franchetii.

Physochlaina orientalis.

Physospermum cornubiense.

Physostegia virginiana.

Phyteuma canescens.
Michelii.
orbiculare.
Scheuchzeri.
serratum.

Phytolacca decandra.

Picridium tingitanum.

Plantago Coronopus.
maritima.
nivalis.
Psyllium.
serpentina.

Platycodon grandiflorum.
— var. Mariesii.

Pleurospermum Golaka.

Poa abyssinica.
caesia.
violacea.

Podolepis acuminata.

Podophyllum Emodi.

Polemonium foliosissimum.

Polygonum affine.
alpinum.
Laxmanni.
lichiangensis.
molle.
viviparum.

Polypogon monspeliensis.

Portulaca grandiflora.

Potentilla argentea.
argyrophylla.
chrysantha.
crinita.
cryptotaenia.

Potentilla—*cont.*
Detomassii.
eriocarpa.
gracilis.
Herbichii.
Hopwoodiana.
leuconota.
Meyeri.
montenegrina.
multifida.
nepalensis.
nevadensis.
recta.
rivalis.
rupestris.
tanacetifolia.
Valderia.
villosa.

Poterium alpinum.
canadense.
obtusum.

Preslia cervina.

Primula Beesiana.
chionantha.
conspersa.
Edina.
helodoxa.
malacoides.
sikkimensis.

Psoralea acaulis.
macrostachya.
orbicularis.
Pycnanthemum lanceolatum.

Ramondia pyrenaica.

Ranunculus aconitifolius.
Flammula.
Gouanii.
millefoliatus.
nissanus.
platanifolius.

Rehmannia angulata.
chinensis.

Reseda virgata.

Rheum acuminatum.
Alexandrae.

Richardsonia scabra.

Ricotia Lunaria.

Rodgersia aesculifolia.
pinnata.
podophylla.
sambucifolia.
tabularis.

Roemeria hybrida.

Romulea Bulbocodium.

Rudbeckia ampla.
amplexicaulis.
speciosa.

Rumex flexuosus.
hymenosepalus.
maritimus.
salicifolius.

Salvia argentea.
Bertolonii.
Columbariae.
cyanescens.
Horminum.
japonica.
nemorosa.
Sclarea.
uliginosa.
verticillata.
virgata.
viscosa.

Sambucus Ebulus.

Santolina pinnata.

Saponaria cerastioides.
ocymoides.
Vaccaria.
Wiemannii.

Saracha umbellata.

Saussurea albescens.
pectinata.
salicifolia.

Saxifraga calabrica.
catalaunica.
cartilaginea.
cochlearis.
— var. minor.
Cotyledon.
crassifolia.
cordifolia.
decipiens.
Delavavi.
exarata.
Fortunei.
granulata.
Haagei.
hirsuta.
Hostii.
lingulata.
— var. lantoscana.
longifolia.
Macnabiana.
marginata.
Mertensiana.
mutata.
pedemontana.
rotundifolia.
trifurcata.
tyrolensis.
Wallacei.

Scabiosa brachiata.
candicans.
caucasica.
Columbaria.
crenata.
daucoides.
Kitaibelii.
prolifera.
Pterocephala.
sylvatica.
vestina.

Schizanthus pinnatus.

Sclerocarpus uniserialis.

Scolymus maculatus.

Scopolia sinensis.

Scorzonera hispanica.

Securigera Coronilla.

Sedum altissimum.
anopetalum.
elongatum.
Ewersii.
hybridum.
kamtschaticum.
middendorfianum.
pilosum.
reflexum.
roseum.
spathulifolium.
stoloniferum.
Woodwardii.

Selinum tenuifolium.
vaginatum.

Senecio abrotanifolius.
adonidifolius.
alpinus.
clivorum.
Doria.
Doronicum.
elegans.
japonicus.
Ledebouri.
Ligularia.
Przewalskii.
squalidus.
stenocephalus.
Veitchianus.
Wilsonianus.

Serratula atriplicifolia.
coronata.
heterophylla.
quinquefolia.
tinctoria.

Seseli elatum.
gracile.
osseum.

Sesleria argentea.

Setaria glauca.
  italica.

Sidalcea candida.
  malvaeflora.
  neo-mexicana.

Siderites scordioides.

Silaus flavescens.

Silene apestris.
  Armeria.
  Asterias.
  colorata.
  conica.
  conoidea.
  cretica.
  elegans.
  fimbriata.
  italica.
  linicola.
  longicilia.
  muscipula.
  noctiflora.
  nocturna.
  nutans.
  Otites.
  paradoxa.
  pendula.
  quadrifida.
  Reichenbachii.
  Saxifraga.
  Schafta.
  squamigera.
  vallesia.
  viridiflora.
  Zawadskii.

Silphium Asteriscus.
  pinnatifidum.

Silybum eburneum.
  Marianum.

Sium sisarum.

Smyrnium Olusatrum
  perfoliatum.

Spartina alterniflora.
  stricta.

Specularia perfoliata.
  Speculum.

Sphaeralcea ambigua.

Stachys grandiflora.
  lanata.
  pulustris.

Statice Bonduellii.
  sinensis.
  sinuata.
  Suwarowii.

Stevia ovata.

Stipa papposa.
  tenacissima.

Swertia dilatata.
  Hookeri.
  longifolia.
  perennis.

Symphyandra Hofmannii.
  pendula.
  Wanneri.

Synthyris reniformis.

Tagetes erecta.
  patula.

Tellima grandiflora.

Tetragonia expansa.

Teucrium Botrys.
  canadense.
  flavum.
  lucidum.

