Livres provenant de la bibliothèque botanique d'**Emile Burnat** (1828-1920), insérés en octobre 1920

da

Ge

Bu

DU

THE

JOURNAL OF BOTANY

BRITISH AND FOREIGN

EDITED BY

JAMES BRITTEN, K.C.S.G., F.L.S.

LATE SENIOR ASSISTANT, DEPARTMENT OF BOTANY, BRITISH MUSEUM.

VOL. LVII.

LONDON
TAYLOR AND FRANCIS
RED LION COURT, FLEET STREET
1919.

CONTRIBUTORS TO THIS VOLUME.

R. S. Adamson.
Agnes Arber, D.Sc., F.L.S.
E. G. Baker, F.L.S.
Arthur Bennett, A.L.S.
G. S. Boulger, F.L.S.
James Britten, F.L.S.
C. E. Britton.
G. Bullock - Webster, M.A., F.L.S.
Miller Christy, F.L.S.
A. H. Church, M.A., D.Sc.
H. N. Dixon, M.A., F.L.S.
H. S. Downes, M.B., F.L.S.
W. Fawcett, B.Sc.
Antony Gepp, M.A., F.L.S.
Col. M. J. Godfery, F.L.S.
W. B. Gourlay, M.B.
W. B. Grove, M.A.
James Groves, F.L.S.
C. P. Hurst.
A. B. Jackson, A.L.S.
Gertrude Jekyll.
C. E. Larter, F.L.S.
L. V. Lester-Garland, M.A., F.L.S.
G. Lister, F.L.S.
J. E. Little, M.A.
E. S. Marshall, M.A., F.L.S.
J. Cosmo Melvill, M.A., F.L.S.
H. W. Monckton, F.L.S.
Spencer le M. Moore, B.Sc., F.L.S.
F. B. Mott.
R. Paulson, F.L.S.
W. H. Pearson, M.Sc., A.L.S.
R. Ll. Praeger.
Sir David Prain, C.M.G., F.R.S.
H. W. Pugsley, B.A.
J. K. Ramsbottom.
Carleton Rea.
A. B. Rendle, D.Sc., F.R.S.
H. J. Riddelsdell, M.A.
F. Rilstone.
F. Robinson.
E. J. Salisbury, D.Sc., F.L.S.
C. E. Salmon, F.L.S.
J. Saunders, A.L.S.
A. Lorrain Smith, F.L.S.
Magnus Spence.
H. S. Thompson, F.L.S.
W. B. Turrill.
G. M. Vevers, M.R.C.S.
Inez C. Verdoorn.
Anthony Wallis.
W. Watson, B.Sc., A.L.S.
H. F. Wernham, D.Sc.
J. A. Wheldon.
F. N. Williams, F.L.S.
A. J. Wilmott, B.A., F.L.S.
Malcolm Wilson, D.Sc., F.L.S.
Sir Bertram Windle, D.Sc., F.R.S.
E. A. Woodruffe - Peacock, M.A., F.L.S.

The first 16 pages of "The Genus *Manettia*" Supplement were issued in September and October 1918; it is now complete, and, with the Supplements issued during 1919, should be bound in the present volume, immediately *before* the Index.

G. R. B.-W. & M. G. del.

NITELLA SPANIOCLEMA, sp. nov.

THE

JOURNAL OF BOTANY

BRITISH AND FOREIGN.

A NEW NITELLA.

By Canon G. R. Bullock-Webster, M.A., F.L.S.

(Plate 551.)

In August 1916, I visited Kindrum in the Fanad Peninsula, County Donegal, with a view to searching for Charophyta in the series of lakes which border on the sea at its northern extremity. One of these lakes, Lough Shannagh, lies at the extreme north-east of the peninsula. It is something under half a mile long and a quarter of a mile broad, and does not exceed 10 or 15 feet in depth. Its northern end, where its shore touches the sandy stretch which divides it from the sea, has a sandy bed; otherwise it has a stony bottom and seems to possess little submerged vegetation. On its western shore the drag brought up two Nitellas, growing closely intermixed in about 4–6 feet of water—the one, *N. translucens*, in sparse quantities, the other growing in great profusion, dull olive-green in colour, very delicate and fragile in habit, and bearing abundant fruit. Its interesting character was not at once observable, but under the microscope it proved to be a plant with very distinctive characteristics. Its exceedingly fragile nature made it very difficult to collect and handle, and almost impossible to lay out on paper with any good results.

I paid another visit to Kindrum in August 1917 for the purpose of making a further examination of this Nitella and its habitat and, if possible, of collecting better specimens. I found it growing at the same spot and in the same luxuriant abundance, and this time made an attempt to transfer the plant direct from the water to the drying-sheets on the bank of the lake; but even so it became rapidly flaccid and proved impossible of disentanglement. I preserved a certain amount in formalin, and this has made it possible to examine the plant under more advantageous conditions than if dried and subsequently treated with reagents.

Mr. Groves, who has carefully examined the plant, agrees that its distinctive character justifies its receiving specific rank, and we have drawn up the following description.

One of its main characteristics is the very restricted number of branchlets, and this has suggested to us its name.

Nitella spanioclema Groves & Bullock-Webster, sp. nov.

Monœcia, statura cir. 30–35 cm., caulis tenuis, internodi plerumque vel æquantes longissimis ramulis vel eosdem paulim superantes.

Rami sæpe usque ad tres ex eodem nodo orientes, 1–2 in loco ramulorum suppressorum, ut videtur, sæpe abbreviati et inchoati et, quum quidem elongati, non raro verticillos rudimentarios proferentes.

Ramuli pauci, plerumque 2–3 tantum in utroque verticillo, normaliter simpliciter-furcati sed aliquando duplicato-furcati.

Laterales radii secundarii singulares, perspicue breviores radiis mediis, sæpe inchoati, brevissimi et inperspicui apud nodos antheridia proferentes. Radii secundarii unicellulati, apicibus variantibus a forma acuminata ad formam vel rotunde-acutam vel obtuse-mucronatam.

Oogonia et antheridia vel ad eundem nodum vel ad diversos nodos producta. *Oogonia* vel singularia vel 2–3 aggregata, 800–850 μ longa, 640–680 μ lata. Cellulæ spirales 7 convolutiones exhibentes et versus apices tumifacientes, coronula decidua, c. 60 μ alta, c. 80 μ lata.

Oospora 475–500 μ longa, 425–450 μ lata, 330 μ crassa, 7 strias tenues exhibens alis promulis versus apicem. Membrana rubra aut rubra-fulva, spissa, semi-rigida, et translucens, scabra perpusillis tuberculis, et minimis granulis decorata.

Antheridium 575–675 μ diametro.

N. spanioclema is closely allied to *N. flexilis*, being monœcious with branchlets normally once furcate and the ultimate rays one-celled; its fruit also is very similar. It differs, however, from that species in its fragile and delicate habit, the extraordinary paucity and irregular development of its branchlets and secondary rays, and in its occasional second furcation. When, as often happens, the secondary rays are suppressed or only rudimentary the antheridia have the appearance of being borne on long stalks. In the frequent absence of lateral secondary rays the plant bears a resemblance to *N. monodactyla* Braun, a sub-tropical diœcious plant described and figured in the *Fragmente*. The oogonia are frequently produced at the base of the whorls, and their enveloping cells are divergent and much distended at the apex. The membrane shows the peculiar mottled surface with wart-like protuberances which are characteristic of *N. opaca* and *N. flexilis*, but besides this it possesses a delicate decoration which is absent in those two species. This decoration consists of exceeding minute granules which are at first linear in their arrangement, but at a later stage assume a reticulate form.

It will be interesting to ascertain whether the plant occurs in other parts of Ireland. In the Fanad Peninsula it appears to be confined to Lough Shannagh.

Explanation of Plate 551.

1, 2. Plant natural size.
3, 4. Branches with branchlets showing short solitary and rudimentary secondary rays and conspicuous scars left by fallen antheridia and oogonia, × 10.
5. Oogonium, × 30.
6. Oospore, showing ridges with broad flanges, × 30.
7. Piece of membrane showing wart-like protuberances and minute granular decoration, × c. 200.
8. Piece of membrane showing disposition of granules, × c. 800.

CORNISH MOSSES AND HEPATICS.

By F. Rilstone.

The following records are from the eastern half of Vice-County 1 (West Cornwall), particularly the coast area from Newquay to St. Agnes and thence inland to Truro and Redruth, and from the drainage areas of the Fowey and Looe Rivers in Vice-County 2 (East Cornwall).

The former area, which appears to have been almost untouched by bryologists, affords a variety of habitats ranging from the calcareous sand-hill tract of Perranporth with a well-defined bryophytic flora of its own to the small peaty moors in which the streams take their rise. Geologically the district consists of old hard quartz-veined slate impinging on the granite outcrop of the Redruth Hills and with a small patch of Pleistocene sands and gravels near St. Agnes Head. These Tertiary deposits, of special interest in a county where practically all the rocks are of Primary age, are too small to have acquired a distinctive flora. *Weisia mucronata* occurs on them, but is not confined to them. Carn Brea, the only hill of the Redruth group which I have at all thoroughly examined, is, considering the great amount of exposed granite, disappointingly poor in silica-loving species.

The area dealt with in v.c. 2 comprises the major portion of the Bodmin Moors—an elevated granite tract with tors and extensive peat moors, and with a wealth of siliceous and moorland plants—and the more or less wooded country lying between the moors and the coast. With a moist climate and varied surface Cornwall possesses a comparatively rich bryophytic flora. The *Census Catalogue of British Mosses* out of a total of 601 species (exclusive of *Sphagna*) credits Cornwall with 287 species, 249 in v.c. 1 and 254 in v.c. 2. The Hepatic *Census Catalogue* (Ed. 2) gives Cornwall 97 species of hepatics, but while 90 are recorded for West Cornwall only 40 are credited to the East Cornwall list. The latter area is certainly not so much poorer in species as these figures would suggest, but has received less attention; the following notes include localities for 14 species not credited to v.c. 2 in the Catalogue. Six plants included in the list of hepatics given below—*Aneura major*, *Fossombronia Dumortieri*, *Sphenolobus ovatus*, *Cephalozia media*, *Ptilidium ciliare*, and *Scapania dentata* var. *ambigua*—are new to Cornwall.

I must acknowledge my indebtedness to Mr. D. A. Jones of Harlech, without whose kind help my study of the Cornish Bryophyta must have been much more laborious.

Mosses.

Andreæa Rothii Web. & Mohr var. *falcata* Lindb. On granite above 1200 ft. on Brown Willy, Kilmar Tor and Sharp Tor (2).

Tetraphis pellucida Hedw. Carn Brea Hill, Redruth (1), Trelawne, near Looe (2).

Polytrichum aloides Hedw. Common and conspicuous on clay banks.—*P. urnigerum* L. Frequent near Polperro (2).—*P. gracile* Dicks. Gollawater and Lambourne near Perranporth (1); near Redgate in the Fowey Valley (2).—*P. formosum* Hedw. Near St. Cleer, Draynes Valley (*i. e.* Upper Fowey Valley), and several places near Looe and Polperro (all in v.c. 2); c.fr. at Trelawne near Looe with 4-angled capsules and at Polperro with 5-angled capsules. Of frequent occurrence in v.c. 2, but I have not seen it in v.c. 1, where *P. gracile* appears to take its place. The *Census Catalogue* treats it as of doubtful occurrence there.

Pleuridium axillare Lindb. Lambriggan near Perranporth (1).—*P. subulatum* Rabenh. Frequent near Perranporth and St. Agnes (1); Trelawne (2).

Ditrichum flexicaule Hampe. Plentiful on shell sand at Perranporth.

Rhabdoweisia denticulata B. & S. c.fr. in crevices between granite blocks, Kilmar Tor (2).

Cynodontium Bruntoni B. & S. c.fr. on granite, Kilmar Tor (2).

Dichodontium pellucidum Schp. Penpoll near Fowey (2).

Campylopus flexuosus Brid. Carn Brea Hill; Ventongimps Downs near Perranporth (1). Bodmin Moors (2), common.—*C. pyriformis* Brid. Abundant and fruiting freely in oak woods near Looe (2).—*C. fragilis* B. & S. Common about Penhallow near Perranporth (1). Sparingly near Polperro (2).—*C. atrovirens* De Not. Common in marshy ground near St. Agnes and Perranporth (1).—*C. introflexus* Brid. Cliff face between Polperro and Looe (2). Through an oversight, no doubt, *C. introflexus* is not credited to Cornwall in the *Census Catalogue*; but in Holmes & Brents' *Mosses of Devon and Cornwall* (1869) Curnow records it (as *C. polytrichoides*); for Kymyal Cliff "on damp ledges of granite rock, rare," and Braithwaite (i. 136) has "Kymyal Cliff, Tregarnow Cliff, and Trungle Moor (Curnow 1861)." These stations are all in West Cornwall. In its East Cornwall station it grows with *Polytricha* on a somewhat moist ledge of the hard blue slate of the locality.—*C. brevipilus* B. & S. Ventongimps Moor near Perranporth (1); near Dozmary Pool (2).

Dicranum Bonjeani De Not. Frequent in marshy ground, sometimes growing with grass in damp field borders.—*D. scoparium* Hedw. c.fr. on trees in Golla Wood near Perranporth (1) and on banks in Draynes Valley and near Polperro (2). Var. *orthophyllum* Brid. Near Cheesewring (2). Var. *spadiceum*. Sharp Tor (2).—*D. Scottianum* Turn. Sharp Tor (2).—*D. majus* Turn. Fine and with abundant fruit at Trelawne (2).

Leucobryum glaucum Schp. Ventongimps Moor (1) rare. Trelawne Woods, abundant; near Brown Willy (2).

Fissidens exilis Hedw. On mud bank in lane below Lansallos Church (2).—*F. viridulus* Wahl. Perranporth (1), Polperro (2). Plants from a sandy hedge-bank at Mount near Perranporth have the leaf characters of var. *Lylei* Wils., but cannot be described as "minute."—*F. pusillus* Wils. Banks above cliff, Polperro (2).—*F. Curnowii* Mitt. Old mine adits at St. Agnes and Trevellas (1). The dripping rock at the mouths of these abandoned tunnellings, often opening on the cliff slopes, forms an ideal habitat for this plant, which covers the upper rock with dense tufts matted with red radicles and at the margins of the rock-pools below forms a fringe of very graceful slender plants with less tomentum.—*F. adiantoides* Hedw. Frequent in a variety of situations, as boggy patches on cliffs at St. Agnes (1), tops of hedge-banks at Polperro (2) and damp rock faces: in the last it usually fruits freely, as at Polperro and St. Keyne (2).—*F. decipiens* De Not. Not common; I have found it only at Lambriggan (1) at the bases of tree-trunks.—*F. taxifolius* Hedw. c.fr. near Looe; usually barren.

Grimmia maritima Turn. Abundant on rocks by the sea at St. Agnes (1) and Polperro (2).—*G. trichophylla* Grev. c.fr. at Idless near Truro (1), and at Broadoak and Helman Tor (2).—*G. subsquarrosa* Wils. Rocks on hillsides, Polperro (2). The species evidently intergrades with *G. trichophylla*. Mr. C. P. Hurst tells me that some plants I sent him from Polperro were shown by him to Mr. Dixon who pronounced them exact intermediates between *G. trichophylla* and *G. subsquarrosa*.

Rhacomitrium aciculare Brid. Common on rocks, but occurs at Tresawzen (1) in boggy ground.—*R. protensum* Braun. Plentiful. c.fr. on rocks on Cheesewring and neighbouring tors and at St. Cleer (2).—*R. fasciculare* Brid. Rock face at Trelawne (2).—*R. heterostichum* Brid. Plentiful. c.fr. on granite at St. Cleer and on Cheesewring Downs (2).—*R. lanuginosum* Brid. More or less sparingly in most of the wet peaty moors near St. Agnes and Perranporth (1), but always, I believe, barren. Plentiful and frequently c.fr. on granite in Draynes Valley and near Cheesewring (2).—*R. canescens* Brid. Frequent; usually beside paths and roads on peaty ground.

Ptychomitrium polyphyllum Fürn. Rejerrah near Perranporth (1). Liskeard, Polperro, Bodmin Moors (2), common. Much commoner in v.c. 2 than in v.c. 1.

Hedwigia ciliata Ehrh. c.fr. on granite at Mabe near Penryn (1). Cliffs near Polperro; Helman Tor (2).

Pottia recta Mitt. Lambourne near Perranporth (1); Polperro (2); not infrequent.—*P. crinita* Wils. Shore between Looe and Polperro (2).

Tortula aloides De Not. Perranzabuloe (1); Polperro (2). Common.—*T. lævipila* Schwæg. var. *lævipilæformis* Limpr. Idless near Truro; Lambriggan near Perranporth (1); Lansallos, Polperro, Talland (2). All the Cornish plants I have seen have either the leaf structure or foliose gemmæ of the variety, and most agree in both respects. Possibly typical *T. lævipila* may not occur in Cornwall. Where capsules are abundant, as at Idless, gemmæ are scarce.—*T. ruralis* Ehrh. On slate roofs near Polperro; uncommon in Cornwall.—*T. ruraliformis* Dixon. Perranporth Sandhills (1) abundant; fruit very sparingly produced.

Barbula lurida Lindb. Wall at Polperro (2).—*B. tophacea* Mitt. On masonry at Perranporth (1); on calcareous matter on rock face, Polperro (2).—*B. cylindrica* Schp. Polperro and Trelawne (2), frequent.

Weisia verticillata Brid. Encrusted with calcareous matter on cliffs at Perranporth (1) and at Lansallos (2). On old lime kilns near Polperro and Looe (2).

Trichostomum mutabile Bruch var. *littorale* Dixon. Mouth of mine adit at St. Agnes (1).—*T. flavovirens* Bruch. Moist hollow in Perranporth sandhills (1). Rocks by coast at various points between Looe and Fowey (2).—*T. nitidum* Schp. On roof near Polperro (2).

Pleurochæte squarrosa Lindb. Plentiful in sandy ground at Rose near Perranporth (1).

Encalypta streptocarpa Hedw. Wall in Looe valley (2).

Aulocomnium palustre Schwaeg. Frequent in boggy ground.

Bartramia pomiformis Hedw. Gollawater and Zelah (1). Very scarce, as far as my experience goes, in West Cornwall, but plentiful in the Cheesewring area (2).

Breutelia arcuata Schp. Ventongimps and Tresawzen Moors (1), and near Dozmary Pool (2).

Leptobryum pyriforme Wils. Earthy bank by churchyard, St. Agnes (1); not infrequent on flower pots in conservatories as at St. Agnes and Falmouth (1) and Lerryn (2).

Webera nutans Hedw. St. Agnes and Perranporth districts, common.—*W. proligera* Bryhn. Frequent on roadside banks, often sandy, near St. Agnes and Perranporth and inland to Truro (1). *W. annotina* should occur, but I have been able to find only the slender gemmæ of *W. proligera.*—*W. carnea* Schp. Near Truro (1), Polperro (2).—*W. Tozeri* Schp. Polperro and Couch's Mill (2), frequent. As pointed out by Holmes and Brent, this usually grows on yellowish slaty earth.

Bryum alpinum Huds. Marshy ground in various localities near St. Agnes and Perranporth (1), common. At Wheal Butson, St. Agnes, the plants are brilliantly coloured, Polperro (2) on damp rock face, rare.—*B. roseum*, Schreb. Roadside at Muchlamick near Pelynt (2).

Mnium rostratum Schrad. Trenewan and Langreek near Polperro (2).

Fontinalis antipyretica L. Loe Pool; leat at Idless near Truro (1). Plentiful in tidal water at head of West Looe River (2); still in St. Keyne well (2), as recorded by F. Brent fifty years ago. Var. *gracilis* Schp. A slender form which is plentiful in Dozmary Pool I take to be this variety.—*F. squamosa* L. Common and freely fruiting in Kennel River near Stithians and Ponsanooth (1); common in Fowey River above Redgate.

Cryphæa heteromalla Mohr. Near Crantock (1); Polperro (2).

Pterygophyllum lucens Brid. Not infrequent in moist shaded spots near Perranporth (1) and Polperro (2).

Pterogonium gracile Swartz. Polperro (2), frequent.

Porotrichum alopecurum Mitt. Chyverton (1); frequent near Polperro and c.fr. at Trenewan (2).

Leskea polycarpa Ehrh. Near Causeland Station (2).

Anomodon viticulosus Hook. & Tayl. Polperro district (2), locally plentiful.

Leptodon Smithii Mohr. Talland and Trenewan near Polperro (2).

Heterocladium heteropterum B. & S. Summit of Brown Willy; St. Cleer; Polperro. In the first two localities on granite, in the last on blue slate.

Thuidium tamariscinum B. & S. Fruits sparingly at Penhallow near Perranporth (1) and at Trelawne (2).

Camptothecium lutescens B. & S. Abundant in Perranporth sandhills (1); rare near Polperro (2).

Brachythecium albicans B. & S. Lambourne (1); by West Looe River (2).—*B. salebrosum* B. & S. var. *palustre* Schp. Pasty Pool near Zelah (1).—*B. rivulare* B. & S. Penwartha (1), Polperro (2).—*B. plumosum* B. & S. Polperro, Pont near Fowey, below Kilmar Tor, Draynes Valley, in each case growing on rocks in or by streams.—*B. illecebrum* De Not. Roadside bank at Bolingey (1); Polmeor Hill, Par; near Polperro (2).—*B. purum* Dixon. c.fr. on banks at Idless (1) and above cliffs between Looe and Polperro (2).

Hyocomium flagellare B. & S. By stream below Golla Wood near Perranporth (1).

Eurhynchium piliferum B. & S. Frequent near Polperro (2); I have not seen it in West Cornwall.—*E. crassinervium* B. & S. Talland and Trevarder (2), on dry rock-faces in lanes.—*E. pumilum* Schp. Old mine-workings by the sea at Perranporth (1).—*E. circinatum* B. & S. Plentiful on sandy banks (shell sand) at Mount near Perranporth (1).

Plagiothecium undulatum B. & S. Woods at Trelawne; Draynes Valley (2); a scarce plant in Cornwall.