Thalictrum aquilegifolium.
calabricum.
corynellum.
dipterocarpum.
Fendleri.
flavum.
minus.
Przewalskii.
squarrosum.

Thermopsis fabacea.
lanceolata.

Thymus odoratissimus.

Tigridia Pavonia.

Trautvetteria palmata.

Tribulus terrestris.

Trifolium alpestre.
elegans.
ochroleucum.
fragiferum.
pannonicum.
physodes.

Trigonella coerulea.
corniculata.
Foenum-graecum.
polycerata.

Trillium grandiflorum.

Trollius patulus.
pumilus.
sinensis.
yunnanensis.

Troximon laciniatum.

Tunica graminea.
prolifera.

Urospermum Dalechampii.

Urtica cannabina.

Valerianella eriocarpa.

Venidium fugax.

Veratrum Wilsoni.

Verbascum Blattaria.
Chaixii.
longifolium.
Lychnites.
olympicum.
phlomoides.
phoeniceum.
speciosum.
virgatum.

Verbena bonariensis.
paniculata.

Veronica austriaca.
Colensoi glauca.
exaltata.
fruticulosa.
gentianoides.
grandis.
incana.
Lyallii.
multifida.
orientalis.
prostrata.
saxatilis.
spicata.
virginica.

Vesicaria grandiflora.

Vicia angustifolia.
calcarata.
fulgens.
grandiflora.
melanops.
pyrenaica.
striata.
sylvatica.
unijuga.

Vincetoxicum fuscatum.

Viola cornuta.
  epipsila.
  lutea.
  tricolor var. nigra.

Zanschreria californica.

Zephyranthes minima.

Zygadenus elegans.
  venenosus.

TREES AND SHRUBS.

Those marked with an asterisk were not grown at Kew.

*Abies balsamea.
    *nobilis.

Acanthopanax divaricatum.
    Giraldii.
    lasiogyne.
    sessiliflorum.
    setchuenense.

Acer Heldreichii.
    — var. macropterum.
    hyrcanum.
    insigne.
    japonicum var. macrophyllum.
    laetum.
    Lobelii.
    macrophyllum.
    micranthum.
    monspessulanum.
    neglectum.
    nikoense.
    tetramerum.

Aegle sepiaria.

Aesculus flava.
    glabra.
    indica.

Ailanthus glandulosa.

Akebia cuneata.

Alnus cordifolia.
    elliptica.
    firma.
    glutinosa.
    incana.
    japonica.
    mollis.
    nitida.
    oregona.
    orientalis.

Alnus—*cont.*
    serrulata.
    sitchensis.
    tenuifolia.
    viridis.

Amelanchier canadensis.
    florida.

Aralia chinensis.
    — var. glabrescens.

Arbutus Unedo.

*Arctostaphylos glauca.
    Manzanita.
    tomentosa.
    Uva-Ursi.

Baccharis patagonica.

Berberis aggregata.
    angulosa.
    aristata.
    Beaniana.
    brachypoda.
    buxifolia.
    canadensis.
    Chitria.
    consimilis.
    Darwinii.
    diaphana.
    dictyophylla.
    dubia.
    Edgeworthiana.
    Francisci-Ferdinandii.
    Gagnepainii.
    Guimpelii.
    Hookeri.
    Lycium.
    koreana.
    Leichtlinii.
    nervosa.
    orthobotrys.

Berberis—*cont.*
polyantha.
Prattii.
Sargentiana.
sibirica.
sinensis.
Soulieana.
Stapfiana.
subcaulialata.
thibetica.
Thunbergii.
umbellata.
Veitchii.
verruculosa.
virescens.
Wilsonae.
yunnanensis.

Betula coerulea.
Ermanii.
— var. nipponica.
fruticosa.
humilis.
japonica var. mandshurica.
lenta.
lutea.
Medwediewii.
occidentalis.
papyrifera.
populifolia.
pumila.
utilis.

Bruckenthalia spiculifolia.

Buddleia albiflora.
alternifolia.
japonica.
nivea.
variabilis.
— var. Veitchiana.

Bupleurum fruticosum.

Buxus sempervirens.

Callicarpa Giraldiana.
japonica.

Calophaca wolgarica.

Calycanthus Mohrii.
occidentalis.

Camellia cuspidata.

Caragana arborescens.
aurantiaca.
Boisii.
decorticans.
frutescens.
microphylla.

Carmichaelia australis.
flagelliformis.
odorata.

Carpinus caroliniana.
orientalis.
Turczaninowii.

Cassandra calyculata.

*Cassia marylandica.

Cassinia fulvida.

Ceanothus integerrimus.
papillosus.
thyrsiflorus.
velutinus.

Cedrus atlantica.
Deodora.
Libani.

Celastrus articulatus.
scandens.

Celtis glabrata.
occidentalis.
Vilmoriniana.

Cephalotaxus drupacea.
Fortunei.
pedunculata.

Cercis Siliquastrum.

Chionanthus virginica.

Cistus canescens.
crispus.
hirsutus.
laurifolius.
populifolius.
salvifolius.
tauricus.
villosus.

Cladothamnus pyrolaeflorus.

Cladrastis amurensis.

Clematis aethusifolia var.
— latisecta.
akebioides.
connata.
— var. velutina.
Fargesii.
fusca.
Gauriana.
grata.
integrifolia.
intermedia.
ligusticifolia.
mandshurica.
orientalis.
Pitcheri.
Rehderiana.
Scottii.
Spooneri.
tangutica.
Veitchiana.
virginiana.

Clerodendron Fargesii.
trichotomum.

Clethra acuminata.
alnifolia.
— var. paniculata.
monostachya.

Cocculus trilobus.

Colutea bullata.
media.
orientalis.

Corema album.

Cornus alba.
Amomum.
Baileyi.
candidissima.
glabrata.
Nuttallii.
officinalis.
pubescens.
sanguinea.
stolonifera.

Corokia Cotoneaster.

Cotoneaster acutifolia.
affinis.
amoena.
apiculata.
applanata.
bacillaris.
— var. obtusata.
bullata.
buxifolia.
divaricata.
Fontanesii.
Franchetii.
frigida.
— var. aurea.
— var. Vicarii.
Harroviana.
hebephylla.
Henryana.
horizontalis.
humifusa.
hupehensis.
integerrima.
laxiflora.
Lindleyi.
lucida.
microphylla.
moupinensis.
multiflora.
— var. calocarpa.
Nummularia.
obscura.
pannosa.
pekinensis.
prostrata.
rotundifolia.
salicifolia var. floccosa.
— var. rugosa.

Cotoneaster—*cont.*
Simonsii.
thymifolia.
tomentosa.
uniflora.
Zabelii.

Crataegus acclivis.
altaica.
Arnoldiana.
asperifolia.
basilica.
Beckwithae.
Boyntonii.
Buckleyi.
canadensis.
Carrierei.
Chapmanii.
coccinea.
coloradensis.
cordata.
densiflora.
dilatata.
Dippeliana.
Downingii.
durobrivensis.
Egglestonii.
Ellwangeriana.
elongata.
georgiana.
glandulosa.
grigoniensis.
Holmesiana.
infera.
intricata.
Jackii.
Jonesae.
Lambertiana.
leptophylla.
Macauleyi.
macracantha.
mollis.
neo-Canbyi.
orientalis.
praecox.
prunifolia.
pubescens var. stipulacea.
punctata.
semi-orbiculata.
sinaica.

Crataegus—*cont.*
succulenta.
tanacetifolia.
verecunda.
viridis.

*Cupressus arizonica.
Goveniana.
Lawsoniana.
nootkatensis.
pisifera.
sempervirens.
thyoides.

Cydonia Maulei.

Cytisus biflorus.
capitatus.
glabrescens.
horniflorus.
monspessulanus.
nigricans.
purgans.
purpureus.
scoparius.
— var. Andreanus.
sessilifolius.

Daboëcia polifolia.

Decaisnea Fargesii.

Deutzia compacta.
corymbosa.
crenata.
gracilis.
longifolia.
— var. Veitchii.
macrocephala.
planifolia.
reflexa.
Sieboldiana.
Vilmoriniae.

Diervilla Lonicera.
rivularis.
sessilifolia.

Dipelta floribunda.

Distylium racemosum.

Elaeagnus angustifolia.
argentea.
multiflora.
umbellata.

Eleutherococcus Henryi.
leucorrhizus.
— var. fulvescens.
scaberulus.
Simonii.

Enkianthus campanulatus.

Erica australis.
cinerea.
scoparia.
stricta.
Tetralix.

Eucalyptus Gunnii.

Eucryphia pinnatifolia.

Euonymus Bungeanus.
Hamiltonianus.
japonicus.
latifolius.
oxyphyllus.
planipes.
ussuriensis.
yedoensis.

Eurotia ceratoides.

Evodia hupehensis.

Exochorda Albertii.
Giraldii.
grandiflora var. Wilsonii.

Fontanesia phillyraeoides.

Forsythia europaea.

Fothergilla major.

Fraxinus Ornus.
pennsylvanica.

Garrya elliptica.

Gaultheria hispida.
procumbens.
Shallon.

Gaylussacia dumosa.
resinosa.

Genista aethnensis.
pilosa.
radiata.
tinctoria.
var. elatior.
var. mantica.
virgata.

Halesia hispida.
tetraptera.

Hamamelis arborea.
— var. Zuccariniana.
japonica.
mollis.

Helianthemum alpestre.
polifolium.
vulgare.

Hibiscus syriacus.
— var. albus.
— var. azureus.
— var. Hamabo.

Hippophae rhamnoides.

Hydrangea.
Bretschneideri.
canescens.
longipes.
paniculata.
petiolaris.
radiata.
xanthoneura.
— var. glabrescens.

Hymenanthera crassifolia.

Hypericum Androsaemum.
aureum.
Buckleii.
elatum.
galioides.
hircinum.
Hookerianum
inodorum.
Kalmianum.
patulum.
— var. Henryi.
perforatum.
prolificum.
uralum.

Ilex cornuta.
crenata.
decidua.
integra.
verticillata.

Indigofera Gerardiana.
Potatinii.

Jasminum Beesianum.
fruticans.
humile.

*Juniperus californica.
*communis.
*monosperma.
*Pinchotii.
*sabinoides.
*virginiana.

Kalmia cuneata.
latifolia.

Koelreuteria apiculata.
paniculata.

Laburnum alpinum.
vulgare.

Laurus nobilis.

Ledum latifolium.
palustre.

Leiophyllum buxifolium.

Leucothöe Davisiae.
racemosa.

Leycesteria formosa.

Ligustrum Delavayanum.
Ibota.
insulare.
macrocarpum.
medium.
Prattii.
Quihoui.
yunnanense.

Lonicera alpigena.
chaetocarpa.
chrysantha.
coerulescens.
deflexicalyx.
depressa.
dioica.
floribunda.
Giraldii.
gynochlamydea.
Henryi.
involucrata.
— var. serotina.
Kesselringii.
Koehneana.
lanceolata.
Ledebourii.
longa.
Maackii.
micrantha.
obovata.
ovalis.
prostrata.
Ruprechtiana.
subequalis.
Sullivantii.
— var. hirsuta
syringantha.
tatarica.
tragopylla.
translucens.
trichopoda.
xerocalyx.