Amblystegium irriguum B. & S. Rocks in streams in various places near Polperro (2).—*A. fluviatile* B. & S. Rocks in bed of stream, Polperro (2): usually submerged; *A. irriguum* grows above the ordinary water-level.

Hypnum riparium L. Stream near Polperro (2), uncommon.—*H. stellatum* Schreb. c.fr. in a small patch of bog by the roadside, Wheal Frances (1); elsewhere common but barren.—*H. fluitans* L. var. *Jeanbernati* Ren. f. *tenella* Ren. Pasty Pool near Zelah (1). Var. *gracile* Boul. Pasty Pool near Zelah (1). These varieties, named by Mr. J. A. Wheldon, grow together in watery depressions in the peaty ground surroundimg the pool.—*H. exannulatum* Gümb. (type, *i.e.* var. *pinnatum* Boul. f. *acuta* Sanio). Silverwell Moors near St. Agnes (1).—*H. uncinatum* Hedw. Hollows among sandhills, Perranporth; dry bed of old mine-pool, St. Agnes; roadside near Truro (1).—*H. revolvens* Swartz. Ventongimps and Tresawzen Moors; sometimes so robust as to resemble *H. scorpioides*, with which it grows.—*H. Patientiæ* Lindb. Side of pathway across Ventongimps Downs (1); roadsides near Polperro (2).—*H. molluscum* Hedw. In peaty ground at Carnkief (1), a small form; fine and robust on rock-faces at Trelawne (2).—*H. ochraceum* Turn. Perrancoombe and Penwartha Coombe (1) on wet rocks, plants dark green; Upper Fowey River (2), plentiful, with the usual yellow and brown coloration.—*H. scorpioides* L. Wet moors at Tresawzen, Ventongimps, and Wheal Butson.—*H. stramineum* Dicks. With *Sphagnum* in Draynes Valley (2).—*H. sarmentosum* Wahl. Silverwell and Wheal Butson Moors (1). This is bracketed in the *Census Catalogue* as of doubtful occurrence in v.c.s 1 and 2. As far as v.c. 1 is concerned, this is probably due to an oversight, as Curnow (Holmes & Brent, *op. cit.*) records it for Trungle Moor. Its distribution in the British Isles, as indicated by the figures of the *Census Catalogue*, appears to coincide with that of the Primary rocks, hence its occurrence in Cornwall was to be expected. —*H. Schreberi* Willd. Chyverton (1); Upper Fowey Valley (2).

Hepatics.

Riccia sorocarpa Bisch. Frequent on earthy banks above cliffs at Polperro (2). In spite of careful search I have not been able to find any other species.

Conocephalum conicum (L.) Dum. Grows finely on wet banks, especially in deep shade, but is usually barren; c.fr. at Penwartha (1).

Lunularia cruciata (L.) Dum. Common; on damp rock-faces near Polperro as well as in its usual artificial habitats.

Marchantia polymorpha L. With ♂ receptacles in old mine-workings at Perranporth (1); on stones in stream, Talland (2): a much less common plant than *Conocephalum conicum*.

Aneura pinguis (L.) Dum. Common in bogs in West Cornwall.—*A. multifida* (L.) Dum. Ventongimps and Tresawzen Moors (1).—*A. major* (Lindb.) K. Müll. In the Perranporth district (1) this is possibly the commonest form of *Aneura*, occurring in wet ground and on moist banks. Near Polperro (2) it occurs under similar conditions but is much less frequent. By a damp pathway across Ventongimps Moor (1) I have gathered a densely tufted plant which Mr. Jones refers to this species. The *Census Catalogue* gives no record for the West of England.

Metzgeria furcata (L.) Dum. Common on trees. Plants on rock-faces near Polperro have the large cells and general appearance of *M. conjugata*, but I have not been able to find monoicous inflorescence.

Pellia epiphylla (L.) Corda. Common on loamy banks and by streams. Very fine and handsome on clay banks at Ventongimps and elsewhere in v.c. 1.—*P. Fabbroniana* Raddi. Perranporth (1); base of damp wall by rivulet at Talland (2).

Blasia pusilla L. Goonhaven Moor near Perranporth (1).

Petalophyllum Ralfsii (Wils.) Gottsche. Damp hollow between sand-dunes, Perranporth (1).

Fossombronia pusilla (L.) Dum. Lambriggan and Callestick (1); Polperro, frequent; Boconnoc (2); almost invariably on earthy patches of hedge-banks.—*F. Wondraczeki* (Corda) Dum. Damp side of path across Silverwell Moors (1).—*E. cæspitiformis* De Not. Mouths of rabbit burrows and earthy patches adjoining in hilly field, Polperro (2).—*F. Dumortieri* (Hüb. et Genth.) Lindb. On peaty ground, Goonhavem Moor (1). Apparently also on similar ground at Trenode (2), but I have not yet found mature capsules. This is not recorded for the West of England in the *Census Catalogue*, its area of distribution comprising only Surrey and Sussex in the south of England, one county (Carnarvon) in Wales, Lancashire, Yorkshire, and Cumberland in the north, and five vice-counties in Scotland.—*F. angulosa* (Dicks) Raddi. Rocky slopes above the cliffs, St. Agnes (1).

Marsupella emarginata (Erhr.) Dum. Kennal Valley near Stithians (1); Boconnoc Park, Helman Tor, Lanlivery, and Kilmar Tor (2).—*M. Funckii* (Web. et Mohr) Dum. Side of footpath, Tresawzen Moor (1).

Alicularia scalaris (Schrad.) Corda. Trelawne (2): not common so far as my observation goes.

Haplozia crenulata (Sm.) Dum. Perranporth district (1), frequent.

Gymnocolea inflata (Huds.) Dum. Damp hollows in granite on Carn Brea Hill, Redruth (1), a green plant with abundant perianths; moors and peaty banks near St. Agnes (1), a dark purple plant without perianths.

Lophozia ventricosa (Dicks.) Dum. Of frequent occurrence, as at Ventong mps and other moors (1); moor below Helman Tor, Dozmary Pool (with abundant gemmæ), and Kilmar Tor (2).

Sphenolobus ovatus (Dicks.) Schiffn. On granite circa 1250 ft. on Kilmar Tor (2); occurs also on Dartmoor.

Plagiochila asplenioides (L.) Dum. A common plant, often of very robust growth.—*P. spinulosa* (Dicks.) Dum. Polperro and Trelawne (2).

Lophocolea heterophylla (Schrad.) Dum. On stumps at Lambourne (1). Much scarcer than *L. bidentata* and *L. cuspidata.*

Chiloscyphus polyanthus (L.) Corda. Stream above Perranporth (1).

Saccogyna viticulosa (Sm.) Dum. Lane leading to beach, St. Agnes (1); frequent in neighbourhood of Polperro (2).

Cephalozia bicuspidata (L.) Dum. Common, very variable in size; perianths sometimes brightly coloured.—*C. connivens* (Dicks.) Lindb. With *Sphagnum* on Tresawzen Moor (1).—*C. media* Lindb. Moist bank by roadside, Trelawne (2).

Cephaloziella byssacea (Roth) Warnst. Steep hillside in field, Polperro (2). Species of *Cephaloziella* occur in various localities near Polperro (2) and at Chyverton (1), but I have not been able to find capsules or perianths.

Calypogeia Trichomanis (L.) Corda. Summit of Brown Willy (2). A scarce plant; I have seen it nowhere else in the county.—*C. fissa* (L.) Raddi. Common in both vice-counties, occurring on moist banks and among *Sphagna.*—*C. arguta* Nees et Mont. Lambourne (1); Polperro (2), rather frequent.

Bazzania trilobata (L.) Gray. Shady banks at Trelawne (2).

Lepidozia reptans (L.) Dum. With *Bazzania trilobata*, Trelawne (2).—*L. setacea* (Web.) Mitt. Tresawzen and Ventongimps Moors (1), with *Sphagnum.*

Ptilidium ciliare (L.) Hampe. With mosses on banks, Cheesewring Downs (2).

Scapania compacta (Roth) Dum. Downs above cliff, St. Agnes (1).—*S. gracilis* (Lindb.) Kaal. Carn Brea Hill, Redruth (1); Sharp Tor and Brown Willy (2).—*S. nemorosa* (L.) Dum. Frequent, as at Tresawzen Moor (1), Kea near Truro (1), woods near Looe (2).—*S. dentata* Dum. Moor below Helman Tor (2): a richly-coloured plant. Var. *ambigua* De Not. Stream flowing across

Silverwell Moor (1): a dark green robust plant growing in dense cushions in the bed of the stream.—*S. undulata* (L.) Dum. Goonhavern Moor (1) and Penhallow Moor near Newlyn East (1); Upper Fowey River; stream at Bolventor (2). Perianths occur on the Goonhavern plants.—*S. irrigua* (Nees) Dum. Damp sides of paths, Ventongimps and Silverwell Moors (1).

Radula complanata (L.) Dum. Frequent near Polperro and Looe (1), but oftener on rocks than on trees. Capsules are freely produced. On a rock-face at Trenewan (2) occurs a darker plant with abundant gemmæ which may be *R. Lindbergii* Gottsche, but I have not been able to find the inflorescence.

Madotheca Thuja (Dicks.) Dum. On "stone hedges," *i. e.* boundary walls of loose stones and earth, at Polperro.—*M. platyphylla* (L.) Dum. On rocks at Polperro and Muchlarnick (2).

Lejeunea cavifolia (Ehrh.) Lindb. var. *heterophylla* Carr. Polperro (2).

Frullania tamarisci (L.) Dum. Frequent on rocks and sometimes on trees; perhaps most plentiful on rocky slopes by the sea.—*F. dilatata* (L.) Dum. Common.

Anthoceros punctatus L. Silverwell and Wheal Butson Moors (1); damp lane near Lansallos Church (2). The West Cornwall plant is as large as *A. Husnoti*, but the section is that of *A. punctatus*.—*A. lævis* L. Damp meadow at Ventongimps (1). A rather common plant on damp soil and moist banks in the area between the Fowey and Looe Rivers (2).

NOTES ON BRITISH POTAMOGETONS.

By Arthur Bennett, A.L.S.

The following notes are suggested by a perusal of Herr Hagström's *Critical Researches* on the genus, noticed in this Journal for 1917, pp. 115–117. The species follow the order of Lond. Cat. ed. 10. The northern range of each species is shown because the author makes a prominent feature of this, sometimes by latitude, sometimes by the year-isotherms. It seems to me that latitude is preferable, as this can be seen on any map, whereas physical maps do not always agree as to the isothermal lines, and there is the trouble of reducing the Centrigrade (employed by the author) to the Fahrenheit scale. The southern range cannot be so well shown, as authors differ as to the identity of southern with northern species. I have added after each name a reference to the page in which the species is dealt with: this is the more necessary in that the author in his otherwise excellent index has cited all his references to each plant without indicating the principal one in thicker type, as is now customary:—

P. natans L. (p. 191). *Sweden* north to Swedish Lapland; *Norway* to 70° 3′ n. lat.; *Finland* to 69° n. lat.; *Scotland* to the Shetlands.

Sub-var. *maximus* Baagoe. Leaves 110 × 70 mm.; stipules 110 mm. long. Barningham, E. Suffolk, *E. F. Linton*. Pembroke (1883), *Ridley*.

f. *pygmæoides* Hagst. Loch Lairing, 1600 ft. alt., M. Perth, *W. F. Miller.*

**P. gessnacensis* Fischer (p. 192). *P. natans*×*polygonifolius*; var. *Richtsfeldii* Fischer=f. *hibernicus* Hagstr. Upper Lake, Killarney, 1874, *R. M. Barrington*: I suppose the "Long Range, Killarney (1888), *Scully*" would also be so named. Fryer called it "a f. of *fluitans*," but in this I do not concur. Then there is the "Ballinahinch River, Co. Galway (1871), *A. G. More*" plant: this I consider a state of *natans*. Fryer's splendid series of *natans*, dried in each month of the year, shows clearly that many forms called hybrids are merely states of this species.

P. POLYGONIFOLIUS Pourr. (p. 175). *Sweden* to S. Helsingland, c. 61° 30′ n. lat.; *Norway* at Melo, 66° 50′ n. lat. (*Blytt*); *Finland*, Aland, 60° 20′ n. lat. (*Hjelt*); *Scotland*, Shetlands (*Beeby*).

Here we have a species that is not abundant in Scandinavia, hence we get no new varieties; yet in leafage no species is more variable. From a small form with leaves 20 mm.×10 mm. to a large one 130 mm.×48 mm., and a deep water state 180 mm.×6 mm., every possible gradation can be found. Of f. *cancellatus* Fryer—a Shetland plant which Beeby was inclined to put as a hybrid—Hagström remarks "if not a hybrid it might be considered a f. of v. *lancifolius*."

P. SPARGANIFOLIUS Laestad. (p. 217). This Hagström considers a hybrid—*gramineus* L.×*natans* L.—and localizes "Shobden Marsh, Heref. 89, *A. Ley*; Surrey, *A. Bennett*, 86; York, Ripon, 80, *Nicholson*; and a dubious f. from Caithness, *E. S. Marshall*. The Surrey plant I have not yet traced; the Hereford one is simply a state of *natans* (as Dr. Hagström himself named a specimen I have) and so is the one from Ripon. The Irish plant presents a more difficult problem. Hagström puts it under *sparganifolius* (i. e. *Kirkii* Syme) without any hesitation; Babington considered it absolutely agreed with Laestadius's plant; Syme, Fryer and I dissented; a study of the plant *in situ* is required.

P. FLUITANS Roth. (p. 238). Hagström proposes another name—*P. sterilis*—for this much discussed plant. This seems unnecessary: Roth's name should be retained for the hybrid, and use *P. nodosus* Pourr. (as the author does) or *P. americanus* Ch. & Schlech., which latter is certain for the plant, which is very ably discussed.

P. COLORATUS Vahl "in Hornemann, Flora Danica, 1813, t. 1449" (p. 178). "M. Vahl et Hofman-Bang primi plantam . . . detexerunt, sed Hornemann nominis autor est" (Lange, Nomencl. Fl. Dan. 132). *Sweden*, Gothland at c. 57° n. lat. Not on record for Norway or Finland. *Scotland* to 56° 30′ n. lat. (v.c. 103).

f. *grandifolius* leaves, 70–80×30–45 mm. The Cambridgeshire fens produce it with leaves 150 mm.×50 mm. on boulder clay; in Herefordshire specimens they are 150 mm.×55 mm.

*P. ANGLICUS Hagst.=*P. coloratus*×*polygonifolius* (p. 180). "Although *coloratus* and *polygonifolius* are so closely connected one to another, yet nobody has observed any crossing between them. Some specimens from Woking Heath, in Surrey, England, gathered by Ar. Bennett in 1881, however, seem to me in all probability to be such a bastard," p. 180. The specimens are simply a f. of *polygonifolius* in deeper water than usual on a heath; the whole growth is of that species and not *coloratus*. If other hybrids suggested rest on no better ground than *anglicus*, I should say they are not to be depended upon. I know the growth of *coloratus* well in the fens and broads of E. Anglia, having seen hundreds in the living state. Hagström admits (p. 176) that "the stem-anatomy of the stem [of *coloratus* and *polygonifolius*] is so much alike that it is practically useless for the distinction of the species." Had he suggested that specimens from Shawley, Salop, Nov. 1888, *W. Phillips*, were *anglicus*, I should hardly have contested it; the growth of the submerged leaves resembles that of *coloratus*, and the floating leaves are thin, with the *coloratus* areolation, yet the habit is that of *polygonifolius*.

P. ALPINUS Balb. (p. 142). *Sweden* to Swedish Lapland; *Norway* to 70° 25′ n. lat. (*Norman*); *Russian & Finnish Lapland*, 68° 43′ (*Hjelt*); *Scotland* to Caithness, c. 59° n. lat.

A very variable species; Hagström does not adopt the names of Fischer (in Ber. Bay. Bot. Ges. xi. 45, 1907), yet introduces two new forms. Fischer has added to the difficulty of collating the varieties by giving a new interpretation of some of the old names. The author places *P. gracilis* Wolf. under *P. gramineus* L. *P. Druceii* he considers to be a hybrid—*P. alpinus* × *natans*, as Mr. Druce first suggested.

P. LANCEOLATUS Sm. (p. 149) is regarded as undoubtedly a hybrid —*P. alpinus* × *pusillus*. In this I do not concur: I consider it as *heterophyllus* × *pusillus*. Hagström states that the submerged leaves are "obtuse," but this is not the case: they are subacute; I had the plant growing for many years, and dried two hundred specimens and distributed them so as to avoid despoiling the Welsh station. Everyone who has grown or gathered *alpinus* knows the peculiar growth of the rhizomes; they resemble no other British Potamogeton. The roots of *lanceolatus* have nothing of *alpinus* in them, but they have of *heterophyllus*; the floating leaves are not *alpinus* either in chemical constitution or structure. A plant that has the chemical nature of *alpinus* will show it in drying, and you can drive it back by soaking again.

For description and figures of the British plant, Hagström (p. 150) refers to my paper in this Journal for 1881 (p. 65, t. 217). He states that the obtuse apices of the submerged leaves remove it from *heterophyllus*: this is a mistake; I have the plant dried from cultivation from January to August in every month, as well as the autumn states, and they contradict this.

P. HETEROPHYLLUS Schreb. (p. 204). The author places this under *P. gramineus* L., and remarks: "Although Linné in his short description of this plant has not mentioned either floating or petioled leaves . . . . . there is no reason to reject the Linnean name, and a mis-determination in Linné's herbarium does not alter the dignity of the good old name." Why then does he use (p. 65) *zosterifolius* Schum. for *compressus* L.?—There is nothing grass-like in *heterophyllus*, while in *compressus* there is the compressed stem, etc. The specimen in Cliffort's herbarium is identical with Schumacher's plant! while in the Linnean herbarium one of the specimens named "*compressus*" is *heterophyllus*! Hagström does not accept *P. graminifolius* (Fries) Fryer for the Irish plant named *P. lonchites* (Syme non Tuckerman). At the date of Syme's determination one had to accept it; he said later he had seen fruit and this seemed final. Writing to A. G. More in 1889, I remarked: "If not a hybrid, what then? I really do not know what to answer, but I strongly suspect it may eventually come under *heterophyllus* as var. *hibernicus*. Out of hundreds of specimens of *heterophyllus* I have seen from over its whole area there is nothing quite like the Irish plant, so that the above is still my opinion.

P. FALCATUS Fryer. Hagström (p. 221) refers this to *nitens* Weber, but some of Fryer's specimens, *e. g.* "Stocking Fen, Ramsey, Hunts., nos. 1265, 1275, 1086"—he refers to "true *gramineus*, verging to f. *jemtlandicus* Tis., or f. *nigrescens* Fr." (p. 209).

P. NITENS Weber (p. 221). *Sweden* to Swedish Lapland; *Norway* to Sydvaranger; *Finland* to 63° n. lat. (*Hjelt*); *Scotland* to Shetland, *Beeby*. Hagström's account of *nitens* is very full: he divides it into three varieties or groups: *α. subgramineus*, with seven forms; *β. subperfoliatus*, with nine; *γ. intermedius*, with ten. Of *subperfoliatus* we have in Ireland, f. *prælongifolius* (Killarney, 1890; Scully, 2734; Ballyputylough, co. Clare, 1905, *Præger*; Ballynane Lake, Donegal, 1893, *H. C. Hart*); and f. *obtusus* (Antrim, Drough river, 1883 and Six-mile river, Dunaday, *S. A. Stewart*): in Scotland, f. *perfoliatifolius* (Thurso river, Caithness, 1886, *F. J. Hanbury*; Brue loch, Dunrossness, Shetland, 1890, *Beeby*) and f. *elongatus* (Lunanburn, E. Perth, 1882, *A. Sturrock*; Isle of Tire, v.c. 103, 1896, *Macvicar*; Birsay, Orkney, 1876, J. W. H. Trail).

P. LUCENS L. (p. 232). *Sweden* to c. 63° n. lat,; *Norway*, to 61° n. lat. (*Blytt*); Finland. Hagström doubts Hjelt and Hult's record of Kolari in Kemi Lappmark (1885), but this is confirmed in Herb. Mus. Fenn. (1889) p. 33, and by Wainio at 67° 25′ n. lat. in his Fl. Lap. findland (1891) p. 71. In Ireland and England f. *insignis* Tis. seems the most frequent form.

P. DECIPIENS Nolte (p. 242). *Sweden* to Gefleborgs län (*Berlin*); Finland (as *P. salicifolius* Wolf), by Hjelt, Fl. Fenn. i. 538 (1895). In Britain to Forfar, and v.c. 102 of Inner Hebrides, *Somerville*. I quite agree with Hagström that this $=$*lucens*$\times$*perfoliatus*, and consider that Graebner's separation into two hybrids (*Das Pflanzenreich*, 137, 1907) is erroneous. It is, as Hagström remarks, a "beautiful hybrid"; the leaves and stipules in Cambs specimens are so translucent that every vein and sub-vein can be seen. I have only seen one specimen in fruit—from "Benwick, Cambs, 7.1884, A. Fryer." Of the Bath plant named in MS. "*P. Burtoni*, Canal, Bath, Som. ex herb. Hopkins, July 1866," I possess two specimens, and one from T. B. Flower, 1867; I also know those at the British Museum and Kew. Fryer agreed with me that "whatever '*decipiens*' they were, they were not the *decipiens* of Nolte's herbarium."

The plate in Journ. Bot. (1867, t. 61) was drawn from a specimen of true *decipiens*; in the description (p. 73) it is definitely stated that it was made "from a specimen collected by Mrs. Hopkins in a canal near Bath." If this were the case, it was the only specimen she found, as the leaves in all the Bath examples I have seen are distinctly petioled. Syme (E. Bot. 3, ix. 39) regards the Bath plants as "a weak state of *lucens*," which seems to be the case.