Lupinus arboreus.

Lycium chinense.

Lyonia ligustrina.

Magnolia acuminata.
glauca.
Lennei.
parviflora.
Soulangeana.
tripetala.
Wilsonii.

Menziesia globularis.

Microglossa albescens.

Myricaria germanica.

Myrtus communis.
Luma.

Neillia capitata.
opulifolia.
stellata.
thibetica.
Torreyi.

Nuttallia cerasiformis.

Olearia albida.
Haastii
odorata.

Ononis fruticosa.

Osteomeles Schwerinae.
— var. microphylla.

Oxydendron arboreum.

Paliurus australis.

Pernettya mucronata.

Pertya sinensis.

Petteria ramentacea.

Phellodendron amurense.
chinense.
Lavallei.

Philadelphus acuminatus.
brachybotrys.
californicus.
coronarius.
Falconeri.
Gordonianus.
incanus.
inodorus.
insignis.
latifolius.
Lewisii.
microphyllus.
pekinensis.
pubescens.
Satsumii.
sericanthus.
speciosissimus.
tomentosus.
Wilsonii.

Photinia Beauverdiana.
— var. notabilis.
subumbellata.

Phyllodoce empetriformis.

Picea Breweriana.

Pieris formosa.
japonica.
mariana.

*Pinus albicaulis.
Armandii.
koraiensis.
*monticola.
*palustris.

Piptanthus nepalensis.

Platanus acerifolia.
hispanica.
orientalis.

Potentilla fruticosa.
micrandra.

Prumnopitys elegans.

Prunus Avium.
emarginata.
japonica.
*Lannesiana.

Pseudolarix Fortunei.

Ptelea isophylla.
trifoliata.

Punica Granatum.

Pyracantha angustifolia.
coccinea.
crenulata.
— var. Rogersiana.
Gibbsii.

Pyrus alnifolia.
alpina.
americana.
— var. nana.
arbutifolia.
Aria var. majestica.
— var. salicifolia.
Aucuparia var. moravica.
crataegifolia.
Folgneri.
glomerulata.
Hostii.
Meinichii.
minima.
munda.
— var. subarachnoidea.
nigra.
pinnatifida.
pohuashanensis.
Prattii.
prunifolia.
Ringo.
rotundifolia.
Sargentii.
sikkimensis.
sorbifolia.
Sorbus.
theifera.
Toringo.
toringoides.
Torminalis.

Pyrus—*cont.*
Tschonoskii.
Vilmorinii.
Zumi.

Quercus conferta.
macrocarpa.
Mirbeckii.

Raphiolepis japonica.

Rhamnus californica.
cathartica.
davurica.
fallax.
Frangula.
infectoria.
japonica.
mandshurica.
Purshiana.
tinctoria.

Rhododendron ambiguum.
Augustinii.
brachycarpum.
californicum.
catawbiense.
concinnum.
Cuthbertii.
Davidsonianum.
decorum.
discolor.
ferrugineum.
Fauriei.
haematodes.
halense.
hippophaeoides.
impeditum.
lepidotum.
maximum.
Metternichii.
micranthum.
nipponicum.
oreotrephes.
racemosum.
rhombicum.
rubiginosum.
Souliei.
Vaseyi.

Rhododendron—*cont.*
viscosum.
yanthinum.
yunnanense.

Rhodotypos kerrioides.

Rhus glabra.
Potaninii.
punjabensis.
vernicifera.

Ribes alpinum.
amictum.
aureum.
cruentum.
divaricatum.
futurum.
holosericeum.
Jessoniae.
mandshuricum.
mogollonicum.
Pringlei.
robustum.
rotundifolium.
stenocarpum.

Robinia Kelseyi.

Rosa alpina.
—var. pyrenaica.
baicalensis.
blanda.
coruscans.
cinnamomea.
Davidii.
— var. elongata.
elegantula.
foliolosa.
glutinosa.
gymnocarpa.
humilis.
Hugonis.
involuta.
lucens.
Luciae.
macrophylla.
mollis.
Moyesii.
multibracteata.
nitida.
nutkana.

Rosa—*cont.*
omeiensis.
— var. atrosanguinea.
— var. polyphylla.
— var. pteracantha.
pisocarpa.
pomifera.
pratincola.
rugosa.
Seraphinii.
sericea.
sertata.
setipoda.
Soulieana.
stylosa var. evanida.
Sweginzowii.
Webbiana.
Willmottiae.
Woodsii.

Rubus adenophorus.
biflorus var. quinqeflorus.
coreanus.
deliciosus.
flosculosus.
Giraldianus.
inopertus.
Kuntzeanus.
lasiostylus.
— var. dizygos.
mesogaeus.
neglectus.
nigro-baccus.
nutkanus.
odoratus.
omeiensis.
parvifolius.
pubescens.
thibetanus.
ulmifolius var. inermis.
xanthocarpus.

Ruscus aculeatus.
*racemosus.

Ruta graveolens.

Sciadopitys verticillata

Securinega fluggeoides.
ramiflora.

Skimmia japonica.

Sophora flavescens.
    viciifolia.

Spartium junceum.

Spiraea Aitchisonii.
    arborea.
    — var. glabrata.
    arcuata.
    bella.
    betulifolia.
    bracteata.
    canescens.
    discolor.
    expansa.
    japonica.
    Lindleyi.
    longigemmis.
    mollifolia.
    Nobleana.
    salicifolia.
    — var. stellipila.
    tomentosa.
    Veitchii.
    Wilsonii.

Stachyurus. chinensis.

Staphylea colchica.
    pinnata.
    trifolia.

Stranvaesia undulata.
    salicifolia.

Styrax japonicum.
    Wilsonii.

Symphoricarpus Heyeri.
    mollis.
    racemosus.

Syringa Emodi.
    japonica.
    villosa.
    Wilsonii.

Tamarix pentandra.

Taxodium distichum.

Taxus cuspidata.

Thuya orientalis.

Trochodendron aralioides

Vaccinium corymbosum.
    hirsutum.
    *macrocarpum.
    pallidum.
    simulatum.
    Vitis-idaea.

Viburnum betulifolium.
    buddleifolium.
    Carlesii.
    cotinifolium.
    Henryi.
    hupehense.
    Lantana.
    lobophyllum.
    ovatifolium.
    pubescens.
    rhytidophyllum.
    theiferum.
    tomentosum.
    Tinus.
    Veitchii.
    venosum.

Vitis amurensis.
    Coignetiae.
    cordifolia.
    heterophylla.
    orientalis.
    sinensis.

Wistaria chinensis.
    floribunda.
    multijuga.

*Yucca angustifolia.

Zanthoxylum alatum.
    Bungei.
    piperitum.

*Zelkova sinica.

Zenobia speciosa.
    — var. pulverulenta.

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ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

APPENDIX II.—1922.

LIST of STAFFS of the ROYAL BOTANIC GARDENS, Kew, and of Botanical Departments, Establishments and Officers at Home, and in the Dominions, India and the Colonies, in Correspondence with Kew.

* Trained at Kew.

Royal Botanic Gardens, Kew.—

Director - - - - - -	Arthur W. Hill, M.A., Sc.D., F.R.S., F.L.S.
Assistant Director - - - -	*Thomas Ford Chipp, M.C., B.Sc., Ph.D., F.L.S.
Assistant - - - - - -	*John Aikman.
,, - - - - - - -	*William Nicholls Winn.

Keeper of Herbarium and Library -	Arthur Disbrowe Cotton, F.L.S.
Assistant - - - - - -	Charles Henry Wright, A.L.S.
,, - - - - - -	*Sidney Alfred Skan.
,, - - - - - -	Thomas Archibald Sprague, B.Sc., F.L.S.
,, - -	Elsie Maud Wakefield, M.A., F.L.S.
,, - - - - -	*William Bertram Turrill, M.Sc.
,, - - - -	*John Hutchinson, F.L.S.
,, - - - - - - -	K. W. Braid, B.A., B.Sc., A.I.C.
,, for India - - - -	S. T. Dunn, B.A.
,, for South Africa - -	——
Artist - - - - - -	Gerald Atkinson.

Assistant Keeper, Jodrell Laboratory	Leonard Alfred Boodle, F.L.S.

Keeper of Museums - - - - -	John Masters Hillier.
Assistant - - - - - - -	*John H. Holland, F.L.S.
,, - - - - - - -	*William Dallimore.
Preparer - - - - - - -	Laurance John Harding.

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Natal.—

Durban.—Municipal Gardens:—

	Curator - - -	*H. Rutter.

Pietermaritzburg.—Botanic Garden:—

	Curator - - -	*H. H. Kidd.

Transvaal.—

Pretoria.—Transvaal Museum:—

	Superintendent of Herbarium.	Mrs. R. Pott.

University of South Africa.—

Bloemfontein	Professor of Botany -	G. Potts, M.Sc., Ph.D.
Grahamstown	,, ,, -	S. Schönland, M.A., Ph.D.
Johannesburg	,, ,, -	C. E. Moss, M.A., D.Sc., F.L.S.
Pietermaritzburg.	,, ,, -	J. W. Bews, M.A., D.Sc.
Pretoria -	,, ,, -	H. A. Wager, A.R.C.S.

University of Stellenbosch.—

	Professor of Botany -	W. Nel, M.A.
	,, ,, Phytopathology and Mycology.	P. van der Bijl, M.A., F.L.S.

Egypt.—

Cairo.—Ministry of Agriculture:—

Inspector General -	A. T. McKillop.
Botanical Section:—	
Director - - -	E. Shearer, M.A., B.Sc.
Botanist - - -	M. A. Bailey, B.A.
,, - - -	T. Trought, B.A.
Mycologist - - -	H. R. Briton-Jones.
Experimental Farms:—	
Inspector - - -	M. W. Gray, M.A., B.Sc.
Horticultural Section:—	
Director - - -	*T. W. Brown, F.L.S.
Assistant Director -	*F. G. Walsingham.
Superintendent - -	*G. S. Crouch.
,,	*H. L. R. Chapman.

Gambia.—Agricultural Department:—

Director - - -	*A. J. Brooks, F.L.S., F.C.S.

Gold Coast.—Agricultural Department:—

Director - - -	W. S. D. Tudhope.
Deputy Director -	A. Ogilvie.
Assistant Director for Research and Mycologist.	R. H. Bunting, F.L.S.
Assistant Mycologist -	H. A. Dade.
Senior Superintendent	*A. E. Evans.
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,,	*H. L. R. Chapman.

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Deputy Director -	A. Ogilvie.
Assistant Director for Research and Mycologist.	R. H. Bunting, F.L.S.
Assistant Mycologist -	H. A. Dade.
Senior Superintendent	*A. E. Evans.
,, ,,	C. H. Knowles, B.Sc.
,, ,,	*A. C. Miles.