P. decipiens var. *affinis* mihi in Journ. Bot. 1879, 289, and Exch. Club. Rep. 1880, 35, is a very odd and difficult plant to name; Hagström merely mentions it, not having seen specimens. Trimen in Journ. Bot. 1867, 289, suggested *P. salicifolius* Wolfg.; Syme in Ex. Club. Rep. 1876, 35 (1878), *nitens* Web.; above I called it *decipiens* (see above); later I suggested × *Brotherstonii* (*decipiens* × *nitens*; see Linton in Journ. Bot. 1907, 300), but no *nitens* seems to produce fruit. After all, I think my first suggestion may stand.

It occurs in the canal. Warwick. 1862, *Baker*; Tweed. Fishnick. Berwick. 1876, *Brotherston*; Sprouston and near Kelso. Roxburgh, 1875, *Brotherston*.

The specimens are very dark, nearly black; the lower leaves 120 mm. × 30 mm., upper 80 mm. × 25 mm., clasping at the base, thus suggesting *decipiens* × *perfoliatus*.

**P. Torssandri* (Tis.) *P. decipiens* β. *Torssandri* Tis. Pot. suec. exsicc. ii. n. 75 (1895), p. 216, *P. gramineus* × *lucens* × *perfoliatus*. The author says, "I have formerly considered the (p. 216) plants belonging hereto to be a mule between *P. Zizii* and *perfoliatus*, but must now leave [it] open . . . possibly *P. lucens* × *nitens*, or *decipiens* × *gramineus*." The plant occurs in Sweden, Denmark, and France. "It resembles much *P. nitens*, and is distributed by Ar. Bennett as *P. nitens* var. η. *cuspidatus* in Graebner, Potamog. 1907, 91." This refers to specimens in the National Herbarium, where I suggested the name many years ago. The plant is, like *affinis*, very difficult to name with any certainty. It occurs in Britain: I have a specimen from Wareham, Dorset, collected by E. F. Linton, in 1893.

The finding of *P. upsaliensis* Tis. at Wool in Dorset was participated in by Mr. Green, as well as by Miss Ida M. Roper. Hagström divides *decipiens* into three varieties: α. *latifolius*, with three forms; β. *brevifolius*, and γ. *longifolius* with two each.

The Wool plant falls under *longifolius* f. *upsaliensis*.

P. ANGUSTIFOLIUS Bercht. & Presl = *P. Zizii* Roth (p. 210).

Sweden to Jemtland and Medepad; *South Norway*; Finland to 66° 20′ n. lat. (*Wainio*). Britain to E. Ross. 57° 30′ n. lat. (*Mennell*).

The author doubts whether this name applies to *Zizii*, but the Bohemian botanists have no doubt, and Fieber, Presl, Kosteletsky, and Celakovsky so consider it. Hagström refers to and figures (103 B) a rare form of leaf with reduced lamina (as in *lucens acuminatus*) from "Long Drove, Pidly Fen, Hunts. *Fryer*." This also occurs in Westmoor, Chatteris, Cambs, where I gathered it with Fryer in 1886, and in Surrey (*Beeby*). He remarks: "I am persuaded that *P. Zizii* rarely, if ever, propagates itself by seeds." There is no doubt that it does so in Cambridgeshire; in a ditch on Witcham Meadlands Fryer showed me plants that had come from seed, though no doubt this is rare—I have only seen good fruit on deep-water forms from Derwentwater, Cumberland (*Pearsall*), and from Butterstone Loch, Perth (*Sturrock*). We do not seem to have any form like f. *splendissima* Tis., with peduncles 28 cm. long; the nearest to it is from Cauldshields Loch, Roxburgh (*Brotherston*), with peduncles 20 cm. long. Of the Cambridge Fens forms, a large number fall under var. *validus* Tieb., f. *coriaceus* M. et K. (*P. coriaceus* Fryer); our usual form is *lucescens* Tis.: f. *communis* Hagst. occurs in Llyn Leydyard (*Griffiths*); f. *lucentiformis* Hagst., Westmoor, Cambs (*Fryer*); var. *elongatus* f. *foliosus* occurs in Coniston Lake, N. Lanc. (*C. Bailey*). The most remarkable state is one from Great Fen Acre Drain, Chatteris, Cambs (*Fryer*) with petioled upper leaves 20 cm. long × 40 mm. wide.

*P. Billupsii Fryer = *angustifolius* × *coloratus*, *P. coloratus* × *gramineus* Hagst. (p. 181), *P. coriaceus* × *plantagineus* Fryer. "The English specimens I have examined are by Fryer himself determined as *P. Billupsii*, and considered to be a combination of his *P. coriaceus* and *coloratus*, which would mean *P. gramineus* × *lucens* × *coloratus*, anything of *P. lucens*, however, cannot be discovered in the specimens here concerned, ... in the specimens figured [as *Billupsii*] in t. 337 [Journ. Bot. 1893] are evidently *P. Zizii* . . . . in the specimens figured on Plate 338 *P. coloratus* can easily be traced in the leaf-texture" etc.

The only other habitat given by Hagström for this hybrid is Gothland, Sweden: I know too little of the plant to venture an opinion concerning it.

*P. varians Morong ex Fryer (p. 205). Hagström puts this under *gramineus* L. He considers the Fryer specimens nos. 1732, 2243, & 1277 Gunty Fen are "pure *nigrescens* Fries; likewise also no. 2056, 2057 from Block Fen, and 2504 from Witcham Meadlands, Mepal." Here I am disposed to agree, but much difference of opinion has been, and will continue to be, expressed as to Fries's plant.

*P. crassifolius Fryer = *P. gramineus* × *lucens* × *natans* (p. 216). "The specimens from Cambridgeshire, Westmoor, Doddington (*P. crassifolius* f. *verrutus* Fryer) under no. 1668, . . . also nos. 422 and 423 from Doddington, seem to be this double hybrid." Other "Fryer specimens of *P. crassifolius*" Hagström (p. 239) places under *P. lucens* × *natans*: I think he is probably right here, as I know some of the early gathered plants referred to *crassifolius* were a state of *fluitans* Roth. (= *lucens* × *natans*).

P. Griffithii Ar. Benn. (p. 149). Hagström identifies this with *P. nerviger* Wolfg. from Lithuania: this and the Welsh station are the only ones known. "Its hybrid origin (i. e. *P. alpinus* × *prælongus*) is beyond all doubt and may nowadays be disputed in earnest by nobody"; nevertheless, I venture to do so. To begin with, the habitats are very different—Lithuania a low-lying marshy country, Llyn-an-afon (Aber Lake) an isolated mountain tarn with wild scenery around. Moreover, *P. prælongus* is not known in Caernarvonshire; *P. alpinus* grows only in one spot, thirty miles away.

The lake is 1620 feet altitude lying under Y Foel Fras, 3091 ft. alt., and all around are mountains. My friend the late E. Straker, who went there at my request, considered that the lake "had been formed by the damming-up of the valley by the remains of an ancient glacier; the moraine is composed of large sharp rectangular blocks of stone, partly covered by bog": at a quarter of a mile from the lake the ground by the stream out of it has fallen to 1434 feet. It is a case of isolation exactly similar to that of *Salmo nigropinnis* (the black-finned trout), which also occurs in these isolated Welsh Lakes. I had the plant growing many years along with *P. alpinus* and *prælongus*: Fryer suggested it might be a *perfoliatus*, *polygonifolius*, or *prælongus* hybrid, and remarked "if *alpinus*, where are the roots of this, and where are the traces of its peculiar winter-buds?"

I have gathered the *P. Griffithii* (cultivated) at all seasons of the year from March to October: in March the leaves are petioled, and very translucent, quite different from *alpinus* or *prælongus*, which grew by its side in the same tank.

I hope at some future time to discuss P. NERVIGER Wolfg., but this is not a British species.

P. PRÆLONGUS Wulf. (p. 250). *Sweden* to S. Lapland (Berlin); *Norway* to 69° 58′ n. lat. (*Norman*); Finland to 69° 30′ n. lat. (*Ewald*); Scotland to Shetlands (*Beeby*).

This is one of the least variable species, both here and elsewhere; we do not have var. *latifolius* Alpers (leaves subrotund), or var. *elegans* Tis. (leaves 30 cm. long × 20 mm. wide).

P. PERFOLIATUS L. (p. 254). *Sweden* to S. Lapland (Berlin); *Norway* to 70° n. lat. (*Norman*); Finland to 69° 31′ n. lat. (*Wainio*); Scotland to Shetland (*Beeby*). Leaves very variable from almost round to 12 cm. long × 3 cm. wide. A form like the former has been described as a species (*P. bupleuroides* Fernald).

P. CRISPUS L. (p. 58). *Sweden and Norway* to Gestricia at 60° 30′ n. lat.; Finland, Aland isles only; Scotland and Orkney and Outer Hebrides. The largest forms I have seen from Britain are from Kinghorn Loch, Fife (*W. Syme*), leaves 90 mm. × 15 mm., and Sidcot, Somerset (*W. F. Miller*), 85 mm. × 15 mm.

This does not vary much with us; curiously enough, Hagström does not mention *P. serratus* Hudson as a synonym. So far as one can judge from named specimens in herbaria (I have not seen a type) the var. *planifolius* G. F. W. Meyer, Chloris Hanov. 523 (1836), is the same form. The author retains E. F. Linton's var. *cornutus*.

*P. BENNETTII Fryer (p. 63). This he regards as *crispus* × *pusillus*, not *crispus* × *obtusifolius* as suggested by Fryer.

*P. LINTONI Fryer. This is regarded by Hagström as *P. crispus* × *Friesii*, but is only mentioned in his index. I have it from Shere, Surrey, C. E. Salmon, 1912. On a specimen from Ireland (Canal below Calloron, Co. Fermanagh, 1892, *Praeger*) Fryer remarks (*in litt.*): "This is my *Bennettii*," but I think it should rather be referred to "*Lintoni*." I sent it to him suggesting "*P. crispus* × *obtusifolius*?"

*P. Cooperi Fryer (p. 61). *P. cymatoides* Asch. & Graeb. Syn. Mitteleur. Fl. i. 337 (1897). *P. cymbifolius* Fischer, Beit. z. Kennt. bayer. Pot. in Mitt. bayer. Bot. Ges. 366 (1904).

Hagström divides this into two forms: *α. serrulatus* and *β. serratus*: under the first he places f. *eu-Cooperi* Graebn. (Leicestershire —the only station); f. *Jacksonii* (Cheshire and Cambridgeshire; the original record was from Yorkshire); and f. *scoticus* Hagst.—a new form—from Stirling; I have it from Salop and Notts. *β. serratus* is only known from Bavaria. "Real *P. Cooperi* is besides observed by us from Gudenå in Denmark."

The Irish specimens are neither of the above, being nearer *perfoliatus* than the others, and may be called f. *hibernicus*:—Folia 6 cm. longa, ·2 cm. lata. Leaves very dark, blackish green, peduncles 4–5 cm. long (*scoticus* 2 cm.); whole plant more robust than the other forms.

P. densus L. (p. 260). Sweden in Halland; Finland, Aland Isles only; Norway at 60° n. lat. (*Hartman*).

The author gives Howden, Yorkshire (1845, *Storey*), as the most northern British locality; but it occurs up to Edinburgh and Lanark. The varieties *latifolius* Wallr., *angustifolius* M. et K., and *lancifolius* Wallr., occur in Britain. The typical form is abundant on Mitcham Common, Surrey.

P. zosterifolius Schum. (p. 65). *Sweden* to 63° n. lat.; *Norway* to Christiana (*Blytt*); *Finland* to 66° n. lat. (*Hjelt*); *Scotland* to 56° 40′ n. lat. (Forfar).

This was referred to *cuspidatus* Schrad. by J. E. Smith, who of course knew nothing of *acutifolius* Link.; but Schrader's specimen in Smith's herbarium is *acutifolius*.

Hagström describes a f. *abortivus*, which he thinks "may be a hybrid with *acutifolius*": "A similar plant is also collected by Babington in Scotland (hb. Stockholm) where *P. acutifolius* is not now met with. Nevertheless it is possible that it has occurred there in olden times." I do not know what this specimen is, but I have little doubt it is a Rescobie one, in which the fruit is sometimes not developed and the flower-heads look just as they would if it were a hybrid. This it is not; in northern latitudes *Potamogeton*, *Sparganium*, &c., often do not fruit freely in wet or cold years (see Laestadius in Bid. till Kann. Vaxt. Tornea Lappmark, 1860, p. 42).

P. acutifolius Link. (p. 67). *Sweden* to 60° 12′ n. lat. (*Hagström*); not recorded from Norway or Finland; *England* to S.E. York. (*Smith* herb.!). Hagström gives the length of the peduncles as usually 10 mm. (5–23); in specimens from Buckenham Ferry, E. Norfolk, they are 25 mm., in those from Staines, Middlesex, 36 mm., but others have the normal length: neither is *P. bambergensis* Fischer (*acutifolius* × *zosterifolius*).

P. obtusifolius M. & K. (p. 115). *Sweden* to 63° n. lat.; *Norway* to 62° n. lat. (*Blytt*); *Finland* to 67°·25′ n. lat. (*Wainio*); *Scotland* to Argyll! and Inverness!

The length of the peduncles in this species is very variable; in specimens from Lake Lancashire (*Pearsall*) they are 36 mm. long, four times the length of the spike. This is var. *fluvialis* Lange & Mortenson, but not var. *lacustris* Fries, Herb. Norm. 5, no. 81

(1840). The author refers Fries's plant to *P. semifructus* Ar. Benn. ap. Graeb. *Das Pflanzenreich*, 138, 1907 (nomen) = *P. mucronatus* × *obtusifolius*. This plant I have from Wire Mill Pond, Surrey, 1882 (*Beeby*), and Clunie Loch, Perth, 1882 (Sturrock). *P. obtusifolius* fruits more freely than any other of the grass-leaved species; a specimen from Stalham, E. Norfolk, has eleven peduncles, one of which has thirty-two well-formed fruits. When growing from winter-buds (turios) in April, the first seven leaves are only 18 mm. long, with an almost square apex, the central lacunæ forming one-third of the leaf-width.

P. Friesii Rupr. (p. 94). *Sweden* to 61° 15′ n. lat. (*Hagström*); *South Norway*; *Finland* to 62° n. lat., *Kihlman* sp.; 66° 59′ (*Hult*) Vienna herb.; *Scotland* to Caithness, Orkney, and Outer Hebrides. Var. *majus* S. F. Gray, Nat. An. Brit. pl. 35 (1821) = *latifolius* (Ruthe herb.) ap. Fischer, Ber. Bayr. Bot. Ges. xi. 100 (1907).

P. panormitanus Biv.-Bernardi, p. 98 (1838) 6; *P. gracilis* Fries, Nov. Fl. Suec. 50 (1828), teste Hagström. This plant, considered as a var. of *pusillus*, has been little noticed by writers on the genus. It is incidentally named by Babington and by myself in Journ. Bot. 1881, pp. 11, 67, 242, and by Morong in Macoun's Cat. Canadian Plants, 87 (1888). Hagström figures and describes fully the differences between this and *pusillus*, one of the principal of which relates to the stipules (ligules): in *panormitanus* these are connate (as shown by his figure 39), in *pusillus* they are not so, and numerous other differences are set forth at much length. I have specimens from pond nr. Lewes, E. Sussex, 1895, *Hilton*; Amberley and Sidlesham, W. Sussex, 1901, *Marshall*; Surrey, coll. by myself in 1881 and by *Nicholson* in 1882; Salop. 1881, *Beckwith*; Caernarvon, Llandudno, 1869, *C. Bailey*; Cambridge, Chatteris, 1886, *Fryer*; Anglesea, Cors Bordialio, 1892, *Griffith*; Cardigan, Aberanth, 1899, *Marshall*; Wexford, ditch n. of harbour, 1896, *Marshall*; Kirkcudbright, Ketton, 1884, *Coles*; E. Inverness, Beauly, 1894, *Marshall*; Fife, Loch Leven, 1909, *West*; Isle of Lismore, v.c. 98, 1898, Macvicar; Caithness, Loch Scarmlett, 1914, *W. Lillie*.

All our specimens called *pusillus* will have to be examined to show to which species they belong; I have determined those from the preceding localities.

P. pusillus L. (p. 121). *Sweden* to S. Lapland; Norway to Naeseby; *Finland* to Svjaitoy-noss at 68° 10′ in Russian Lapland; *Scotland* to Shetland (*Beeby*).

*P. pusilliformis Hagström (*P. pusillus* × *Friesii* Rupr.) (p. 97). The author gives no English localities: I have it from Betchcott, Salop, 1882, *Beckwith*; Coulterhouse, Sauchie, Stirling, 1892, Kidston.

P. Sturrockii Ar. Benn. (p. 117). The author regards this species, known only from Scotland, as *P. obtusiflorus* × *panormitanus*, but my specimens have plenty of good fruit and I therefore cannot accept this conclusion.

P. trichoides Cham. & Schlecht. *Sweden* at 56° 50′ n. lat. (*Winslow*); *Scotland* at 56° 18′ n. lat. (*Barclay & Matthews*).

Hagström says: "Such varieties as *Trimmeri* Casp. and *capillaris* Fischer, recorded as three-nerved and by this fact separated from the main form are probably bastards." I do not know Fischer's plant, but *Trimmeri* (our *trichoides*) is certainly not a bastard; curiously enough he quotes a Norwich specimen from Babington under his *trichoides*. Caspary separated it from the type because that is figured with one-tuberculed fruit and one-veined leaves, and this is the case in the type-specimens in the Berlin herbarium. Our plant fruits very freely in Norfolk.

*P. FRANCONICUS Fischer (*P. pusillus* × *trichoides*) f. *aspicosus* Hagstr. (p. 126). Hedge Court Mill Pond, Surrey, *Beeby*, *teste Hagström*; Ewood Pond, Surrey, *Straker*.

The author refers to this specimens from "Glastonby [Glastonbury], Somerset, Murrey [Murray]." On receipt of specimens from the late R. P. Murray I wrote: "I should call this *pusillus* var. *pseudotrichoides*," and I still maintain this name, as the plant fruits freely. Mr. Marshall notes "no *trichoides* in Somerset."

P. PECTINATUS L. (p. 39). *Sweden* to S. Lapland; *Norway* to Finmark; *Finland* to 66° n. lat. (*Hjelt*); *Scotland* to Shetlands.

The varieties of this species are treated very fully. They include the following British forms:—

Var. *ungulatus* Hagstr. f. *sub-æquabilis*. River Leen, Notts (*Mitchell*); Wallasey, Cheshire (*Lomax*).

f. *latiusculis* Hagstr. Benwick, Camb. (*Fryer*).

Var. *diffusus* Hagstr. f. *laxus* Hagstr. Hedge Court Mill Pond, Surrey (*Beeby*); Chatteris, Cambs (*Fryer*); Stirling (*Stirling & Kidston*); Outer Hebrides (*Somerville*); *Orkney* (Syme); Shetland (*Beeby*); I. Man (*Kermode*); Castle Gregory, Co. Kerry (*H. C. Hart*).

The author refers *P. flabellatus* Bab. to *P. interruptus* Kit. and does not consider it entitled to specific rank.

P. VAGINATUS Turcz (p. 32).

He remarks: "Shetland, Beeby, see Journ. Bot. 1907, 192. I am not fully convinced of the correctness of this statement." The Shetland plant agrees with Swedish specimens accepted by Hagström; but I am not fully convinced that his Swedish specimens are correct: I have two specimens of Turczaninow's plant from the original locality: but this must be discussed elsewhere.

P. FILIFORMIS Persoon (p. 14). *Sweden* very general and far north; *Norway* to 70° 51′ n. lat. (*Norman*); *Finland* to 69° 40′ n. lat. (*Wainio*); *Scotland* to Shetlands (*Beeby*).

The author uses the above name, not accepting *P. marinus* L. With regard to the use of the latter the specimens so-named in the Linnean herbarium are *pectinatus*! In *Rhodora* (1916, p. 134) Mr. H. St. John takes me to task for using *marinus*, as I had previously used *filiformis*, and his arguments are to the purpose; he writes "In just such cases as this we are authorized by the International Rules for Botanical Nomenclature to cast aside the name 'when it becomes a permanent source of confusion.'" But if a specimen could be found of the plant of Boccone on which Linnæus based his *marinus* and it proved to be *filiformis*, then *marinus* would stand; meanwhile I am quite content to use *filiformis*.

Hagström divides this species into many forms of which the following are British:

f. *vulgaris* Tis.; most of our specimens belong here, others are f. *luxuriosus* Hagstr., Rescobie, Forfar, 1913 (*Somerville*); Isle of Tiree, v.c. 103, 1897, *Macvicar*; near Old Man of Wick, Caithness, 1893; (*Kidston*)—very fine 50 cm. high; Asta Loch, Scalloway, Shetlands (*Beeby*).

f. *major* Tis. Wick, Caithness, 1885 (*Grant*); Coldingham Lock, Berwick (*Brotherston*); Orkney, 1876 (*Trail*).

f. *alpinus* Blytt. Camilla Loch, Fife, 1909 (*West*).

SHORT NOTES.

The Height of Carduus (Cnicus) palustris. This very common Thistle is abundant in Essex, though Gibson (*Flora of Essex*, p. 184, 1862) gives only one definite locality for it. It flourishes in boggy meadows and in the open parts of damp clayey woods. It grows freely in the more open glades I have formed in my own wood here at Chignal St. James, near Chelmsford, which is on the south-eastern edge of the area of the Chalky Boulder-Clay. With it grows a white-flowered variety which, though not mentioned in most of the botany books, is, I believe, pretty common generally. In regard to the height to which it attains, the books seem much at fault; for they all greatly understate its usual stature here. I find the following statements on this point in the few books I happen to have at hand:—Withering gives 5 to 6 feet and upwards (Brit. Plants, ii. 874, 1787); J. E. Smith, 3 to 5 feet (Engl. Flora, iii. 386, 1825); Hooker & Arnott, 4 to 6 feet (Brit. Flora, 237, 1860); Syme, 1 to 5 feet (Engl. Bot. v. 13, 1866); Babington, 3 to 5 feet (Manual, 207, 8th ed., 1881); H. & J. Groves, 3 to 5 feet (Bab. Manual, 222, 1904); Druce, 1 to 5 feet (Hayward's Bot. Pocket Book, p. 112, 1909). There is, as will be seen, a consensus of opinion that its maximum height is at most six feet. These dimensions are, however, much below the normal height to which the plant attains here in the months of August and September, when it reaches its fullest growth. They are, in fact, scarcely half its usual height here, which I should guess at an average of seven or eight feet. Some of these are little more than a third of the stature of the finest examples I have seen—*e. g.*, on 5 August, 1916, I measured three plants growing close together in a group in one glade, which were 9 feet, 9 feet 2 inches, and 9 feet 3 inches high, respectively. Since then I have seen many substantially higher and have measured several over 10 feet high; but I have omitted to note their exact heights, with the exception of one I measured on 21st September, 1918, which was 10 feet 6 inches high. Not improbably the height of these examples is due to the fact that they grow in glades in a wood, and that they were drawn up, to some extent, by the much greater height (20 feet at least) of the surrounding bushes; but there is nothing very abnormal in the circumstances, and I suggest that the average height of this Thistle has been much understated. The plant is, in ordinary circumstances, a very elegant one, with a slender, straight, wand-like, unbranched stem; but these exceptionally tall examples are graceful in the extreme.—MILLER CHRISTY.