Gold Coast—*continued.*

Superintendents - -	C. Saunders.
,, - -	*A. B. Culham.
,, - -	*T. Hunter.
,, - -	W. Caldwell.
Assistant Superintendents.	*G. H. Eady.
,, ,,	M. D. Reece.
,, ,,	*W. C. Fishlock.
,, ,,	T. J. S. Smellie.
,, ,,	G. C. Coull, B.Sc.
,, ,,	J. Steele.
,, ,,	H. J. Horwood, B.A.
,, ,,	A. W. Paterson.
,, ,,	H. K. Hewison.
Supervisor of Fruit and Vegetable Farms.	*M. Vardy.
,, ,,	A. A. L. Smith.
Conservator of Forests -	N. C. McLeod.

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Nairobi.—Director of Agriculture -	A. Holm.
Deputy Director of Agriculture.	E. Harrison.
Mycologist - -	J. McDonald, B.Sc.
Plant Breeder - -	G. J. L. Burton.
Plant Import Inspector	C. C. T. Sharpe.
Coffee Plant Inspector-	A. D. Le Poer Trench.
Manager, Kabete Experimental Farm.	J. Johnston.
Manager, Kibor Farm	*F. B. Butler.
Experimentalist -	*J. Sparrow.
Conservator of Forests -	F. Battiscombe.
Naivasha - Manager of Experimental Farm.	J. H. W. Beale.

Nigeria.—Agricultural Department :—

Director of Agriculture.	O. T. Faulkner, B.A.
Assistant Director -	P. H. Lamb, F.L.S.
Mycologist - - -	T. Laycock.
Senior Superintendents	*F. Evans, F.L.S.
,, ,,	A. J. Findlay, M.A., B.Sc.
,, ,,	K. T. Rae.
Superintendents -	*A. R. Bell.
,,	H. G. Burr, B.Sc.
,,	S. M. Gilbert, B.Sc.
,,	F. D. Golding.
,,	J. E. Gray, B.A.
,,	J. O'N. Hewitt, A.R.C.S.
,,	C. J. Lewin, M.C.
,,	J. R. Mackie, B.Sc.
,,	R. Nichol.
,,	H. Roebuck.
,,	R. Swainson-Hall, F.L.S.
,,	T. Thornton.
,,	H. B. Waters, B.A.
Director of Forests - -	H. N. Thompson, C.M.G.

South Australia.—

Adelaide.—University Professor of Botany. — T. G. B. Osborn, D.Sc.
Botanic Gardens:—
Director - - - J. F. Bailey.
Woods and Forests:—
Conservator - - Walter Gill, F.L.S.

New Guinea.—

Rabaul.—Department of Agriculture:
Director - - - - ——
Botanic Gardens:—
Superintendent - - ——

Northern Territory.—

Port Darwin - Superintendent of Agriculture and Curator, Botanic Gardens - *C. E. F. Allen.

Tasmania.—

Hobart - - Government Botanist — Leonard Rodway, C.M.G.
Conservator of Forests — L. G. Irby.
Botanic Gardens:—
Superintendent - - J. Wardman.

Victoria.—

Melbourne.—Botanic Gardens:—
Curator - - - J. Cronin.
National Herbarium (South Yarra):—
Government Botanist - W. Laidlaw, B.Sc.
Assistant - - - J. R. Tovey.
,, J. W. Audas.
,, P. F. Morris.
University Professor of Botany. — A. J. Ewart, D.Sc., Ph.D., F.L.S.
Chief Commissioner of Forests. — Owen Jones, B.A.

Western Australia.—

Perth - - Botanist and Pathologist. ——
Acting Conservator of Forests. — S. Kessell, B.Sc.

BERMUDA.

Agricultural Department:—
Director - - - E. A. McCallan.

CANADA.

Ottawa - - Director of Government Experimental Farms. — J. H. Grisdale.
Dominion Horticulturist. — W. T. Macoun.
Dominion Botanist - H. T. Güssow.

Gold Coast—*continued.*

Superintendents - -	C. Saunders.
,, - -	*A. B. Culham.
,, - -	*T. Hunter.
,, - -	W. Caldwell.
Assistant Superintendents.	*G. H. Eady.
,, ,,	M. D. Reece.
,, ,,	*W. C. Fishlock.
,, ,,	T. J. S. Smellie.
,, ,,	G. C. Coull, B.Sc.
,, ,,	J. Steele.
,, ,,	H. J. Horwood, B.A.
,, ,,	A. W. Paterson.
,, ,,	H. K. Hewison.
Supervisor of Fruit and Vegetable Farms.	*M. Vardy.
,, ,,	A. A. L. Smith.
Conservator of Forests -	N. C. McLeod.

Kenya Colony and Protectorate.—

Nairobi.—	Director of Agriculture -	A. Holm.
	Deputy Director of Agriculture.	E. Harrison.
	Mycologist - -	J. McDonald, B.Sc.
	Plant Breeder - -	G. J. L. Burton.
	Plant Import Inspector	C. C. T. Sharpe.
	Coffee Plant Inspector-	A. D. Le Poer Trench.
	Manager, Kabete Experimental Farm.	J. Johnston.
	Manager, Kibor Farm	*F. B. Butler.
	Experimentalist -	*J. Sparrow.
	Conservator of Forests -	E. Battiscombe.
Naivasha -	Manager of Experimental Farm.	J. H. W. Beale.

Nigeria.—Agricultural Department :—

Director of Agriculture.	O. T. Faulkner, B.A.
Assistant Director -	P. H. Lamb, F.L.S.
Mycologist - - -	T. Laycock.
Senior Superintendents	*F. Evans, F.L.S.
,, ,,	A. J. Findlay, M.A., B.Sc.
,, ,,	K. T. Rae.
Superintendents -	*A. R. Bell.
,,	H. G. Burr, B.Sc.
,,	S. M. Gilbert, B.Sc.
,,	F. D. Golding.
,,	J. E. Gray, B.A.
,,	J. O'N. Hewitt, A.R.C.S.
,,	C. J. Lewin, M.C.
,,	J. R. Mackie, B.Sc.
,,	R. Nichol.
,,	H. Roebuck.
,,	R. Swainson-Hall, F.L.S.
,,	T. Thornton.
,,	H. B. Waters, B.A.
Director of Forests - -	H. N. Thompson, C.M.G.

South Australia.—

Adelaide.—University Professor of Botany. T. G. B. Osborn, D.Sc.
Botanic Gardens:—
Director - - - J. F. Bailey.
Woods and Forests:—
Conservator - - Walter Gill, F.L.S.

New Guinea.—

Rabaul.—Department of Agriculture:
Director - - - - ——
Botanic Gardens:—
Superintendent - - ——

Northern Territory.—

Port Darwin - Superintendent of Agriculture and Curator, Botanic Gardens - *C. E. F. Allen.

Tasmania.—

Hobart - - Government Botanist Leonard Rodway, C.M.G.
Conservator of Forests L. G. Irby.
Botanic Gardens:—
Superintendent - - J. Wardman.

Victoria.—

Melbourne.—Botanic Gardens:—
Curator - - - J. Cronin.
National Herbarium (South Yarra):—
Government Botanist - W. Laidlaw, B.Sc.
Assistant - - - J. R. Tovey.
,, J. W. Audas.
,, P. F. Morris.
University Professor of Botany. A. J. Ewart, D.Sc., Ph.D., F.L.S.
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Western Australia.—

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Dominion Horticulturist. W. T. Macoun.
Dominion Botanist - H. T. Güssow.

Ottawa—*continued.*

Assistant - - -	J. Adams.
,, - - -	R. A. Inglis.
Plant Pathologist -	F. L. Drayton.
,, ,, (Forests)	A. W. McCallum.

National Herbarium, Victoria Memorial Museum:—

Chief Botanist - -	M. O. Malte.
Assistant - -	Mary Stewart.

CEYLON.

Peradeniya.—Department of Agriculture:—

Director of Agriculture -	F. A. Stockdale, M.A., F.L.S.
Botanist and Mycologist -	T. Petch,. B.A., B.Sc.
Economic Botanist - -	H. O. Iliffe, B.A.
Assistant Botanist and Mycologist.	G. Bryce, M.A., B.Sc.
Assistant Mycologist - -	M. Park, A.R.C.S.
Manager, Peradeniya Experiment Station.	T. H Holland.
Superintendent of Botanic Gardens.	*H. F. Macmillan, F.L.S.
Curator of Royal Botanic Gardens, Peradeniya.	*T. H. Parsons.
Curator, Hakgala Gardens -	*J. J. Nock.
Divisional Agricultural Officer.	G. G. Auchinleck, M.Sc., A.I.C., F.C.S.
,, ,, (Acting)	G. Harbord.
,, ,,	N. Marshall, B.Sc.
,, ,,	F. Burnett, M.C., B.A.
Plant Diseases Inspector (Mycological).	C. H. Gadd, B.Sc.
Conservator of Forests - -	J. D. Sargent.

CYPRUS.

Principal Forest Officer -	A. H. Unwin, D.Oec.
Director of Agriculture -	W. Bevan.

FALKLAND ISLANDS.

Government House Garden:—

Head Gardener - - - -	——
Forest Officer - - - -	James Reid.

FIJI.

Superintendent of Agriculture and Curator, Suva Botanic Gardens (Temporary).	G. M KcKeown.

HONG KONG.

Botanic and Forestry Department:—

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Assistant Superintendent - -	*A. J. Thornton.

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Agricultural Superintendent.	F. R. Shepherd.
Assistant Superintendent	——
Agricultural Instructor, Nevis.	W. I. Howell.

Virgin Islands.—Botanic Station:—

Curator - - -	C. A. Gomez.

Windward Islands:—

Grenada.—Botanic Garden:—

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Agricultural Instructor -	E. L. Cherubim.

St. Lucia.—Botanic Station:—

Agricultural Superintendent.	*E. A. Walters.
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St. Vincent.—Botanic Station:—

Agricultural Superintendent.	*T. Jackson.
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British Guiana.—Department of Science and Agriculture:—

Georgetown -	Director - - -	Sir J. B. Harrison, C.M.G., M.A., F.I.C., F.C.S., F.G.S.
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	Forestry Officer - - -	L. S. Hohenkerk.

British Honduras.—Botanic Station:—

Curator - - -	——
Forestry Officer - - -	C. Hummel.

Ottawa—*continued.*

Assistant - - -	J. Adams.
,, - - -	R. A. Inglis.
Plant Pathologist -	F. L. Drayton.
,, ,, (Forests)	A. W. McCallum.
National Herbarium, Victoria Memorial Museum:—	
Chief Botanist - -	M. O. Malte.
Assistant - -	Mary Stewart.

CEYLON.

Peradeniya.—Department of Agriculture:—

Director of Agriculture -	F. A. Stockdale, M.A., F.L.S.
Botanist and Mycologist -	T. Petch,, B.A., B.Sc.
Economic Botanist - -	H. O. Iliffe, B.A.
Assistant Botanist and Mycologist.	G. Bryce, M.A., B.Sc.
Assistant Mycologist - -	M. Park, A.R.C.S.
Manager, Peradeniya Experiment Station.	T. H Holland.
Superintendent of Botanic Gardens.	*H. F. Macmillan, F.L.S.
Curator of Royal Botanic Gardens, Peradeniya.	*T. H. Parsons.
Curator, Hakgala Gardens -	*J. J. Nock.
Divisional Agricultural Officer.	G. G. Auchinleck, M.Sc., A.I.C., F.C.S.
,, ,, (Acting)	G. Harbord.
,, ,,	N. Marshall, B.Sc.
,, ,,	F. Burnett, M.C., B.A.
Plant Diseases Inspector (Mycological).	C. H. Gadd, B.Sc.
Conservator of Forests - -	J. D. Sargent.