JUNCUS ACUTUS L.: A CORRECTION. Mr. Arthur Bennett writes to call attention to the improbability of the record of this species from an inland locality such as Cornard, given by me from the Andrews Herbarium (Journ. Bot. 1918, 351). The plant is labelled by Andrews "Juncus acutus R. S. 3. 432. 3," and by Hemsted "Juncus inflexus." In my transcript of W. A. Clarke's determinations of species in the Dillenian Synopsis this species, "Juncus acutus *Ger.* 31, acutus vulgaris *Park.* 1193, etc.... *Common hard Rush*," is identified as *J. glaucus*, which the specimen in Andrews's herbarium certainly is. I am, therefore, at a loss to explain how I came to enter it as *J. acutus* L.—G. S. BOULGER.

REVIEW.

A Monograph of British Lichens: A Descriptive Catalogue of the Species in the Department of Botany, British Museum. By ANNIE LORRAIN SMITH, F.L.S., Acting Assistant, Department of Botany. Printed by order of the Trustees of the British Museum. Part I., Second Edition, pp. 519: 71 plates and 11 figures in text. Price £1 10*s.*

THE present volume, which has been awaited with keen interest by lichenologists, brings to completion the *Monograph of British Lichens*—re-written, re-arranged and enlarged by Miss A. Lorrain Smith; it is thus practically an independent work. The Monograph, originally planned by the late J. M. Crombie, was partly prepared during his lifetime, and Part I. was published in 1894, under the above title. After a considerable interval, Part II. following as far as possible the lines of the work previously carried out by Crombie, was prepared by Miss Smith and issued in 1911. The publication of Part II. rendered a second edition of the earlier volume an urgent necessity, for it was at once fully recognised that the value and usefulness of the work would be greatly enhanced if brought uniformly into line with modern views.

A short and lucid introduction of seventeen pages is arranged under the following sections:—The Lichen Plant, Morphology, Vegetative Structures peculiar to the Lichen Thallus, Reproductive Organs, Physiology, Ecology and Distribution, Economic Uses of Lichens, Phylogeny and Classification. In the first section under the sub-head "Algal Elements of the Thallus," a tabulated statement is given as follows:—

"2. *Chlorophyceæ* associated with *Archilichenes*:—

"*Protococcus* (*Cystococcus*, *Pleurococcus*) and *Palmella* in the greater number of the larger lichens and in many crustaceous genera."

With the existing diverse views of writers respecting the algal symbiont of many lichens, it is undoubtedly preferable not to specify particularly the gonidium variously referred to as *Cystococcus*, *Protococcus*, or *Pleurococcus*: there is reason to believe that *Proto-*

coccus viridis Ag., as defined by Wille, is rarely the gonidium of British lichens, as vegetative division by true "cloisonnement" is seldom seen within the thallus.

In the section describing the reproductive organs, four illustrations show the structure of apothecia and perithecia as seen in transverse section. These should prove helpful to the student, as they illustrate the essential points to be considered when a genus is being determined by the structure of the reproductive organs.

In the section Ecology and Distribution, reference is made to a specimen of *Parmelia saxatilis*, kept under observation for a considerable time, which increased in diameter on an average of one centimetre in a year. This probably represents the average increase in diameter of a large number of foliose lichens, but sometimes growth is more rapid: this is the case with *Peltigera spuria*, which often makes an appearance on burnt portions of heath land at the time when the moss *Funaria hygrometrica*, which first occupied the burnt patch, shows signs of exhaustion. The branchea of the thallus of this lichen grow from 2 to 3 cm. in from six to eight months. *Lecanora saxicola* has been observed to grow 2·5 cm. within the same period.

The chief characteristics of Phylogeny and Classification are tabulated and concisely described. We welcome the method introduced in this volume of giving measurements of spores and spermatia in mikrons rather than in fractions of millimetres, as being simpler and clearer than that previously employed. The warning that chemical reactions cannot always be relied upon will save the amateur a certain amount of hesitation and uncertainty when dealing with specimens that require critical determination.

Comparison with the first edition shows that the subject of classification is now approached from a different standpoint. The structure of the reproductive organs has become the touchstone; British lichens are accordingly arranged in two series, *Gymnocarpeæ* and *Pyrenocarpeæ*; the former including the subseries *Coniocarpineæ*, *Cyclocarpineæ*, and *Graphidineæ*.

Each order is provided with a key to the genera. The list of synonyms following the diagnosis of a species has in many cases received additions, and the record of localities shows a wider distribution than was previously indicated. The restriction of general habitat has been occasionally removed; thus *Calicium hyperellum* "in upland wooded districts" (ed. 1, p. 91) now reads (p. 13) "in wooded districts." This recognises a considerably greater latitude in distribution and accords with the actual facts. The sequence of orders and the inclusion, or otherwise, of genera within their limits afford ample evidence of independent opinion and of the exercise of a mature judgement based upon laborious microscopic examination of large numbers of specimens. There is a wide divergence of view as to the genera that should be included in *Usneaceæ*. In this work the following are given as comprising the order:—*Evernia*, *Ramalina*, *Usnea*, *Alectoria*, and *Cerania* (*Thamnolia*). Zahlbruckner (1901) omits *Alectoria*, while Hue (1901) does not include *Evernia*; Harmand (1907) includes *Teloschistes* and Jatta (1909) adds *Cetraria* and *Platysma.* In the genus *Usnea*, the indispensable nature of the list of synonyms already referred to makes itself evident: both editions begin with *florida*, but the *U. florida*, Web. of the present edition, is *U. ceratina* var. *scabrosa* Ach. of the first; *U. hirta* Hoffm. becomes *U. florida* var. *hirta* Ach. and *U. barbata* Web. replaces *U. dasypoga* Nyl. The genus *Lecanora* has undergone thorough revision. In the first edition it included 197 species, a number now reduced to 92. The sub-genera *Placodium* and *Rinodina* are now included in the *Physciaceæ* and are raised to generic rank—the former on account of the presence of polarilocular spores and the lichen acid parietin, found mostly in both thallus and apothecium, the latter by reason of the distinctly polarilocular brown spores. No fewer than twelve Nylanderian species of *Lecanora* have been, with evidently good reason, transferred to *Placodium.* Each plate represents very clearly the whole plant, natural size if small, or a part of it enlarged, vertical sections of the thallus and apothecium, the ascus with paraphyses, and spores. The magnification of spores and spermatia ranges from 500 to 1800 diameters. Each plate illustrates a more or less typical species; all genera are represented.

It is due to Miss Smith to add, that although this volume appears as the second edition of a work by a former writer, the revision has been so complete that the results of her own research are evident on every page. This must have entailed a vast amount of patient and laborious investigation not only of the herbarium specimens, but also of the extensive literature of the subject. The work does much to raise the standard of British lichenology to a high level, and there is reason to believe that its publication will greatly encourage and assist the reviving interest in the plants with which it deals.

ROBERT PAULSON.

BOOK-NOTES, NEWS, ETC.

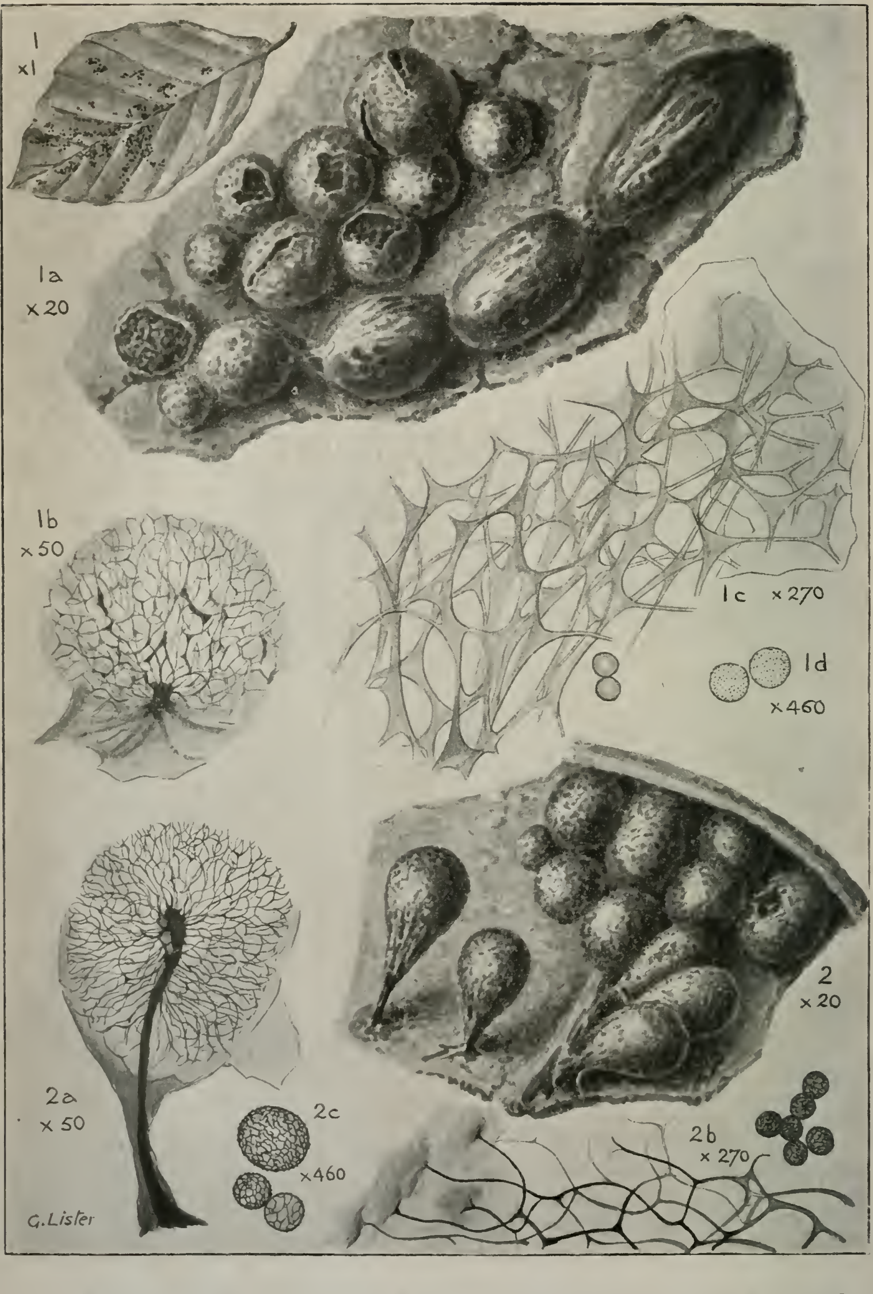
THE death of ANNE CASIMIR PYRAMUS DE CANDOLLE, at his home near Geneva on October 3, is for the systematic botanist the breaking of a link with the past. There are a few great classic works in Systematic Botany, and one of these is the *Prodromus Systematis Naturalis Regni Vegetabilis* initiated by Augustin P. de Candolle in 1824, and brought to a conclusion by his son Alphonse in 1873. The penultimate volume (Part xvi. 1864–69), dealing with the families Piperaceæ, Juglandeæ, and Myricaceæ, was the work of the grandson, Casimir. Casimir was associated with his father, Alphonse, in the scheme for the continuation of the work of the *Prodromus* by the issue of a series of monographs under the title *Monographiæ Phanerogamarum*, in which the families of the Monocotyledons were to appear and also those families of the Dicotyledons, already elaborated in the *Prodromus*, which stood in need of revision. The first volume issued in 1878 included the Smilaceæ (by A. P. de Candolle), the Restiaceæ (by Masters), and the Meliaceæ (by Casimir de Candolle). The ninth and last volume appeared in 1896: in all eleven families of Monocotyledons and eight of Dicotyledons were treated. Casimir de

Candolle's contributions to botanical science were not of the fundamental character of some of those of his grandfather and father. He did not inaugurate a system of classification, nor even formulate a code of nomenclature, but he did some useful work; in his younger days he was specially interested in the leaflet and published several papers on phyllotaxy, also papers on the comparative anatomy of the leaves of some families of Dicotyledons (1879), on the structure and movements of the leaves of *Dionæa* (1876), and on the rolling of tendrils (1879). One of his earliest papers was a valuable contribution to the morphology and systematic study of the Juglandeæ (1862). His later work was mainly systematic—the families to which he was most devoted were the Meliaceæ and Piperaceæ; to the last he was regarded as the expert on the Piperaceæ, and collections from all parts of the world were submitted to him for determination. Those who had the privilege of his personal acquaintance remember Casimir de Candolle as a kindly and courteous gentleman; many of our less young botanists will recall a gracious welcome to the old house in the Cour de St. Pierre at Geneva, and the loving pride with which the 'Prodromus' herbarium was shown. He was familiar with our own botanical collections and institutions; his numerous honours included the foreign membership of the Linnean Society, to which he was elected in 1893, and an honorary doctorate of Aberdeen University, as well as the Universities of Rostock and Upsala.—A. B. R.

The *Kew Bulletin* issued in November contains papers on "*Cordia Myxa* and allied species," by Mr. Hutchinson; "New and Rare British Fungi," by Miss E. M. Wakefield; and "New Orchids," by Mr. Rolfe. Mr. J. S. Gamble describes new Indian Melastomaceæ and Myrtaceæ—among the latter we note a new genus, *Meteoromyrtus*, based on *Eugenia wynaadensis* Bedd.,—and publishes notes on the second part of his *Flora of Madras* in which "explanatory notes were not admissible." The omission is quite intelligible on the ground of space; but, as the *Flora* is in English, the notes, as well as Latin diagnoses of new species, have to be published elsewhere.

The *Transactions of the Botanical Society of Edinburgh* (xxvii. part 3) contains papers by Prof. Balfour on "new species of *Primula* which have flowered recently," on "some late-flowering Gentians," and on the genus *Nomocharis*: Dr. David Paul records the occurrence of *Clathrus cancellatus* in Argyleshire—its first record for Scotland; and Dr. Stapf describes, as *Koeleria advena*, a grass found by Mr. James Fraser "in the neighbourhood of Edinburgh, growing among surroundings and under conditions which indicate that its seeds must have been introduced into this country along with esparto grass from the east of Spain or the north-west of Africa."

Dr. Kingston Fox announces the publication at an early date of a volume on *Dr. John Fothergill and his Friends*, which will contain a chapter on his botanical work and one including Peter Collinson, the Bartrams, and Humphrey Marshall.



1. *LAMPRODERMA VIOLACEUM* Rost. var. *DEBILE* G. Lister & Howard.

2. *L. ATROSPORUM* Meylan var. *ANGLICUM* G. Lister & Howard.

TWO NEW VARIETIES OF LAMPRODERMA.

By G. Lister, F.L.S.

(Plate 552.)

Two interesting forms of *Lamproderma*, differing in some respects from any hitherto described, were obtained last spring by Mr. H. J. Howard in the Whitlingham Woods, near Norwich. They occurred close together in two beds of beech-leaves, several yards apart, and some distance below the surface, and also on the leaves of two small box-plants, around which the beech-leaves were thickly heaped. They were first noted on April 3rd, when specimens were collected in good condition. On May 11th, when the woods were revisited, careful search resulted in sporangia being found on from thirty to forty leaves; many were in a weathered condition, others were still in good preservation. On the whole, it seems probable that no further development of sporangia had taken place between the two dates of collecting.

The two forms may be referred to, for convenience, as forms A and B. Form A appears to be a sessile variety of *Lamproderma violaceum* (Fries) Rost.; form B bears considerable resemblance to *L. atrosporum* Meylan, a species fairly common in the Jura Mountains and on the Swiss Alps, but not recorded from any other locality hitherto.

Form A (fig. 1) was by far the more abundant, and may be described first. The dark brown iridescent sporangia are either crowded together or scattered over the surface of the beech-leaves, a few only are on box-leaves; they are sessile, subglobose, or hemispherical on a broad base, and measure 0·5 to 0·8 mm.; a few form long plasmodiocarps constricted at intervals. The sporangium-walls are mottled with purplish shades, and, though somewhat persistent, at length break away in large fragments. The columella, in many sporangia, is represented only by a slight central thickening of the membranous floor; in other sporangia it is better developed and forms a short black column which may reach to about a third the height of the sporangium: very rarely it is a more massive structure and expands below to form the rudiment of a stalk. The pale purplish capillitium-threads are combined into a dense network with membranous expansions at the axils of all the branches; a few of these expansions form conspicuous dark strands, such as are not infrequently seen in irregular developments. The spores are pale purplish-brown, closely and minutely spinulose, 10 to 11 μ diam.

Although differing in many respects from the typical *L. violaceum* with its slender black stalks, and capillitium forming a tuft of threads repeatedly branching at acute angles, form A is probably a weak sessile growth of this species. We propose to name it *L. violaceum* var. *debile* G. Lister & Howard.

More or less sessile forms have been met with occasionally before, but in almost all the sporangia the columella and capillitium have been normally developed.

Interesting light is thrown on the variation which may occur in one growth of *L. violaceum* by the study of a specimen found on the Weissenstein, in the Jura Mts., 4000 feet alt., in June 1910. As in the Norfolk gatherings, the sporangia were on beech-leaves, but in the alpine form they are of much sturdier build: they are nearly sessile, subglobose, 1 to 1·3 mm. diam., and either brilliant iridescent blue or glossy bronze in colour. The walls in the iridescent sporangia consist of a pale purplish membrane, entirely free from refuse deposits of any kind; but in the bronze form the sporangium-walls include much brown granular refuse-matter, distributed fairly evenly or concentrated to form irregular lumps and patches. It is very disconcerting to have a *Lamproderma* behaving in this way, for by thus loading its walls with refuse-matter it bids defiance to our schemes of classification. The short black stalks, columellæ, and capillitium are, on the whole, normal. But, amongst the typical globose sporangia, a few ring-shaped plasmodiocarps occur, and in these the columella forms an irregular low ridge and the capillitium consists of a dense network of pale slender threads, branching mostly at right angles, and without conspicuous expansions at the axils. In all the sporangia the dark purplish-brown spores are minutely spinulose and 9 to 10 μ diam. The structure of the ring-shaped sporangia recalls var. *debile* from Norfolk, and the whole development illustrates the sporting character of the species.

Before leaving the subject of *L. violaceum*, reference may be made to the curious crystalline structures frequently found scattered over the surface of the sporangium-wall in the typical form. They consist of clusters of slender rods arranged either in parallel clusters or crossing at right angles to form a star: sometimes they spread out like a fan, or are broader and form flat plates. I am much indebted to Mr. A. R. Sanderson and Mr. W. H. Burrell for having tested these bodies chemically. It is found that they contain no trace of calcium or silica; that they are neither waxy nor resinous; on the whole, it seems most probable that they may be some form of crystalloid.

Form B (fig. 2) from the Whitlingham woods may be now described. The iridescent or glossy blue-black sporangia are clustered on the leaves of box and beech; they are narrowly obovoid or subglobose, and either very shortly stalked or sessile; a few scattered sporangia have slender black stalks, 0·2 mm. high; the sporangium-walls are pale purple and somewhat persistent, the columella is long, slender, and often irregularly expanded above; the capillitium consists of a network of slender flexuose dark brown threads, radiating from all parts of the columella, and attached by their expanded tips to the sporangium-wall. The spores average 11 μ, but range between 10 and 13 μ, or may be even larger. They are purplish-brown and marked with a close and more or less complete reticulation of low ridges.

A sample of form B was sent to M. Meylan for his opinion. His comment is that it bears the same relation to form A that *L. atrosporum* Meylan does to *L. Sauteri* Rost., and that it is probably a slender form of *L. atrosporum* *.

* In a recent communication, M. Meylan suggests that forms A and B are both varieties of *L. atrosporum*. If this view should prove correct. the characters distinguishing *L. atrosporum* from *L. violaceum* become rather shadowy. It is to be hoped that further gatherings may throw light on this difficult subject.

The latter species in its typical form has large globose or ovoid glossy black sporangia, short stalks, dense black capillitium attached by the tips of the threads to the sporangium-wall, which breaks away ultimately in small fragments; the purplish-black spores measure 13 to 16 μ, and are either spinose, spinulose, or closely reticulated *.

Form B resembles *L. atrosporum* in having the capillitium attached to the sporangium-wall and in the closely reticulated spores, and differs chiefly in its more slender habit; we propose to include it under that species, distinguishing it by the varietal name *anglicum* G. Lister & Howard.

That the size and colour of the spores cannot be regarded as an entirely reliable character is shown by a gathering of *L. atrosporum*, found on the Weissenstein on earth and beech-leaves, close to the sporting development of *L. violaceum* described above. In some of the large black sporangia the spores are spinulose, very dark, and 10 to 13 μ diam., in other sporangia they are purplish-grey, 12 to 15 μ diam., and spinose: in all the spores there is a tendency for the spines to be connected by low ridges, the result being a very imperfect reticulation.

M. Meylan has recently published a new species, *L. Crucheti* (see "Myxomycètes nouveaux" in Bull. Soc. Vaud. Sc. Nat. lii. p. 95), found in Sept. 1915 on Chasseron, in the Jura Mountains, at an altitude of 1400 m. It is allied, he writes, to *L. columbinum* (Pers.) Rost., from which it differs in the smaller blackish-brown sporangia, whose walls show no trace of iridescence, in the very slender capillitium, and, above all, in the dull yellow almost ochraceous colour of the plasmodium.

It must be confessed that the genus *Lamproderma* still presents many difficulties, and we have much to learn concerning the limitations and variations of several of the species, and particularly of the relation between alpine and lowland species in different countries.

Explanation of Plate 552.

1. *Lamproderma violaceum* (Fries) Rost. var. *debile* G. Lister & Howard. Sporangia on Beech-leaf.

1 *a*. Sporangia of various shapes.

1 *b*. Sporangium after dispersion of spores showing short columella and capillitium.

1 *c*. Capillitium-threads and spores.

1 *d*. Two spores.

2. *L. atrosporum* Meylan var. *anglicum* G. Lister & Howard. Stalked and sessile sporangia on Box-leaf.

2 *a*. Sporangium after dispersion of spores.

2 *b*. Capillitium, showing the tips of the threads adhering to the sporangium-wall and spores.

2 *c*. Spores, showing reticulated markings.

---

* The form described as *Lamproderma violaceum* var. *dictyosporum* in the British Museum Catalogue, ed. 2, p. 167, is included in *L. atrosporum* Meylan.

"JOHN" ROXBURGH.

By Sir David Prain, C.M.G., C.I.E., F.R.S.

In an interesting article on "John" Roxburgh in this Journal (1918, p. 202) the Editor, reviewing the facts at his command, was led to suggest that the John Roxburgh whose name finds a place in the *Biographical Index of British and Irish Botanists* (First Suppl. p. 215) and the "Roxburgh, junior" alluded to in Dr. William Roxburgh's *Flora Indica* (vol. iii. p. 338) may be the same person; further that this individual may be identical with James Roxburgh, the officer who, in 1832, made himself responsible, in conjunction with his brother Bruce Roxburgh, for the publication of their father's *Flora*. Were this the case it must follow that the entry in the *Index* is erroneous, seeing that there had been no John Roxburgh.

The writer at once informed the Editor that there is reason to believe that the entry regarding John Roxburgh in the *Biographical Index* is substantially accurate. The present note has been prepared in response to the Editor's request that the writer should give reasons for the belief that the judgement arrived at twenty years ago was justified. It may be explained that the writer has not hitherto found it necessary to investigate the life of Dr. William Roxburgh or to discuss the career of any of his sons; this task has been undertaken, more than once, by hands abler than his. He has, however, had occasion to deal with the career of Dr. William Roxburgh's immediate successor, Dr. Francis Buchanan (afterwards Hamilton) (Ann. Roy. Bot. Garden, Calcutta, vol. x.), and, in perusing the letters addressed by that distinguished officer to Roxburgh, he has met with various incidental allusions to members of Roxburgh's family, which seem to throw light on certain points that were obscure to the Editor while his careful note on "John" Roxburgh was being prepared. The writer would also desire it to be understood that the present note is supplementary to the Editor's valuable article and is to be read in conjunction with the latter. The facts in that article are not open to debate; the only point at issue concerns the deductions to which these facts appear to lead.

The difficulty connected with the acceptance of the view that "John" Roxburgh and "Roxburgh, junior" are the same individual lies in the fact that, as the article in the Journal shows, "John" Roxburgh resided at the Cape, and was there engaged in the collection of botanical specimens during the period 1801–4; whereas, as we know from statements in the *Flora Indica*, "Roxburgh, junior" was occupied in the botanical exploration of Chittagong, Penang, and Sumatra during the same period. The difficulty connected with the identification of either of these sons with Major James Roxburgh lies in the fact that—unless by reason of more strength, this officer, whose death took place on 11 July, 1884, had greatly exceeded the extended span of fourscore years—he could hardly have been engaged in botanical work, either at the Cape or in Malaya, between the years 1801 and 1804.

The earliest reference to John Roxburgh with which the writer has met occurs in a letter dated 15 May, 1793, addressed to

Dr. William Roxburgh by the Rev. A. John, then at the head of the Tranquebar Mission. This letter says:—

"Your Jack you shall never get till I have made him fit for your Assistance and be sure that I am so much your friend that no Body in Indostan will endeavour so much for his best than I. Though his genius is but of the middle sort I hope to make him a useful member of Society and suitable for your purposes if you only leave me Time.

"Our ships with botanic Books are not yet arrived. Depend on my Readiness. You may easily be with the Moravians, who are mostly Shoe- Escritoir- and Watch-makers but no Planters.

"Now I wont tire you any more and am with Compliments from all, who esteem you and your good Lady. My most valuable friend, Yours intirely, A. John."

This letter, then, tells us that John Roxburgh did exist. It does not tell us where John was born or who his mother was. The circumstance that the up-bringing of the lad had been entrusted to the Danish Mission at Tranquebar, instead of being arranged for in his father's house, suggests that he was not the son of the "good Lady" to whom the letter transmits the compliments of the Moravian brethren. Whether this "good Lady" were the first or the second of the wives of Dr. Roxburgh, whose names are given in the "family table" so courteously supplied by Mr. N. Bonham-Carter for incorporation in Sir George King's "Memoir of William Roxburgh" (Ann. Calc. Bot. Gard. v.), can only be settled by those who have access to the dates of Dr. Roxburgh's various marriages.

If the letter be equally silent as to when John Roxburgh was born, it nevertheless shows that by May 1793 the lad was of such an age as to induce his father to consider the time had come when he might reasonably hope to take advantage of his son's "Assistance." That the "purposes" Roxburgh had in view included the employment of the lad as a gardener may be surmised from the Rev. John's half-apologetic, half-playful reminder that "planting" was not one of the accomplishments to which the Moravian brethren laid claim.

The date of Mr. John's letter shows us that Roxburgh's anxiety to receive his son John from the Mission had nothing to do with his own transfer from Samalcotta in Madras to the Botanic Garden, Calcutta, which took place in 1793. The letter was written on 15 May; Colonel Robert Kyd, Superintendent of the Calcutta Garden, did not die until 26 May; it was not till 29 November, 1793, that Dr. William Roxburgh entered on his duties at Calcutta as Col. Kyd's successor. It seems probable, however, from this letter, that John Roxburgh did not accompany his father to Calcutta in 1793, and the writer has met with no document suggesting that father and son met during the next five years. In fact, we hear no more of John Roxburgh until the period of four or five years during which, according to Mr. D. Don, he lived at the Cape. The Editor of this Journal has pointed out that a Banksian sheet at the British Museum fixes the date of Dr. William Roxburgh's own residence for a twelvemonth at the Cape as 1799 and that an entry in the *Hortus Bengalensis* (p. 54), written by Roxburgh himself, shows that his son John was in South Africa in 1804, a year which falls within the period alluded to by Don.

As the writer had occasion to explain in his "Memoir of Francis Buchanan (afterwards Hamilton)," Roxburgh left Calcutta for the Cape early in 1798; a letter dated 16 October, 1798, was sent to Roxburgh from India and reached him while he was in South Africa; in October 1799, Roxburgh had just returned to Calcutta from the Cape. We know that on the return voyage Roxburgh's vessel was detained at Madras sufficiently long to admit of his being received in audience by the second Lord Clive, then Governor of Fort St. George. There must have been a corresponding detention at Madras on the outward journey, and the known facts render it reasonable to surmise that in 1798 the Moravian brethren, satisfied that John Roxburgh now knew all they could teach him at Tranquebar, handed him over to his father as fit for the latter's "Assistance" during this South African visit.

The matter of John Roxburgh's age in 1798 is of secondary importance. We know that Roxburgh, as was usual with medical officers towards the close of the XVIIIth Century, made several voyages as Surgeon on East Indiamen before he was definitely appointed to the Medical Service of the H.E.I. Company. The dates of these voyages have not, however, been supplied us by Dr. Roxburgh's biographers, and we have as yet no knowledge of his various ports of call. When, at last, his definite appointment came about, we know that he took up his duties at Madras in 1776. The probability, therefore, is that in 1793, when Roxburgh asked the Moravian brethren to let him have his boy back, the latter was at most somewhere about sixteen. He cannot, then, have much more than attained his majority when he accompanied his father to the Cape in 1798 or joined his father there in 1799. The young man appears to have given his father such satisfaction as a botanical collector while in his company that Roxburgh decided to leave John behind, to collect South African seeds and plants and herbarium specimens, when he himself returned to India in 1799.

Leaving "John" Roxburgh in South Africa, we now turn to "Roxburgh, junior," cited by his father (Hort. Beng. p. 56 and *Flora Indica*, vol. iii. p. 338) as author of the name *Flemingia prostrata*. The individual alluded to was William Roxburgh, junior (*Flora Indica*, vol. i. p. 554), whose name is associated in the first volume of that work with the finding of fifteen species, in the second volume with the collection of six species, in the third with the discovery of twelve, and in the supplementary (cryptogamic) portion, which Griffith first had printed in the *Calcutta Journal of Natural History* in 1844, with the communication of eleven species. As in the case of "John" Roxburgh, we do not yet know where or when William junior, was born. In William's case, moreover, we are unable to say where or how he was educated. We know, however, that by 1799, when his father returned from the Cape, he had reached an age which justified the Government at Fort William in appointing him Assistant to the Superintendent of the Calcutta Botanic Garden. A letter from Mysore written in 1800 by Buchanan to Roxburgh contains the passage:—"I congratulate you on William's appointment. Although it certainly would have been better to have got him a Writer, yet the garden will be a handsome provision for him, and with the opportunities he will have under your tuition he will soon become a proficient." It seems clear from this letter that Buchanan believed that William's appointment carried with it, if not the right, at all events the prospect of succeeding his father.

A youth of great energy and much promise, William Roxburgh, junior, at once entered on a career of active botanical exploration. He spent a considerable portion of the year 1800 at work in the Rajmahal Hills (*Flora Indica*, vol. ii. p. 51). When Buchanan, who was a personal friend and correspondent of the younger man as well as of his father, became aware of this, he at once expressed his disappointment. "I am very sorry," he remarks to Dr. Roxburgh in a letter from Mysore, dated 31 January, 1801, "that William has gone to the Rajmahal hills. If possible, send him to Chittagong—an immense field remains there, by far the best I have seen in India." Roxburgh followed Buchanan's advice; during 1801 William was at work in Chittagong (*Flora Indica*, vol. i. p. 81). By the time that William returned Buchanan had completed his Mysore survey and had joined the embassy led by Captain Knox into Nepal during 1801–2. Roxburgh endeavoured to secure William's attachment to this embassy and on 22 February, 1802, wrote to Buchanan explaining his wishes. Replying from the Nepal frontier on 2 March, 1802, Buchanan said "I shall be very happy if you succeed in sending William: but I am affraid you will not meet with success in the application to Government for the purpose." Buchanan had, in fact, discussed the proposal with Captain Knox, who explained to him that the Nepal Durbar had already objected to the number of English officers attached to the Embassy. The anticipation was correct; Government did not permit William to cross the Nepal frontier. The dated entries in the *Hortus Bengalensis* show that William was still in Chittagong at the beginning of 1802 and that he collected in Bengal on his return journey, probably in the Sundribuns. When he reached Calcutta his father appears to have arranged that William should proceed to Penang, and although none of the Penang collections alluded to in the *Flora Indica* are dated, all the dated ones in the *Hortus Bengalensis* were secured in 1802. After having investigated Penang we find from the *Hortus Bengalensis* (pp. 1, 11) that William visited the Moluccas, returning thence to Sumatra, where he was employed during 1803 (*Flora Indica*, vol. i. p. 70; Hort. Beng. pp. 1, 63, 65, 69) and 1804 (*Flora Indica*, vol. iii. p. 457; Hort. Beng. pp. 43, 69). In the following year William was once more at the Botanic Garden with his father; for the solitary name, *Flemingia prostrata*, which Roxburgh has attributed to his son, was bestowed by the latter on a plant "raised from seed sent by Mr. Kerr from China to the Botanic Garden in 1805, where they blossom about the close of the rains in November and ripen their seed during the cool season." This indirect reference is the last we can find to William Roxburgh, junior, and the suggestion that William died soon after the cold weather of 1805–6 is strengthened by the circumstance that when Buchanan, who was at this time on furlough in England, returned to India early in 1807, he brought with him a nomination from the Court of Directors as successor to Roxburgh when the latter should retire.

That the name John Roxburgh should be absent from Mr. N. Bonham-Carter's "family-table" printed by Sir George King, is due to the fact that he was not the son of one of the three ladies whom Dr. William Roxburgh married. More difficult at first sight is the task of reconciling Mr. Bonham-Carter's "family-table" with the known facts in the history of William Roxburgh, junior. This William was the active coadjutor of his father during the height of Dr. William Roxburgh's career. Yet Mr. Bonham-Carter's chart shows that the only William, junior, of whose existence his family was aware, was the youngest son of Dr. Roxburgh by his third wife. Sir George King, fully realising the difficulty, has suggested that the name attributed by the Bonham-Carter family to Roxburgh's youngest son may be erroneous.

To the courtesy of the late Mr. Frederick Henry Norman, also a descendant of Dr. Roxburgh and his first wife, the writer is indebted for another family-table which agrees with that printed by Sir George King save in two particulars. It queries, as Sir George King had independently queried, the accuracy of the name William as applied to one of Roxburgh's sons by his third marriage; it states that, by his first wife, Roxburgh had a son William, brother-uterine of Mary Roxburgh, from whom both the Norman and the Bonham-Carter families are descended. This son, who is shown in this table as senior to his sister Mary, died young. The writer is further indebted to the courtesy of Miss Mary Ann Tucker, granddaughter of Dr. Roxburgh and his third wife, for yet another family-table, which agrees substantially with that of Mr. Bonham-Carter and shows that one of her uncles, brother-uterine of her mother, really was named William Roxburgh.

The difficulty then is purely imaginary. There were two William Roxburghs, junior; the eldest and the youngest of Dr. Roxburgh's lawful children were named after their father. The statement in the Norman "family-table" that the first "William Roxburgh, junior" died young, is correct in the sense that this William Roxburgh, junior, had died before the second William Roxburgh, junior, was baptised. But the first "William, junior," whose name recurs so frequently in his father's published works, lived sufficiently long to become his father's Assistant and to accomplish much notable botanical exploration. His claims to recognition, and to an honourable place in the *Biographical Index of British and Irish Botanists*, are by no means confined to his association with the name *Flemingia prostrata* Roxb. f.

The nomination of Buchanan as Roxburgh's successor in 1806 is not the only circumstance which points to this as the year in which William Roxburgh died. About the same time the residence of John

Roxburgh at the Cape came to an end. When John returned to India from South Africa is not definitely known; after his return he was employed under his father in the Calcutta Botanic Garden. As his missionary guardian explained in 1793, John's genius was "but of the middle sort." This may account, at least in part, for his appointment to a subordinate executive post. It may also explain why, in the *Flora Indica*, there is but one reference, and that a reference which might easily be overlooked, to his work as a collector. The passage in question (*Flora Indica*, vol. ii. p. 169) informs us that *Tacca aspera* was "found by Mr. J. R. indigenous in the vallies amongst the hill behind Chittagong." But his activity as a collector during the years 1810 and 1811 was very marked and, as the Editor has pointed out, the *Hortus Bengalensis* records the introduction by him of many plants from Chittagong. For 1810 we find such records on twenty-five pages of the *Hortus* for Chittagong alone, and an examination of the entries suggests that on his way to Chittagong he collected in the Sundribuns; that while in Chittagong he gave especial attention to orchids; that on his way back from Chittagong he was able to reach Silhet. In 1811 he was again active, though for this year his records occur only on about half as many pages of the *Hortus*.

When Roxburgh, broken in health, left India for the last time in March 1813, John Roxburgh was Overseer of the Botanic Garden. He held this post during the various changes in the superintendentship which marked the period between March 1813 and August 1817. Not long after Dr. Wallich's definite appointment as Superintendent took place in 1817, incompatibility of temper led to differences between the new administrative and the old executive head of the establishment. John Roxburgh thereupon ceased to be a member of the staff. Whither he moved or when he died we do not know.

While none of the sons of Dr. Roxburgh by his second wife can be claimed as botanists there is an indication that the eldest of this family, George Roxburgh, might have developed into a collector had he not, as the Bonham-Carter "family-table" explains, been "killed by lightning in Java." We know, from the *Flora Indica* (vol. iii. p. 380), that his father was indebted to George for specimens of at least one species from Hardwar. Two other sons of the same family, Bruce Roxburgh and James Roxburgh, though in no sense botanists, have claims to the gratitude of botanical students which it is not easy to repay. To their filial piety we owe the publication in 1832 of their father's *Flora Indica*, and on this account readers of the *Journal* may be interested to know the outlines of their careers, for the particulars of which the writer is indebted to the kindness of his friend Mr. W. Foster, C.I.E., of the India Office.

Bruce Roxburgh, according to the various family-tables the third son and fourth child of Dr. William Roxburgh by his second wife, is recorded officially as having been born at Calcutta on 12 December, 1797. It seems possible, however, that in this instance the date recorded is that of baptism, not that of birth, for among the letters addressed to Roxburgh by Buchanan is one, written on 4 September, 1797, which ends with a message of congratulation on the birth of this child. Bruce Roxburgh entered the service of the H.E.I. Company on 21 April, 1815; became Cornet, VI. Bengal Cavalry, 4 October, 1816; Lieutenant, 1 September, 1818; Captain, 1 December, 1829; was transferred to the Invalid Establishment, 31 August, 1831; retired on medical certificate, 13 September, 1832; and died 14 June, 1861. Though he joined his younger brother James in financing the publication of the *Flora Indica*, it seems clear that the state of his health must have prevented him from taking any very active part in the correspondence which brought about the production of the work.

James Roxburgh, the fourth son and seventh child of Dr. William Roxburgh by his second wife, is recorded officially, and in this instance probably correctly, as having been born in India on 25 January, 1802. In a letter dated 11 March, 1802, in which Buchanan informs Roxburgh that he had received "a letter from William," written doubtless after William's return from Chittagong and just as William was preparing to leave for Penang, the concluding sentence reads:—"Be so good as to accept of my congratulations to you and Mrs. Roxburgh on the increase to your family and present my compliments to Miss Roxburgh and William." James was nominated to the service of the H.E.I. Company by John Thornhill, Director, on the recommendation of his brother-in-law, Henry Stone (husband of the Miss Roxburgh referred to by Buchanan). He became Ensign, XIX Native Infantry (Bengal), 14 February, 1820; Lieutenant, 11 July, 1823; Captain, 12 November, 1832; Major, 18 November, 1846; permitted to retire from the Army, 28 November, 1849. On 30 December, 1835, he was transferred to the Military Auditor's Department and appears to have served in that department till his retirement. After his transfer to this branch of the service it is on record that "the Madras Government authorised the purchase of nine copies of a botanical work written by the late Dr. Roxburgh, the Company's Botanist, called 'Flora Indica,' published by him (Capt. Roxburgh) in conjunction with his Brother, Capt. B. Roxburgh." Shortly thereafter he was "permitted to place at his own expense a suitable building over the column or monument erected in the Botanical Gardens in 1822, to the memory of his late father." The inscription on the monument that James Roxburgh thus so thoughtfully protected may be found by the curious at the end of the preface to the reprint of Roxburgh's *Flora Indica* which we owe to the public spirit of the late C. B. Clarke, issued at Calcutta in 1874, ten years before the death of James Roxburgh.

WEIGHING MOORINGS.

By A. H. Church.

From the standpoint that the algæ constituting the phytobenthon of the sea may be preferably regarded as anchored (hormon), the problem of the security of the moorings becomes one of primary significance, and conditions clearly vary within wide limits according as the bottom consists of mud, sand, shingle, or clean rock. The fact that the larger algæ require good holding-ground of rock, while sandy coasts are comparatively bare of all vegetation, is sufficiently obvious; and it has been pointed out elsewhere that this has had a remarkable influence on the history of algology, more particularly in countries where the coast is predominantly of sand-dune formation. The case of mud is more satisfactory, since, owing to the cohesive nature of its slimy texture and the effect of bacterial zooglœa in binding the surface-film, the substratum may be able to bear considerable movement of the superjacent medium, while algæ with rhizoid attachment may penetrate considerable depths and assist in binding the surface to constitute good anchorage for plants of considerable size, as *Chorda*, 10 ft. or more, in close association. A muddy bottom may thus carry a distinctive flora when a sandy shore, owing to the readiness with which the particles are lifted by surge-action of the water, affords no security at all, and may present no characteristic plants beyond loose-lying calcified *Lithothamnion*, which are practically pebbles. As the specific gravity of such sand-particles may be taken as little over 2, it may be noted that a stone in sea-water loses nearly half its weight, while irregular shapes offering considerable "form-resistance" may considerably delay the rate of sinking. The surging action of the waves, as an upward thrust, may thus if sufficiently violent maintain in suspension particles of considerable size; and the scour of the sea-shore by particles and pebbles so lifted, is in fact the commonplace of the sea, and constitutes one of the factors limiting plant-life on "exposed-coast"; but it also expresses the insecurity of the moorings of smaller algæ in such biological stations. A further means of moving particles of even considerable size is noted in the evolution of bubbles of photosynthetic oxygen which are so extensively utilized for the erection of axes, as in rounded types of lacunar and hollow thallus, or the differentiation of special members, pneumatophores with pneumatocysts (*Ascophyllum*, *Sargassum*, *Macrocystis*), culminating in the 6 ft. bladder of *Nereocystis*. Since the pull of such erecting bubbles constitutes a further strain on the hapteron-system, such forces may combine to exert a considerable lifting effect on the substratum; and where the holding is insecure the plant-soma may be lifted off its bed, thus weighing its moorings, to be drifted out to sea, or in shore, according to the direction of the tide or current-flow.