CYPRUS.

Principal Forest Officer -	A. H. Unwin, D.Oec.
Director of Agriculture -	W. Bevan.

FALKLAND ISLANDS.

Government House Garden:—	
Head Gardener - - - -	——
Forest Officer - - - - -	James Reid.

FIJI.

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HONG KONG.

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Assistant Superintendent - -	*A. J. Thornton.

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	Travelling Instructor -	*William Cradwick.
	,, ,,	James Briscoe.
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Curator - - -	R. J. Link.

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Mycologist - - -	F. Stell.
Assistant Botanist -	*W. E. Broadway.
Curator, Royal Botanic Gardens.	*R. O. Williams.
Conservator of Forests -	C. S. Rogers.

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Departments of Agriculture, Botanical Officers attached to :—

Imperial Agricultural Research Institute, Pusa, Bengal :—

Imperial Mycologist - -	W. McRae, M.A., B.Sc., F.L.S.
Second Imperial Mycologist	F. J. F. Shaw, D.Sc., F.L.S.
Supernumerary Mycologist -	J. F. Dastur, M.Sc.
Imperial Economic Botanist	——

Bengal Agricultural Department, Dacca :—

Economic Botanist - -	G. P. Hector, M.A., B.Sc.

Bihar and Orissa Agricultural Department, Sabour :—

Economic Botanist - -	——

Bombay Agricultural Department, Poona :—

Economic Botanist - -	W. Burns, D.Sc.

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Allahabad.—Government Gardens :—

Superintendent - - *W. Head

Cawnpur.—Memorial and other Gardens :—

Superintendent - - — Johnson.

Kumaon.—Government Gardens :—

Superintendent - - *Norman Gill, F.L.S.

Lucknow.—Horticultural Gardens :—

Superintendent - - ——

Probationer - - ——

Saharanpur.—Government Botanic Gardens :—

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Imperial Forest Botanist R. S. Hole, C.I.E., F.L.S.

ASSAM.

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NATIVE STATES.

Indore :—

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Mysore (**Bangalore**) :—

Economic Botanist - *G. H. Krumbiegel.

Baroda :—

Superintendent - - T. R. Kothawala.

Travancore (**Trivandrum**) :—

Director - - - Major F. W. Dawson.

Udaipur :—

Superintendent - - T. H. Storey.

Gwalior :—

Director, State Gardens *B. F. Cavanagh.

Jamaica	Director	Hon. H. H. Cousins, M.A., F.C.S.
	Assistant Director and Government Botanist	——
	Microbiologist	C. G. Hansford.
	Travelling Instructor	*William Cradwick.
	,, ,,	James Briscoe.
	Public Gardens and Plantations:—	
	Assistant Superintendent.	*E. Downes.
	Farm Superintendent	R. S. Martinez.

Tobago.—Botanic Station:—

Curator	R. J. Link.

Trinidad.—Department of Agriculture:—

Director	W. G. Freeman, B.Sc., A.R.C.S., F.L.S.
Assistant Director	W. Nowell, B.A., B.Sc
Economic Botanist	*A. G. Bailey, B.A.
Mycologist	F. Stell.
Assistant Botanist	*W. E. Broadway.
Curator, Royal Botanic Gardens.	*R. O. Williams.
Conservator of Forests	C. S. Rogers.

INDIA.

Botanical Survey of India:—

Director	Lt.-Col. A. T. Gage, I.M.S., M.A., M.B., B.Sc., F.L.S.
Economic Botanist	——
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,, ,, ,,	N. Naryanswami, M.A.

Departments of Agriculture, Botanical Officers attached to:—

Imperial Agricultural Research Institute, Pusa, Bengal:—

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Second Imperial Mycologist	F. J. F. Shaw, D.Sc., F.L.S.
Supernumerary Mycologist	J. F. Dastur, M.Sc.
Imperial Economic Botanist	——

Bengal Agricultural Department, Dacca:—

Economic Botanist	G. P. Hector, M.A., B.Sc.

Bihar and Orissa Agricultural Department, Sabour:—

Economic Botanist	——

Bombay Agricultural Department, Poona:—

Economic Botanist	W. Burns, D.Sc.

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Superintendent - - *W. Head

Cawnpur.—Memorial and other Gardens :—

Superintendent - - — Johnson.

Kumaon.—Government Gardens :—

Superintendent - - *Norman Gill, F.L.S.

Lucknow.—Horticultural Gardens :—

Superintendent - - ——

Probationer - - ——

Saharanpur.—Government Botanic Gardens :—

Superintendent - - ——

Dehra Dun.—Imperial Forest Research Institute :—

Imperial Forest Botanist R. S. Hole, C.I.E., F.L.S

ASSAM.

Shillong.—Government Gardens :—

Curator - - - *L. F. Ruse.

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Mysore (**Bangalore**) :—

Economic Botanist - *G. H. Krumbiegel.

Baroda :—

Superintendent - - T. R. Kothawala.

Travancore (**Trivandrum**) :—

Director - - - Major F. W. Dawson.

Udaipur :—

Superintendent - - T. H. Storey.

Gwalior :—

Director, State Gardens *B. F. Cavanagh.