Thus Professor Oliver, for Blakeney (1912, *in lect.*), has described the germinating zoospores of *Enteromorpha* on exposed wet sand, actively photosynthetic and attached to individual sand-particles of ·25–·3 mm. diam., floated off by the incoming tide, each supported by its bubble of oxygen. The most striking example of the effect of such phytosynthetic bubbles is that of *Colpomenia sinuosa*, a Mediterranean Phæosporean, which appeared in 1906 at Vannes in the Gulf of Morbihan (Belle Isle), growing attached to oysters. The plant became an economic nuisance, and is known as the Oyster-thief (Voleuse d'huîtres) (*cf.* Cotton in *Kew Bulletin*, 1908, p. 75). The thallus of parenchymatous organization and papery texture is hollow, and may attain the size of a hen's egg or tennis-ball, as a "balloon." On active photosynthesis in shallow water the cavity so fills with internal gas-bubbles that on the return of the tide the inflated balloons weigh the young oysters to which they are attached and float them out to sea. The number of oysters so carried off was so considerable that attempts were made to recapture them by nets, while faggots were dragged over the beds in the hope of tearing the thallus-balloons. The story is usually approached from the standpoint of the oyster-owner, but it shows that *Colpomenia* merely attaches to the oysters in such a station for want of better anchorage, while the final disaster is possibly greater in the case of the plant than in that of the animal. The point of interest is that the majority of the oysters so weighed are lost, not cast on shore, and the effect of weighing moorings generally is to be carried out to deep water rather than to be thrown up. There seems to be no means of obtaining an estimate as to the relation between the amount of sea-weed detached and thrown on shore and that drifted back to deep water, to exist as "loose-lying" vegetation, or to sink and die in the open sea. Immense quantities of weed thrown on the beach by one storm may be swept out to sea again by a succeeding tide. The amount of weed thus cast up as flotsam and jetsam which might be economically utilized is probably but a very small proportion of the wastage of the sea, as expressing the amount of increase over what the station will carry.

Further observations on the lifting of stones of considerable size have been recently made by Mr. Spence at Orkney in the case of the larger Laminarians (*cf.* Journ. Bot. 1918, p. 281). Thus *L. Cloustoni*, though usually growing on rocky bottom will bring ashore stones of 6–8 lbs. weight. In one case 9 large Laminarias, of which one was *L. flexicaulis*, were brought in attached to a stone of over 56 lbs., or an average of 8 lbs. per plant, whose weight might be 3–5 lbs. each. *Saccorhiza bulbosa* more frequently brings adherent boulders as rounded blocks of 50–60 or even 80 lbs.; a good example of 9 Saccorhizas brought a rounded block 12 in. by 11, weighing over 56 lbs. From such data it would appear that one of these larger Laminarians with full head of fronds presents a form-resistance enabling it to sustain in a rough sea a stone equal to twice its full weight (averaging 8 lbs.); or a plant of specific gravity little more than that of the salt water, may carry a stone equal in the water to the true weight of the former. *Saccorhiza*, in fact, is to be regarded as an alga specially adapted by its remarkable hapteron-bulb, which replaces the usual crampon-system, to grow among loose boulders, as a plant of more marked individuality than the gregarious *L. Cloustoni*.

These observations again do not refer to the rolling of still larger blocks by ground-swell, which changes the sea-bottom irrespective of the attached vegetation: they are of special interest, not so much as affording evidence of the effect of wave-action in changing the bottom and carrying stones to the beach, as indicating the converse action of also carrying stones with attached plants out to deeper water, where it seems unlikely that their zoospores would ever germinate.

Thus Hooker at the Crozet Islands (*Flora Antarctica*, 1847, p. 464) describes a large *Macrocystis* as rising obliquely at 45° from 40 fathoms, and extending several times the length of the ship, definitely suggesting that this must have been a plant which had weighed its moorings. It is clear that the effective pull of a *Macrocystis* with a hundred yards of fronds, each buoyed by a pneumatocyst, must be enormous; but in this case the strain is met by a flexible cable, and the general occurrence of "free-floating" *Macrocystis* and "islands" indicates that the stem is usually the first to give way. It should be possible to measure the breaking-strain of the *Macrocystis* cable, though this does not appear to have been done; but it may be pointed out that even *Desmarestia aculeata* in British Seas, as the finest representative (except *D. ligulata*) of the "filamentous soma," may present a breaking-strain of 12 lbs., implying that it would in the water lift a stone of 20 lbs. Observations on *D. aculeata* at 90 fathoms in the Skagerack (Areschoug), or for *D. viridis* at 150 fathoms at Spitzbergen (Kjellman, 1883), or for similar algæ in the Arctic (Dickie, in Journ. Bot. 1869, p. 148) are clearly referable to "loose-lying" drift, maintained in the last cases in a condition of "cold-storage"; the deepest apparently satisfactory record for a sea-weed of any size is still that of *Laminaria Rodriguezii* off Minorca in 75 fathoms (125–150 metres, Bornet in Bull. Soc. Bot. 1888, p. 361), the plant showing rhizome-runners and many young growths. But all such records of plants in deep water, where observations are confined to dredging stones from the sea-bottom are thus open to the further error of weighed moorings, a factor that it seems difficult to eliminate.

EPIPACTIS VIRIDIFLORA Reich.

By Colonel M. J. Godfery, F.L.S.

On July 29th, 1918, I was so fortunate as to discover, a few miles from Guildford, a woodland form of *E. viridiflora* Rchb., which is nearer to the continental descriptions of this plant than the forms *dunensis*, so ably described by Wheldon and Travis (Journ. Bot. 1913, p. 344) and *vectensis* by the Rev. T. Stephenson (Journ. Bot. 1918, p. 1). The descriptions of the elder Reichenbach (Fl. Germ. Excurs. p. 134), of his son (Rchb. Icon. p. 142), and of Barla (Icon. Orch. p. 11) agree very well with our plant, only differing in unimportant minor details. Reichenbach fil., while correctly citing *E. purpurata* Sm. as a synonym of his *E. Helleborine* 5. *violacea*, curiously enough quotes *E. purpurata* Sm. (varietas bracteis evolutissimis) as identical with his *E. Helleborine* 3. *varians* (*viridiflora*), giving Surrey and Boxhill as respective localities. Barla's figure (Icon. t. 7) is noteworthy for the pubescence of the upper stem and ovary, and for the hairy pollinia. This is the earliest indication by any author of the outgrowth of pollen-tubes, *in situ*, on the pollinia, which was first described by Hermann Müller (Verhandl. d. N. H. Ver. preuss. Rheinl. &c. 1868). It is necessarily exaggerated, and the hairs appear black, whereas they are really as clear and colourless as glass, but it would be impossible to show this on the scale of the figure. He does not mention it in the text, but the indication in the figure is sufficiently remarkable. Rouy's description (Fl. France, xiii. 204) fits our plant accurately as far as it goes, but it is silent as to the column, anther, stigma, and rostellum. Like Rouy, Ascherson and Graebner (Syn. Mitt. Europ. Fl. iii. 862) treat it as a race of *E. latifolia*, their description showing some advance on previous ones, as it notices the absence of a rostellum (which is present in our plant in newly-opened flowers) and mentions that self-fertilisation occurs.

As our plant, while specifically identical with the continental one, has certain marked characteristics of its own, is constant in the limited area in which it grows, and differs from the forms *dunensis* and *vectensis* referred to above, I propose to describe it as a new variety * :—

Epipactis viridiflora Rchb. var. nov. leptochila.

A typo differt caulibus altioribus (2–7 dm.) sæpe aggregatis; foliis inferioribus sæpe ovatis; sepalis acuminatis 12–15 mm. longis, 4 mm. latis; lobello protinus prominente; hypochilio orbiculari 4 mm. diam., 3–4 mm. alto; epichilio cordato acuminato (cuspide longa acuta) angustissimo (± 8 mm. longo, 4 mm. lato, ubi latissimum est) viridi albomarginato; callis duobus irregulariter rugosis albis interdum pallide roseis; rostello evanescente.

Differs from the type as follows:—Stems taller (2–7 dm.), often clustered. Lower leaves frequently ovate. Sepals acuminate 12–15 mm. long by 4 mm. broad. Labellum projecting forward. Hypochile orbicular, 4 mm. in diam., 3–4 mm. deep. Epichile cordate acuminate, with long acute point, very narrow (± 8 mm. long by 4 mm. broad at widest part), green, bordered white. Bosses two, irregular rugose, white, sometimes faintly tinged pink. Rostellum evanescent.

Stems clustered in older parts, 20–70 cm. tall. *Leaves* ovate to broadly lanceolate, upper lanceolate tapering, all acute, often wavy-edged, yellow-green or dark green, not grey-green.

Internodes short.

Sepals long, acuminate, 12–15 mm. long by ± 4 mm. broad.

* The differences between Mr. Stephenson's forma *dunensis* and typical *viridiflora* are considerably greater than those between many recognized varieties; indeed, I am inclined to think that *dunensis* has gone far on the road towards differentiation as a species. It appears to be fully entitled to rank as a variety, much more so, for instance, than *E. palustris* var. *ericetorum* Asch. & Graebn.

Labellum shorter than sepals ± 10 mm. long, 4 mm. broad. *Hypochile* small, nearly circular, 4 mm. in diameter, 3–4 mm. deep, green within, mottled with pale pinkish red near the base, edges semi-transparent, wavy, irregularly crenate. *Epichile* cordate acuminate, with a long acute point ± 8 mm. long by 4 mm. broad, greenish, white-bordered, not deflexed; bosses distinct, low, rugose, white, sometimes tinged faintly with pink. *Column* rising in a curved nib-shaped stalk (filament) in the centre at the back, on the apex of which stands the anther; on each side is a V-shaped incision in the wall of the column, the anterior side of which rises into a tooth or staminode at its junction with the stigma. *Anther* ovate, with a bluntly-pointed empty apex, projecting for upwards of half its length over the upper edge of the stigma. *Stigma* transversely oblong, a prolongation of the front of the column, not supported on a pedestal at the back as in *E. latifolia*; upper edge sloping slightly downwards from the centre to the tooth (staminode) at each corner. *Rostellum* present when the flower first opens, but functionless, quickly disappearing, leaving a brownish mark.

The gland contains viscid matter, but this is too weak to remove the pollinia; moreover, it does not appear to come in contact with them, for, instead of being opposite their united apices, it lies, owing to the forward position of the anther, opposite the V-shaped space between the downward-diverging pollinia, so that the latter, in sliding downwards, pass over the viscid gland without touching it.

As compared with the forma *vectensis* Stephenson, the following differences are observable:—

Var. LEPTOCHILA. *Stems* clustered, 20–70 cm. tall, pubescent below, rather densely so above. *Leaves* yellow-green or dark green, lower ovate, sometimes broadly lanceolate. Lower *bracts* twice as long as flowers. *Raceme* many-flowered, up to 23 cm. long. Flowers as large, and opening as widely as in *E. violacea.*

Forma VECTENSIS. *Stem* solitary, delicate and slender, almost glabrous below, slightly pubescent above. *Leaves* grey-green, lower lanceolate to elliptic lanceolate. Lower *bracts* never much exceeding the flowers. *Raceme* lax, few-flowered. *Flowers* small, green, never opening so widely as in *violacea.*

In *English Botany*, ed. 3, ix. 123, *E. media* "Fries" Babington (as sub-spec. I of *E. Helleborine* Cr.) includes two forms:—var. *α. viridis* (*E. viridiflora* Hoffm. is quoted as a synonym) and var. *β. purpurata* Sm. (*E. violacea*). The question therefore requires consideration as to whether *E. viridiflora* and *E. violacea* are in reality forms of one species. They are in some respects more closely allied than *E. viridiflora* and *E. latifolia*, as they agree in two remarkable characters in which they both differ from the latter; they have a similar root-system—a knotted rhizome with fleshy rootlets growing from the nodes at different levels (in *latifolia* the rootlets spring from the base of the stem at the same level), and the older plants have clustered stems, at least this is so in the variety *leptochila.* The following comparison shows the main points of difference between the two plants:—

E. VIRIDIFLORA var. LEPTOCHILA.	E. VIOLACEA (*E. purpurata* Sm.).
The *new bud* has only one rootlet, on the outside, furthest from the stem.	Each bud has two rootlets, one on each side between bud and stem.
Stem pale green.	Dark grey-green, tinged throughout with violet, giving it a curious mealy and livid appearance.
Leaves often numerous, near together, internodes short, lower often ovate, sometimes broadly lanceolate, upper lanceolate to linear lanceolate, yellow-green or dark green *.	Distant internodes long, lowest never ovate, all similar in shape, dull grey-green sometimes flushed with violet, much smaller, shorter, and narrower †.
Raceme lax.	*Raceme* much denser.
Sepals lanceolate, acuminate.	Lanceolate obtuse, sometimes rather acute.
Petals ovate-lanceolate, acuminate, very acute, nerves clearly visible.	Oblong-lanceolate, obtuse, the same breadth for most of their length, nerves almost obsolete.
Epichile. Not deflexed, cordate acuminate, with a long acute point, longer than broad (8–9 mm. × 4 mm.) green, with 2 white rugose hunches.	Deflexed, cordate acute, broader than long (4 mm. long by 5–6 mm. broad), white, very faintly tinged pink, with 2–3 parallel $\pm$ confluent hunches.
Column rises into a nib-like tooth at the back, with a deep acute sinus between it and the staminode on each side.	Upper wall continuous, wavy-edged and level from centre of back to staminode.
Anther stalked, projecting far over edge of stigma, so that the viscid gland is opposite the V-shaped space between the downward-diverging pollinia.	Sessile, not projecting over upper edge of stigma (except the empty tip); gland opposite apex of pollinia.
Viscid gland. Functionless, withering by the time the flower above it opens, not coming in contact with with the pollinia.	Large and very effective, firmly attached to pollinia just below their apex.
Ripe capsule yellowish green, elliptical, broadest in the middle, $\pm$12 mm. long and $\pm$ 8 mm. broad; stalk $\pm$ 6 mm. long.	Dark grey-green, markedly trigonous, broadest just below apex, $\pm$ 20 mm. long, each side 10–11 mm. broad at the widest point; stalk $\pm$3 mm. long.
The flower is self-fertilized.	Fertilized by wasps.

The above-marked points of difference, extending to most parts of the organism, appear amply sufficient to prove that we have in these plants two good and distinct species, and a careful examination of the essential organs of the flower will show that *E. latifolia*, *viridiflora*, and *violacea* are morphologically different. It is true that many botanists have considered *viridiflora*, and several *violacea*, to be but forms of *E. latifolia*, but all these authors have given judgement without taking into account the evidence afforded by the anther, pollinia, stigma, and rostellum, their descriptions stopping short at the perianth. Nevertheless, there have been clear-sighted botanists who, apart from the organs of reproduction, have recognized that the

* Ovate lower leaves vary from 7 by 5 cm. to 5 by 4 cm.; lanceolate lower leaves from 10 by $3\frac{1}{2}$ cm. to 6 by 2 cm.

† Varying in length from 4–7 cm., in breadth from $2–2\frac{1}{2}$ cm.

differences between these plants are of specific rank. For, indeed, to the eye trained by observation of the living plants, the three species are recognizable at a glance in most stages of their growth.

Max Schulze (Orchid. Deutschl. No. 54) considers that *E. violacea* is a good species, but thinks that *E. latifolia* and *E. viridiflora* can hardly be distinguished, though he admits that their extreme forms are so different as to suggest two species. He says that numerous intermediate forms occur, in which all the leading characteristics show great variation, so that it is difficult to tell whether a plant belongs to one or the other. This is a recrudescence of the old idea, which dies so hard, that two recognizably different plants, if intermediate examples occur, must belong to one and the same species. Sir J. D. Hooker (*Life and Letters*, ii. 34) wrote to Darwin (Oct. 2, 1862) "The dismal fact you quote of hybrid transitions between *Verbascum Thapsus* and *nigrum* , . . . and its bearing on my practice of lumping species through intermediate specimens, is a very horrible one . . . . Your orchid book has convinced me that such cases must be abundant." It is curious that Schulze should have followed this time-honoured practice, for he knew and described many hybrid orchids. Perhaps the frequency of intermediates between *E. latifolia* and *viridiflora* blinded him to the probability of their hybrid origin. He appears to have overlooked the fact that, as *viridiflora* is self-fertilizing, we might reasonably expect that any hybrid between itself and *latifolia* should also be self-fertilizing. Its offspring would be partly like itself, and partly tending to resemble more closely one or other of the original parents. In this way a number of intermediate plants might arise, and a great range of variation occur, where the two species grow together. A parallel case occurs with the self-fertilizing *Ophrys apifera.* J. T. Moggridge states (Journ Linn. Soc. viii. p. 258) that *Ophrys Scolopax* appears under two forms. He says, referring to the latter, "At Mentone I never saw any tendency to self-fertilization, but all the spikes of a large bundle sent me from Cannes were so without exception. It is a remarkable coincidence that at Mentone the Bee Ophrys is scarce, and at Cannes very abundant. So, within 30 miles of one another, we have one spot where self-fertilization is in full action, and another, where it is, as far as I am aware, unknown." Evidently at Cannes hybrids have occurred between the insect-fertilized *O. Scolopax* and the self-fertilized *O. apifera*, and their offspring, taking after the latter parent, are self-fertilizing also. There is nothing to prevent the self-fertilizing hybrid from multiplying freely and becoming abundant. The correctness of this supposition appears to be confirmed by Moggridge himself, who says that the difference between the self-fertilizing *O. Scolopax* of Cannes, and the insect-fertilized *Scolopax* of Mentone is brought about "by a very slight bend in the anther-cells, which are prolonged into a beak of variable length in the case of the self-fertilizing blossoms." This prolonged beak is one of the most striking features of *O. apifera*, and betrays the parentage of the Cannes *Scolopax*.

The fertilization of *leptochila* differs somewhat from that of *dunensis*. In the latter the pollinia are extremely friable, and, even before the flower opens, numerous tetrads of pollen fall on the lip, into the hypochile, etc., and probably thus become transferred to the stigma. In the former the pollinia slide downwards bodily from the anther-cells over the sloping upper edge of the stigma, and come to rest obliquely on its frontal viscous surface, to which they become anchored by an outgrowth of pollen-tubes, in much the same way as described by H. Müller (*op. cit.*) in the case of the continental *viridiflora.*

THE GENUS HERBERTA
AS REPRESENTED IN THE MANCHESTER MUSEUM.

By William Henry Pearson, M.Sc., A.L.S.

Prof. A. W. Evans of Yale University has done a great service to British hepaticologists in his "Notes on the genus *Herberta*, with a revision of the species known from Europe, Canada and the United States" published in the *Bulletin of the Torrey Botanical Club* for 1917 (pp. 191–22), wherein are described and figured two British plants which have hitherto been considered as forms of one species—*Herberta adunca* (Dicks.) and *H. Hutchinsiæ* (Gottsche) Evans. In 1862 Gottsche (Rabenhorst Hep. Eur. n. 210) discriminated the two forms; Carrington in his *Gleanings among the Irish Cryptogams* (1863) has an interesting note in which he regarded *H. adunca* as a form found only on high and exposed mountains; the habitat he thought accounted for the differences and he did not separate them. Evans proves by the different characters that they may justly be considered distinct: for full descriptions reference must be made to his paper; I merely give here the salient characters of the two species.

Herberta adunca (Dicks.). Leaves bifid to about one half; divisions broad, slightly or not at all curved, acute or acuminate: vitta not distinct, usually indistinct even in the basal region, extending for a short distance into the divisions, but coming to an end considerably below the apex. (The vitta or nerve is a band of elongated cells which extend from the middle of the base of the leaves to the segments.) Basal portion of leaf normally entire.

Herberta Hutchinsiæ (Gottsche) Evans. Leaves bifid two-thirds to four-fifths, divisions narrow, strongly curved, long-acuminate; vitta distinct, extending far into the divisions, but hardly to the apices. Basal portion of leaves entire or nearly so or furnished with a few teeth. Of this species Prof. Evans gives a plate. *H. adunca* is recorded from Scotland and Wales; *H. Hutchinsiæ* from Scotland, England, Wales and Ireland: the further distribution of the former is Norway and Faroe Islands, and of the latter, Norway, Alaska and British Columbia.

Another European species—*H. Sendtneri* (Nees) (*Sendtnera Sauteriana* Nees, *Schisma stramineum* Dum.)—has been credited by Dumortier and Lett to Scotland, but no specimens have been seen to support the statement. A large form of *H. adunca* collected by C. Howie (near Loch Maree, Rosshire) has been so named, but there is nothing to separate this from the normal form of *adunca*, the base of the leaves being quite entire, whereas in *H. Sendtneri* the large teeth at the base of the leaves are very characteristic of the species. Evans raises to specific rank as *H. tenuis*, a small form found only in North America.

Stephani describes seventy-one species of *Herberta* (*Schisma*), and four more have been added, making a total of seventy-five; of these about twenty are represented in the Manchester Museum from the localities given in the following list:—

H. ADUNCA (Dicks.) Gray. *Scotland*: Ben Nevis, *Greville*, 1823; Clova, Gardiner; Glen Lyon, Clova, *Stark*; Braemar, *Carrington*, July 1849; mountains by Loch Maree, Rosshire, *Howie*, 1867, Ben Hope, Sutherland, *Greville*, 1834; Ptarmigan, *Holt*, and Ben Laoigh, *Holt*, July 1880; Ben More, Mull, *Kennedy*, June 1906; Ben Lawers, *Hunter*, July 1906.

Wales. Twll Dhu, and Snowdon, *Wilson*, May 1828; Cwm Idwal, *Pearson*, April 1878.

Norway. Schiffn. Hep. eur. exsicc, 463–5.

H. HUTCHINSIÆ (Gottsche) Evans. *Ireland*. Conner Hill, Dingle, *Moore*; Brandon Mountain, *Moore*, G. & R. Hep. eur. n. 491; Eagles' Nest, Killarney, *Holt*, June 1885; Killarney, *Carrington* G. & R. Hep. eur. exsicc. n. 210; Errigal Mountain, Donegal, *Hunter*, Oct. 1911.

England. Ill Bell, Westmoreland, and head of Mowdale, Cumberland, near Keswick, Cumberland, *Holt*, April 1884; Borrowdale, Cumberland; *Pearson*, April 1893.

Wales. Snowdon, Wilson; Craig-y-cau, Merioneth, *Wild & Pearson*, May 1877 (C. & P. Hep. Brit. Exsicc. n. 421); Dolbadarn Castle, Llanberis, *Stabler*, May 1883; Crib Coch, Snowdon, *Holt*, April 1878.

Scotland. Grampians, *MacAndrew* 1884; Ben Cruachan, Argyll, *Macvicar*, June 1903; near Glen Shee, Braemer, *Carrington*, July 1850; Invermoidart, West Inverness, *Macvicar*, May 1901 (Schiffn. Hep. eur. exsicc. n. 467).

Norway. Lyse near Stavanger, *Jörgensen* (Schiffn. Hep. eur. exsicc. n. 466).

North America. Banks Island, *A. Menzies*, 1787, with fruit.

H. SENDTNERI (Nees) Evans. Fourteen continental specimens.

H. TENUIS Evans. *N. America*. Rocks, Cauterskill Falls, Catskill Mountains, *Austin*, Hep. Bor.-Amer. n. 82; New Jersey, Greenwood Mountains; Pennsylvania, Stony Creek, Aug. 1874, Wolle; North Carolina, on trees, top of Black Mountain, *Lesquereux*, 1850; North Carolina, *James*, Herb. Austin; Sullivant Musc. Alleg.; Herb. Lanming, Aust., coll. *Buckley*, 1858.

H. JUNIPERINA (Swartz) Spruce. Cuba, West Indies.

H. SANGUINEA (Austin). Hawaii (base of leaves entire) (4 specimens).

H. COMMUTATA (St.) (*H. pensilis* Spruce non Taylor). Chimborazo, Spruce; Guadeloupe, Dr. Madiano, Herb. Austin (see Stephani Sp. Hep. vol. iv. p. 17, 1909).

H. GRANDIFOLIA (St.) (*H. juniperina* Spruce Hep. exsicc.).

Stephani says "discus entire": I find some of the leaves entire, others dentate or lobate: the measurements he gives—leaves 1·2 mm. long, discus 3·6 mm. long, 2·8 mm. broad—I cannot confirm. I get leaves 5 mm. long, discus 2·75 mm. long, 2 mm. broad.

H. ORIZABENSIS (G.) *Sendtnera orizabensis* G. Hep. Mexic. Orizaba, F. Mueller. Stephani says (*op. cit.* p. 19) that he has not seen the plant: the leaves are divided to below the middle, segments usually entire or now and then with a tooth, base of leaves toothed.

H. ALPINA (Steph.). Paparoa Range, South Island, New Zealand: *Helms*, 1888; Stephani says "base of leaves entire"; some are so, but many are furnished with a tooth.

H. RUNCINATA (Taylor), Chiloe, *Cuming*.

H. ACANTHALIA Spruce, Hep. Sp. Am. et And.

H. BIVITTATA Spruce, Hep. Sp. Am. et And.

H. LIMBATA (Steph.), Bolivia, *Herzog*, Oct. 1911.

H. SERRATA Spruce, Bolivia, *Herzog*, April 1911.

H. DIVERGENS (Steph.), Bolivia, *Herzog*, May 1911. I have found a leaf with segment again divided: base of leaves entire, one leaf with two small teeth, one and two cells long.

H. PARISII Steph. Mt. Fulog, province of Benguet, Luzon, Philippines, Coll. *McGregor*, July 1909. Very near *H. Hutchinsiæ*, of which a specimen labelled "*Sendtnera juniperina* var. *ramosa*" (Tonglo, Sikkim, 10,000 ft.) is a slender form.

H. DICRANA (Tayl.). *Sendtnera dicrana* Tayl. Syn. Hep. p. 239. India, *Hooker & Thomson*. Ceylon. Very near *H. Hutchinsiæ*.

H. SIKKIMENSIS (Steph.). *Sendtnera fragilis*, Sikkim, Hooker. Very similar to *H. Hutchinsiæ* and *H. dicrana*.

H. LONGIFISSA Steph. in Hedw. 1895, p. 44. *Sendtnera gracilis* M. & N. Flora Hawaiiensis, n. 58. Coll. *Mann & Brigham*. I found a tooth at the base of a leaf.

REVIEW.

Flora of Bermuda (illustrated). By NATHANIEL LORD BRITTON, Ph.D., etc., Director-in-Chief of the New York Botanical Garden. 8vo, cloth, pp. xi, 585. New York: Charles Scribner's Sons. 1918.

THIS handsome and admirably produced book is devoted to the history of an isolated group of islands in the Atlantic Ocean, whose land area is "a little over nineteen square land miles, or about one-seventh the size of the Isle of Wight." Small as it is, it has a remarkable flora, inasmuch as about 8·7 per cent. is endemic, "there being 61 species in Bermuda or its waters not known to grow naturally anywhere else in the world." Of these about a third (22) are Algæ—a proportion maintained in the relation of the class to the whole Flora; 11 out of the 146 flowering plants and 4 of the 19 ferns are endemic. The total number of native species is 709; about 303 are introduced and completely or partially naturalised: in addition to these 864 cultivated plants are mentioned or described in these pages.

The full and clear descriptions of the Spermatophyta, Pteridophyta, and Bryophyta are accompanied by figures, usually excellent though occasionally—e. g. *Polygonum Convolvulus*—hardly representing the usual appearance of the plant. We have failed to find any indication of the artist whose work has added so much to the attractiveness and usefulness of the book. Except where otherwise indicated, Dr. Britton is responsible for the work; Mrs. Britton has undertaken the Bryophyta; in the Thallophyta the Lichens are contributed by Prof. Lincoln W. Riddle, the Fungi by Dr. Fred. J. Leaven, and the Algæ by Dr. Marshall A. Howe.

The nomenclature adopted is that which prevails in many American books and is thus not always in accordance with the more generally accepted Vienna rules. Trinomials are used for "races or varieties"; "priority of place" and "once a synonym always a synonym" are accepted as principles; names are duplicated—e. g. *Fagopyrum Fagopyrum*; and the original spelling is observed in such names as *Coccolobis*, *Canavali*, and *Cajan*. The division and limitation of genera has introduced names which have not hitherto appeared in British books—such are *Tiniaria Convolvulus* "Webb. & Moq." (*Polygonum*), *Microstigma incana* "(L.) Britton" (*Matthiola*), *Carara didyma* "(L.) Britton" (*Senebiera*), *Xanthoxalis corniculata* "(L.) J. K. Small" and *X. stricta* "(L.) J. K. Small" (*Oxalis*); others although not entirely new are unfamiliar, such as *Cymbalaria Cymbalaria* "(L.) Wettst." and *Kickxia Elatine* "(L.) Dumort." (*Linaria*).

The material upon which the book is based was the result of various expeditions carried out by Dr. Britton and Mr. Stewartson Brown between 1905 and 1913, with the assistance on some occasions of Mrs. S. Britton and Dr. Seaver. A list of the "principal botanical collections made in Bermuda" and a bibliography are appended: it would appear from the former that no plants were collected there between 1699—the latest date of John Dickinson's gatherings—and A. W. Lane's collections made prior to 1845. Dickinson—here and elsewhere misspelt Dickenson—really collected considerably earlier, for Petiver (Mus. Pet. viii. 80; Dec. 31, 1700) acknowledges "plants lately sent from Bermudas (besides 2 collections some years agoe) with assurances of larger performances." These "assurances" do not seem to have been realised, as only thirteen species labelled as from him are in the Petiver and Plukenet collections in the Sloane Herbarium. Of these five are of special interest: attention was first directed to these by Dr. Hemsley in this Journal for 1883, where *Erigeron Darrellianus* and *Carex bermudiana* were first described: the latter was only known from Dickinson's specimens until 1905, when it was rediscovered by Dr. Britton. The endemic *Sisyrinchium*, long confused with *S. angustifolium* Mill., was shown to be distinct by Dr. Hemsley in this Journal for 1884, and is still so regarded: Dr. Britton says "it doubtless originated, however, from seed of one of the Continental species brought to Bermuda by a bird or on the wind, the plant becoming differentiated through isolation from its parent-stock." A similar explanation is given, though somewhat more cautiously, of the origin of another endemic species, *Chiococca bermudiana*, which "probably originated from seeds of *C. alba*." The name *Bermudiana*, which is here retained for the *Sisyrinchium* must, as Mr. Farwell points out in a paper reprinted in this Journal for 1918 (p. 271), be assigned to the species generally known as *S. angustifolium*; the Bermuda plant must be called *S. iridioides* Curtis, whose beautiful figure (Bot. Mag. t. 94) contrasts favourably with that given as frontispiece to the book under notice. The plant here called *Galium bermudense* L. is regarded—perhaps rightly—as conspecific with the United States species included by Linnæus under the name. The matter is discussed in this Journal for 1909 (p. 41) in a paper which seems to have escaped Dr. Britton's notice; in this the two are differentiated, and the name *bermudense* is restricted to the Bermudan plant, which is called *Relbunium bermudense.* The fifth of Dickinson's endemic species is *Adiantum bellum*, first distinguished in 1879 by Thomas Moore, "who," as Dr. Britton informs us, "was not the same man as the celebrated poet of the same name"—it is not easy to suppose that anyone would be likely to consider the two identical! The other Bermudan species represented in the Sloane Herbarium by specimens from Dickinson are *Melilotus indica* All., *Erigeron canadense* L., *E. linifolius* Willd., *Eupatorium macrophyllum* L., *Verbena urticifolia* L., *Sclerochloa rigida* Link, and *Cenchrus tribuloides* L. Petiver also received from him *Juniperus bermudiana* in fruit; of this species there is in the Sloane Herbarium labelled by Petiver: "This from Bermudas a D. (vol. 332, f. 81) James and Dickinson": I have not met with the former name elsewhere. Another early collector was the Rev. William Clarke (fl. 1710–34), whose plants, gathered at Carolina, Bermudas, and the Caribees, are in Herb. Sloane, vol. 318. Unfortunately the localities for the specimens are not distinguished in any way: that some are from Bermuda is, however, shown by a specimen (f. 34) of the endemic *Erigeron Darrellianus.*

It may be noted that Dickinson gives two local names which do not appear in the *Flora*: "Love-grass" for the *Cenchrus*—"I suppose," says Petiver, "from their prickly seeds, which may stick to y[e] cloaths like our Burdock or Clivers, wh. last for y[t] reason is called Philanthropos"— and "Hogweed" for *Erigeron Darrellianus*: we note that Dr. Britton, conforming to the absurd fashion which would supply every plant with an "English" name, dubs the latter "Darrell's Fleabane," which it is safe to say no one ever has called or ever will call it.

The index—evidently excellent, although the first name we looked for (*Relbunium*, p. 368) does not appear in it—demands a special word of praise in that there is but *one*: a method which, often urged in these pages, is emphasized by Sir Edward Cook in his recent delightful volume, *Literary Recreations* (p. 63): writing on "The Art of Indexing" he says: "I lay down as the first rule, One book, One index. . . . Multiplication of indexes is an unmitigated nuisance: it makes reference less easy. One index alphabetically arranged is the only right plan."

BOOK-NOTES, NEWS, ETC.

ALTHOUGH he did not die on the field of battle, REGINALD PHILIP GREGORY may be added to the list of those for whose loss the War, in the prosecution of which he had been engaged since 1915, must be held responsible. In the year named he obtained a captain's commission in an officer cadet battalion at Cambridge, and in July 1917 went to France with the 1st 6th battalion of the Gloucestershire Regiment. He was badly gassed in the trenches, and never completely recovered; discharged from the army in October last, he resumed his tutorial work at Cambridge, where he was University Lecturer in Botany, but succumbed on Nov. 24 to an attack of pneumonia following asthma. Born at Trowbridge, Wilts, on June 7, 1879, he early took up botanical pursuits under the guidance of his mother, whose name is familiar to British botanists in connection with the genus *Viola*. Going up to Cambridge, he took first-class honours in both parts of the Natural Science Tripos, and in 1904 gained the Walsingham medal for an essay embodying the results of original research in botany. We take the following summary of his work from a memoir contributed to *Nature* (Nov. 28, 1918) by Prof. Seward:—"Mr. Gregory was one of a group of students who were stimulated by the teaching and enthusiasm of Prof. Bateson to take up different branches of genetics; it was mainly with cytological problems that his researches were concerned. His most important contributions were those dealing with the genetics and cytology of giant races of *Primula*, published in the *Journal of Genetics* (1911) and in the *Proceedings of the Royal Society* (1914). His work demonstrated the striking fact that some forms of *Primula* exhibit the giant character not only in the plant-body as a whole, but also in the constituent cells. The results obtained constituted a definite advance in our knowledge of phenomena connected with the reduplication of certain terms in a series of gametes. His researches also included the investigation of heterostylism, habit, leaf-form, and flower colour in *Primula sinensis*, seed characters of *Pisum*, reduction-division in Ferns, forms of flowers in *Valeriana*, and other subjects." In *Nature* for Dec. 12 Prof. Bateson deals more fully with Gregory's work, paying a high tribute to its special interest; he left a mass of material which it is hoped will be published.

THE *Botanical Magazine* for Oct.–Dec. contains a figure (t. 8783) and description of *Mesembryanthemum edule* L. "from material obtained by Mr. J. Hutchinson on the face of an old quarry at the entrance to Caerthillian Valley in Cornwall, where it is thoroughly naturalized in company with the Australian and Chilian species *M. æquilaterale* Haw." The latter is entered by Davey from several places in Cornwall (Fl. Cornw. 204), but the former is not recorded by him.

MR. H. W. MONCKTON has prepared for private distribution a nicely-printed little book on *The Flora of the District of the Thames Valley Drift between Maidenhead and London*—on lines similar to those of *The Flora of the Bagshot District* noticed in this Journal for 1916, p. 95. The idea of these geological district floras is to take a satisfactory and in a way tolerably complete area of a single geological formation and to make a complete flora for it: in a way this has been done in Brewer's *Flora of Surrey* and in W. R. Linton's *Flora of Derbyshire*, but in both of these cases the geological areas are hampered by the county boundary. An interesting introduction describes the limits and geological formations of the district dealt with: the author has noted in the list the plants which have been found fossil in the neighbourhood of London, as it is of interest to compare them with the existing flora. The number and species enumerated (including the ferns) is 1308. The author's address is Whitecairn, Wellington College Station, Berks.

The *Kew Bulletin* (No. 9) published in December contains the first instalment of "Contributions to the Flora of Macedonia," by W. B. Turrill, based on collections made by the writer and by others in their spare time by men engaged in active service with the British Salonika Forces. *Paliurus microcarpus* and *Calamintha epilosa*, described by Mr. Wilmott in this Journal for 1918, p. 145, find no place in the list, which contains a description of a new *Dianthus* (*D. Harrisii*) and some interesting notes, including one on *Trifolium subterraneum*. No. 10 (issued in the same month) contains letters from Charles Ogilvie Farquharson, who had held the post of mycologist in Southern Nigeria since 1911, was drowned on his homeward voyage on the 'Burutu,' which was lost through collision. Mr. W. G. Craig continues his "Contributions to the Flora of Siam," which include a new genus *Damrongia* Kerr (Gesneraceæ-Didymocarpeæ) "named in honour of Prince Damrong, who, himself interested in scientific pursuits, has done so much for the advancement of education in the country."

The Report for 1917 of "The Botanical Society and Exchange Club of the British Islands" consists of two parts—the first by the Secretary, Mr. G. C. Druce, the second by the Editor and Distributor, Mr. C. E. Britton. Of the former, "on the salient features of British Botany," the author says: "This being his own compilation in no way assumes to express other than individual opinion, but all rights in its publication are reserved." No copy of either part has reached us for notice; our readers may, however, like to know that besides the usual notes of unequal value on individual plants, there are "Notes on British Violets," by Mrs. Gregory, "Notes on British Orchids," by Mr. Druce, and a "Revision of the British species of *Sagina*," by Mr. F. N. Williams. Perhaps the most remarkable feature of the Report is the entire omission of any reference to the existence of this Journal, which for fifty-six years has had some claim to be regarded as one of "the salient features of British Botany." It would be affectation to pretend to regard the omission as accidental; but, from the scientific standpoint it is regrettable that the "individual" action of the Secretary of a Society, who is apparently its only official, should deprive its members of the knowledge of what has been published in a Journal especially devoted to the science in which they are interested. The Watson Botanical Exchange Club would seem to be also under Mr. Druce's boycott, as although its name appears its Report is not mentioned.

Supplement

23. M. CANESCENS K Schum., in Mart. Flor. Bras. VI. vi. 718 (1889).

ECUADOR. Andes: Mt. Guayrapata. Fl. June. *Spruce* 5438! "Suffrutex volubilis tenuis subramosus. Flores albi."

24. **M. pichinchensis**, sp. nov.

Frutex volubilis, caule valde complanato angulato-sulcato, primo dense pubescente, tardius glabrescente, cortice dilute induto brunneo plus minus annulatim excorticante. *Folia* inter minora subcoriacea margine valde revoluta, venis omnino occlusis, triangulari-lanceolata acuminata acutissima, basi latissime truncata sæpius cordata, *petiolo* valido dense pubescente brevissimo, supra glabra necnon aspera subnitentia in siccitate nigrescentia, subtus valde discoloria densissime incano-tomentella; *stipulæ* triangulares acuminatæ acutæ, vix primo vaginantes, tandem circum nodo cupulam sublignosam formantes tumidiusculam. *Flores* parvi singuli v. pauci in axillis gracilibus in pedicellis oriundi hirtellis. *Calycis* lobi anguste lanceolati crassiusculi rigidi acutissimi longiusculi, ovario sulcato hirtello. *Corolla* inter minimas hypocrateriformis extus glaberrima, lobis oblongis obtusissimis suberectis, ore dense barbata. *Capsula* parva pyriformis extus minute puberula.

ECUADOR. Mt. Pichincha, 10,000 to 12,000 ft., *Couthouy*! *Fraser*! *Jameson* 56! 152! 287! *Lehmann* 495! At 13,000 ft., *Hall* 80!

Allied to *M. pubescens*, but readily distinguished by the truncate or cordate leaf-base. *Leaves* 1·5–2 cm. × 4–9 mm. broad at the base, which is the broadest part; *stipule* 5 mm. × 3 mm., on an average. *Calyx*-lobes 2–3 mm. long. *Corolla*-tube 5–6 mm. long, lobes 2–2·5 mm. *Capsule* 5–6 mm. long, 4 mm. wide.

25. M. EVENIA Sprague, in Bull. Herb. Boiss. II. v. 835 (1905).

ECUADOR. In valle Lloense, 8000 ft. Fl. Aug.–Sept., *Jameson* 352! Pichincha, 12,000 ft., *Jameson* 74! In herb. Kew.

Readily distinguished by the apparently veinless condition of the leaves, and the truncate stipules.

26. **M. corticifer**, sp. nov.

Frutex volubilis, ipsis in novissimis glaberrimus, caule in juventute filiformi mox tamen cortice dilute flavo nitente induto subannulato. *Folia* parva crassiuscula evenia lanceolata acuminata, basi acuta *petiolo* brevi; *stipulæ* truncatæ nec apiculatæ. *Flores* minimi inter folia passim nunc in cymulis nunc racemulis sæpius plus minus subumbellatim dispositi, *pedunculis* sæpius validiusculis, nunquam tamen fasciculati, inter minimos. *Calycis* dentes parvi subulato-lanceolati. *Corollæ* tubus pinguiusculus necnon tamen brevis insuper parum ampliatus, lobi parvi obtusi intus pubescentes. *Capsula* parva pyriformis vix costulata glabra lævis.

COLOMBIA. Pasto, 8800 ft., *ex parte Triana* 1795! In herb. Mus. Brit.

Allied to Sprague's *M. evenia*, but distinct in the narrow leaves with flat margins, the glabrous ovary, etc. *Leaves* 2–4 cm. × 5–13 mm.; *petiole* 3·5 mm. *Calyx*-teeth barely 1·5 mm. long. *Corolla* 4 mm. long. *Capsule* about 5 mm. long.

27. M. LYGISTOIDES Griseb., in Mém. Acad. Amer. Sci. & Art. viii. 505 (1860); Sprague, in Bull. Herb. Boiss. II. v. 833 (1905). *M. Lygistum* Sw. var. *lygistoides* K. Schum. in Mart. Flor. Bras. VI. vi. 180 (1889).

WEST INDIES. Cuba (eastern): Monte Verde, *Wright* 255! hb. Kew.

28. M. PARVULA K. Schum., ex Glaziou, in Bull. Soc. Bot. France, lvi. Mém. iii. 336 (1909), *nomen*.

The following is the first published description:—

Frutex scandens gracilis foliosus glabratus, caule tenuisculo minute præsertim in novitate pubescente, mox cortice dilute flavo-brunneo induto. *Folia* plana lævia chartacea subevenia glabra pro genere minima elliptica v. latiuscule lanceolata acuminata acutissima basi acuta, *petiolo* gracili brevissimo. *Flores* inter minimos 1–2 in axillis in pedicellis tenuibus dispositi, *bracteolis* minutis subulatis basi vix vaginantibus. *Calyx* dentiformibus in laciniis 4 ad basin divisus brevibus triangulari-lanceolatis acutis. *Corollæ* hypocrateriformis tubus insuper paullo leniterque ampliatus extus sparse minute asperulo-pubescens, lobi 4 ampliusculi ovato-oblongi acutiusculi vix acuminati utrinque qua tubus induti patentes. *Capsula* minima subglobosa basi subturbinata.

BRAZIL. Rio de Janeiro: *Glaziou* 17061! 18294!

The affinity is undoubtedly with *M. Lygistum*. The present species is at once recognizable by the small, flat, herbaceous *leaves*, with average size not much more than 2 cm. × 7 mm. The *stipules* form a rather deep sheath, relatively speaking, with a very short apiculate portion. The *calyx*, together with the ovary, is barely 2 mm. in the flower, the small lobes barely half a millimetre. *Corolla*-tube 5 mm. long, and about 2 mm. wide at the mouth; lobes about 2·5 mm. long and 1·5 mm. broad. *Capsule* 3 mm. long, 2 mm. wide.

29. **M. Lobbii**, sp. nov.

Frutex volubilis in novitatibus necnon inflorescentiæ maturæ in axibus circumque nodis ferrugineo-puberulus aliter glabratus, caule lævi striato subterete. *Folia* inter minora crassiuscula margine reflexa subevenia elliptica parum acuminata acutissima basi sæpius acuta, *petiolo* brevi tamen notabili, supra in siccitate olivaceo-nigra subtus valde discoloria dilute flaviusculo-viridia utrinque glaberrima; *stipulæ* truncatæ. *Flores* inter minimos in umbellis paucifloris pedunculatis dispositi alaribus foliis brevioribus. *Calyx* ad basin in laciniis 4 ovato-lanceolatis divisus acutis qua *ovarium* anguste infundibulare glaberrimis. *Corolla* hypocrateriformis, tubo validiusculo insuper paullo ampliato extus glabro, lobis ovatis subacutis intus qua in ore dense pilosis.

COLOMBIA. *Lobb* 97! in herb. Kew.

Allied to *M. Lygistum* and its circle of affinity by way of *M. evenia* and *M. Trianæ*, this species is distinct in the leaf-characters, the truncate stipules, and the glabrous ovary and calyx. *Leaves* 3–5 cm. × 1·3–2·3 cm., with *petiole* 3–7 mm. long. Primary *peduncle* as much as 1·5 cm., or even longer. *Calyx*-lobes barely 2 mm. *Corolla*-tube 7 mm. long, 3·5 mm. wide at the mouth, the limb 6–7 mm. in diameter.

30. **M. Trianæ**, sp. nov.

Frutex alte scandens nisi novitatibus sparsiuscule hirtellis necnon pedunculis pubescentibus glaberrimus; caule validiusculo lævissimo valde complanato nec manifeste angulato. *Folia* firme chartacea subcarnosa venatione vix prominula, majuscula elliptico-lanceolata utrinque longiuscule acuminata acuta petiolata; *stipulæ* vaginam latam formantes brevem insuper brevissime acuto-acuminatæ. *Flores* parvi umbellis paucifloris in alaribus dispositi, *pedunculis* valde complanatis longiusculis dense flavo-hirtis. *Calyx* ad basin laciniis in 4 qua *ovarium* glaberrimis divisus ovato-lanceolatis marginibus valde inflexis nec majusculis. *Corolla* hypocrateriformis extus glabra, tubo brevi pinguiusculo, lobis amplis brevibus patentibus intus dense pubescentibus.

COLOMBIA. Pasto: 8800 ft., *ex parte Triana* 1795! ECUADOR. Andes, in woods at the foot of Mt. Tunguragua, *Spruce* 5092!

This species is of critical interest, as it connects the *M. Lygistum*-group, via *M. Lobbii*, with *M. fimbriata* and its allies. Spruce says of his plant, that it is "herba alte volubilis, foliis carnosis. Corolla intus lilacina, extus purpurea, basi virescens." The distinctive characters are, the completely glabrous character of the mature vegetative parts, the rather pronounced leaf-stalks, and the short corolla with lobes densely pubescent on the ventral side. *Leaves* 4 × 1·7 cm. to 6·5 × 2·5 cm., with *petiole* increasing to as much as, or more than, 1·5 cm. in length; the sheath of the *stipules* is about 2 mm. deep, with the apiculate portion about the same in length. *Peduncle* 1 to 2 cm. long. *Calyx*-lobes 2·5 mm. × 1·7 mm., the latter being the breadth when flattened out. *Corolla*-tube 4·5 mm. long, 2 mm. wide at the mouth; lobes 3 mm. long.

31. M. GUILLEMINIANA K. Schum., in Mart. Flor. Bras. VI. vi. 181 (1889).

BRAZIL. Rio de Janeiro: Mt. Corcovado, *Guillemin* 740 (non vidi).

According to the author, this is allied to *M. Lygistum* through his *M. Beyrichiana*, being distinct especially in the general presence of a puberulous ferruginous indumentum, which covers even the exterior of the corolla.

32. **M. pisifera**, sp. nov.

Frutex volubilis sempervirens, caule pubescente mox cortice dilute flavo-brunneo induto. *Folia* inter minora tenuia plana, in siccitate supra nigrescentia subtus dilute discoloria subcinerea elliptica acuminata acutissima basi acuta, *petiolo* brevissimo, supra fere glabra subtus præsertim in venis incano-hirtella rete subtus interveniente sub lente saltem notabili, venisque manifestis nec tamen prominentibus; *stipulæ* basi vaginantes insuper acuminato-apiculatæ. *Flores* in axillis singuli, nonnunquam subumbellati, *bracteis* parvis subsetaceis basi connatis involucrantibus, sæpius pauci laxe in ramulis foliosis dispositi lateralibus abbreviatis; *pedicelli* filiformes pro rata elongati glabrescentes; *ovarium* subcupulare glabrum; *calycis* laciniæ 4 lanceolatæ glaberrimæ breves acutæ. *Corolla* hypocrateriformis, tubo pinguiusculo insuper vix ampliato extus glaberrimo pro affinitate inter mediocros, limbi angusti lobis brevibus late ovatis obtusis intus (ventro) glabratis. *Capsula* pisiformis glaberrima, calyce coronata persistente.

Colombia. La Banca, 10,000–11,000 ft. Fl. January. *Pearce*! in herb. Kew.

An evergreen twiner with pink flowers, allied to *M. Lygistum* itself, but easily distinguished by the whitish hairs on the under side of the leaves, which are markedly acuminate, and by the stipules. *Leaves* 3–5 cm. × 1·2–1·8 cm., with *petiole* not attaining 3 mm.; sheath of *stipules* 2 mm. or deeper, the acuminate free portion—sooner or later deciduous, 2 mm. or longer. *Ovary* rather more than 2 mm. long in the flower; *calyx*-lobes nearly the same length. *Corolla*-tube 1·2 cm. long nearly, lobes 2·8 × 2 mm. The globose *capsule* is 4 mm. long and wide.

33. **M. thysanophora**, sp. nov.

Frutex volubilis, caule in novitate filiformi sparse hirtello glabrescente subtereti striato. *Folia* inter mediocra plana membranacea herbacea, utrinque præsertim in juventute sparsiuscule hirta, elliptica acuminata utrinque acuta, *petiolo* tenui subelongato; *venæ* primariæ subtus prominulæ lateribus (utrinque ca. 8) pro rata crebræ, rete tamen interveniente vix manifesto; *stipulæ* membranaceam in vaginam brevissimam connatæ mox reflexam margine irregulariter setis numerosis fimbriatam inæqualibus. *Flores* in paniculis dispositi vel umbellis cymosis alaribus inter minores, hypocrateriformes, *pedicellis* sæpe longiusculis filiformibus cum *ovario* campanulato sub anthesin nonnunquam flavo-pulverulentibus tardius glabrescentibus. *Calyx* ad basin laciniis in 4 late ovatis divisus apice sæpe obtusis parvis glaberrimis. *Corollæ* tubus pinguis tamen brevis cylindricus extus glaberrimus, lobi ovati utrinque glabri obtusissimi suberecti.

Peru. *Matthews* 1501! in hbb. Mus. Brit. & Kew.

Allied to *M. Lygistum*, this species is notable for the peculiar stipular structure, and the broad blunt calyx-lobes. *Leaves* 3·5–5 cm. × 1·3–1·9 cm., the *petiole* as much as 7–8 mm. long; sheath of *stipules* barely 2 mm. deep, the setæ of the marginal fringe as much as 2·5–3 mm. in length. *Peduncle* 1–2 cm. long; pedicels 3–8 mm. *Ovary* scarcely 2 mm. long; *calyx*-lobes rather longer than 1 mm., and of the same breadth, or broader. *Corolla*-tube not exceeding 5 mm., lobes 2 × 1·7 mm.

34. M. Lindenii Sprague, in Bull. Herb. Boiss. ii. v. 833. (1905). *M. Lygistum* Sw. var. *α. typica* K. Schum., in Mart. Flor. Bras. vi. vi. 180 (1889).

Colombia. *Linden* 1439! Venezuela. *Funck & Schlim* 788!

This differs from *M. Lygistum* especially in its truncate stipules and much smaller corolla. Both species have strongly-marked reticulation, especially on the lower surface of the leaves.

35. M. Lygistum Swartz, Prodr. 37 (1788). *Lygistum flexile fruticosum, foliis ovatis oppositis, petiolis pedatis, racemis alaribus*, P. Browne, Hist. Jam. (1756) 142, t. 3. f. 2. *L. axillare* Lam. Ill. i. 286. *Petesia Lygistum* Linn. Syst. ed. x. 894 (1759). See also Grisebach, Flor. Brit. W. Ind. 329 (1861).

West Indies. Jamaica; *P. Browne*! *Wright*! *Masson*! *Shakespeare*! *Flor. Jam.* 880! *Dancer*! *March* 814! Moist woods, New Haven Gap. 5500 ft., *Nicholls* 65! Summit of Blue Mt., *Purdie*! Portland Gap, Blue Mt., *Alexander*! Hayti: *Schomburgk*!

This species has a double interest as being the first known of the genus, and also the basis of the identification of *Manettia* with *Lygistum* and *Petesia* (*P. Lygistum*; see historical introduction, *supra*). According to Alexander the flowers are "deep blue." It is essentially a West Indian species, and is distinguished from its allies by the manifestly apiculate stipules, the nearly orbicular leaves, and the narrow, rather elongated calyx-lobes, curling and more or less setaceous at the tip. K. Schumann, in the *Flora Brasiliensis*, treats several of these allied species as varieties of *M. Lygistum*; but their characters seem well worthy of the specific rank to which Sprague (Bull. Soc. Herb. Boiss. II. v. (1905)) has assigned several of them; among these the latter author has properly recalled Willdenow's *M. picta* (*M. alba*, infra), a native of Guiana.

36. M. Schumanniana Sprague, in Bull. Herb. Boiss. II. v. 834 (1905). *M. Lygistum* Sw. var. *glabrata* K. Schum., in Mart. Flor. Bras. VI. vi. 181 (1889).

Venezuela. Tovar: *Fendler* 589! *Moritz* 1807!

Barely distinguishable from *M. alba*, except by the corolla, which is over a centimetre in length.

37. M. alba, nom. nov. *M. picta* Willd. Sp. Pl. i. 624 (1797); Sprague, in Bull. Herb. Boiss. II. v. 834 (1905). *M. Lygistum* var. *alba* K. Schum., in Mart. Flor. Bras. VI. vi. 180 (1889). *Nacibea alba* Aubl. Pl. Guian. i. 95, t. 37. f. 2 (1775). *Conotrichia alba* A. Rich., in Mém. Soc. Hist. Nat. Paris, v. t. 14. f. 1 (1829). *Lygistum album* O. Kuntze, Rév. Gén. Pl. i. 287 (1891).

Guiana. *Aublet*! *Martin*! Karouany: *Sagot* 300! Macouria River: *Jenman* 2470! Mazaruni River: *Jenman* 5305! *Appun* 304! 669! Bartica: *Jenman* 4727! Hbb. Mus. Brit. & Kew.

Discovered in Guiana nearly a century and a half ago by Aublet, this species has not yet been recorded elsewhere—unlike the widely-distributed *M. coccinea*, also the discovery of Aublet, the only other native Guianan species (*infra*). Its most notable character is the short, stout corolla, densely hairy in the mouth (see Richard's excellent figures quoted). This connects the *M. Lygistum*-group with that species-group characterized by a short infundibular corolla, by way of *M. barbata*.

38. M. flexilis Brandegee, Pl. Mex. Purp. 196 (1915).

Mexico. Chiapas: Cerro del Boqueron; fl. June, *Purpus* 7218! Guatemala. Alta Verapaz: Pansamala, 3800 ft. *J. D. Smith* 936! Ecuador. Chimborazo, 3000 ft. *Spruce* 6185!

39. M. barbata Oerst., in Kjob. Vidensk. Medd. Natur. 47 (1852). *M. stenophylla* J. D. Smith, in Coult. Bot. Gaz. lvi. 58 (1913).

Costa Rica: *Endres* 240! Mt. Aguacate, about 2000 ft., *Oersted*! in herb. Kew.

Derives its name from the dense beard of white hairs about the mouth of the very short funnel-shaped corolla.

40. M. MICROCARPA K. Schum., in Mart. Flor. Bras. VI. vi. 179 (1889).

VENEZUELA. Carabobo *Funck* 783! Tovar: *Fendler* 1997!

Remarkable for the small corolla, widely funnel-shaped above, barely 4 mm. long, as well as for the small fruits 2 mm. in diameter.

41. M. PANICULATA Poepp. & Endl. Nov. Gen. & Sp. iii. 24 (1845).

PERU. Cassapi, *Poeppig*! in herb. Kew.

This identification is supported by Bentham (MS. in herb.). This species, together with *M. Beyrichiana*, is unique in the genus in the inflorescence, which is very lax and diffuse; the effect of the three or four axillary inflorescences at the end of a twig recalls the panicle characteristic of so many species of *Psychotria*. This resemblance, in the case of the species before us, extends also to the individual flowers, which have a very short tube, and are rather funnel-shaped than hypocrateriform.

42. **M. Sonderiana**, sp. nov. *M. punicea* Klotsch MS. in herb. Sonder.

Frutex volubilis novitatibus sparse hirtellis tandem omnino glaber, caule in juventute filiformi mox validiore. *Folia* inter majora utrinque demum glabra, firme chartacea, *venis* prominulis tenuissimis lateralibus utrinque 5–6 rete interveniente sub lente manifesto, ovato-elliptica acuminata subacuta basi subcuneata, *petiolo* brevi graciliusculo; *stipulæ* vaginam brevissimam formantes fere ad lineam transversam reductam insuper arista subsetosa onustam interpetiolari caduca. *Flores* 2–3 in axillis umbellatim dispositi, pedicellis necnon pedunculis longiusculis, *bracteis* parvis lanceolatis basi altiuscule vaginantibus. *Calyx* ad basin in laciniis 4 late lanceolatis divisus demum glaberrimis minusculis tamen subfoliaceis acuto-acuminatis adscendentibus. *Corolla* hypocrateriformis tubo gracillimo extus glaberrimo apice vix ampliato, lobis angustis oblongis limbum pro rata parvum formantibus. *Capsula* oblongo-ellipsoidea glabra costulata.

VENEZUELA. *Moritz* ex parte 839! Caracas, *Linden* 350!

Distinguished among *M. Lygistum* and its allies especially by the conspicuous stipular aristæ, and by the long, very slender corolla. *Leaves* 4·5–7 cm. × 2–3 cm., with *petiole* 5–12 mm. long; *stipules* 3–4 mm. *Peduncle* and pedicels each 5 mm., more or less, in length. *Calyx*-lobes 3 mm. long, increasing to about 5 mm. in the *fruit*, which is 5 mm. long and 3·5–4 mm. in diameter. *Corolla*-tube 1·8 cm. long, the limb barely 7 mm. across.

43. **M. sabiceoides**, sp. nov.

Frutex volubilis caulibus junioribus dense sulphureo-pubescentibus tarde glabrescentibus. *Folia* elliptica papyracea breviter acuto-acuminata brevissime petiolata, supra glabrescentia subtus nisi in venis puberula glabra; *venæ* primariæ subtus prominulæ pro genere lateralibus crebræ (utrinque 8–10); *stipulæ* inconspicuæ minimæ arcuatæ margine pilosæ. *Flores* inter minores in umbellis validiuscule pedunculatis dispositi paucifloris foliis brevioribus. *Calycis* lobi conspicui ovato-oblongi acuminati acuti accrescentes latiusculi subfoliacei cum ovario glabri. *Corolla* hypocrateriformis tubo gracili pro affinitate longiusculo insuper vix ampliato extus sparse puberulo, lobi oblongi parvi.

COLOMBIA. Mariquita, Quindio, 6500 ft., *Triana* 1793 (=143)!

Readily distinguished by the sulphur-yellow pubescence of the stem, the close venation of the leaves, and the arrangement of the flowers in small, concise, regular umbels. *Leaves* 3–4·5 cm. × 1·5–2·5 cm. *Peduncle* about 7 mm. long, pedicels 4–5 mm. *Calyx*-lobes 3 × 2 mm., more or less. *Corolla*-tube 1·2 cm. long, lobes 3 mm.

44. **M. Moritziana**, sp. nov. *M. Lygistum* Swartz var. *δ Moritziana* K. Schum., in Mart. Flor. Bras. VI. vi. 180 (1889).

Frutex volubilis glaberrimus, caule lævi tereti. *Folia* inter majuscula firme chartacea plana elliptica caudato-acuminata acutissima basi acuta, *petiolo* brevi; *venæ* primariæ cum rete interveniente præsertim infra manifestæ laterales distantes nec numerosi; *stipulæ* truncatæ vaginam formantes ad lineam reductam prominulam. *Flores* inter minores in paniculis dispositi alaribus laxis folia subæquantibus nisi brevioribus; *bracteæ* subulato-lineares. *Calycis* lobi ut ovarium oblongiusculum glaberrimi carnosuli parvi late ovati ad suborbiculares apice sæpius rotundati. *Corolla* hypocrateriformis tubo extus glaberrimo subcylindrico longitudine mediocro, lobis dorso glaberrimis parvis oblongis.

VENEZUELA. Faji: *fl.* Feb.; "cor. carn.," *Moritz* 976! in herb. Mus. Brit.

I regard this as the passage-form connecting the *Lygistum* group with *M. mitis*, *M. fimbriata*, and their allies. The present species is distinct especially in the small rotund calyx-lobes, at most 2·3 × 1·7 mm. *Leaves* 4–7 cm. × 1·5–2·3 cm.; *petiole* 4–7 mm.

45. M. UMBELLATA Ruiz & Pavon, Fl. Peru & Chili, i. 58. t. 90. f. *a* (1798).

I was inclined at first to identify with this species a plant collected by Pearce, in agreement with Sprague's MS. in the Kew herbarium. But comparison with the description, and with the figure quoted above, leave no doubt that this plant is distinct. According to the authors, *M. umbellata* is a native of woods in the neighbourhood of Muña, in Peru, flowering in the late autumn. It has ovate, subcordate *leaves*: the *bracts* form a distinct involucre to the umbellate *inflorescence*, which, according to the figure, has a decidedly stout *peduncle* and primary branches; the *calyx*-lobes are lanceolate; and the *corolla*-tube cylindrical, not widened at all toward the apex. These characters distinguish *M. umbellata* without doubt from Pearce's plant, which I proceed to describe as a new species, viz.,

46. **M. dubia**, sp. nov.

Frutex scandens sempervirens omnino nisi intus floribus glaberrimus, caule validiusculo valde complanato manifeste striato. *Folia* pro genere inter majora carnosula plana ampla elliptica basi rotundata petiolata apice vix acuminata sæpe obtusa; *venæ* impressæ primariæ nec occlusæ lateralibus utrinque 4–5 nec tamen rete apparente interveniente; *stipulæ* basi altiuscule vaginantes insuper deltoideæ acuminatæ acutæ. *Flores* inter minores hypocrateriformes in umbellis paucifloris pedunculatis dispositi axibus gracilibus alaribus, *pedicellis* elongatis ebracteolatis; *bracteæ* exiguæ. *Ovarium* globosum glaberrimum baccoideum læve ecostulatum, *calycis* lobis coronatum amplis foliaceis planis ovato-orbicularibus sæpius vix acuminatis apice tamen mucronato-acutis. *Corollæ* cæruleæ tubus pinguis extus glaberrimus e basi os versus leviter ampliatus, lobi patentes late ovato-triangulares intus cum ore puberulo-barbati.

PERU. Puitac, 10,000–11,000 ft. Fl. April. *Pearce*, in herb. Kew.

Allied to the preceding species, *q. v.* *Leaves* 6·5–8·5 cm. × 3–4 cm., with *petiole* 8 mm., or longer; *stipule*-sheath 3 mm. deep, the upper acuminate part 2 mm. long. *Peduncle* 6–15 mm. long; *pedicels* as much as 2 cm. *Ovary* 7 mm. long; *calyx*-lobes 6 × 4 mm. *Corolla*-tube 1·2–1·3 cm., 5–6 mm. wide at mouth; lobes 4–5 mm. × 2·5–3·5 mm.

47. M. MITIS K. Schum., in Mart. Flor. Bras. VI. vi. 185, t. 104 (1889) (*sensu angusto*—var. *α typica*). I am very doubtful of the synonymy given by Schumann, viz., *Guagnebina mitis* Vell. Flor. Flum. 46, t. 118 (1825) and ? *suavis* Vell. l. c. t. 117, under this species, even if it be associated with the next, *M. fimbriata* Cham. & Schl.—after Schumann's loose way. If this synonymy be correct, then Vellozo's figures must be poor indeed!

BRAZIL. Rio de Janeiro: *Vauthier* 99! *Miers* 4109! *Glaziou* 9476! *Schott* ex parte 853! St. Estella, *Riedel* 503! near Petropolis, 2000–3000 ft., in mountain-woods, 10–16 July, *Ball*! Oregon Mts.—woods, Imbuhy, 3000 ft., April, *Gardner* 455! Vargem, *Miers*! In hbb. Mus. Brit. & Kew.

Very distinct in the tough leathery oblong *leaves*, often rounded at the base, and the globose *fruits*, crowned by conspicuous rotund-ovate *calyx*-lobes. Schumann regards this and the following as varieties of one species.

48. M. FIMBRIATA Cham. & Schl., in Linnæa iv. 173 (1829). *M. mitis* K. Schum. *loc. cit. sub spec. præc.* var. *γ. fimbriata* K. Schum., & var. *δ rosea* K. Schum. *loc. cit.* *M. acutiflora* Bowie & Cunn. MS. in herb. no. 178, nec Persoon.

BRAZIL. Rio de Janeiro: *Glaziou* 6569! *Riedel* 621! *Schott* ex parte 853! *Bowie & Cunningham* 178! Fl. rose-coloured, *Bunbury* 423! Ilha dos Frades, Bay of Rio, *Miers* 3278! Corcovado, *Gardner*! Aquas Novas, *Miers*! Valley of Catumbé, up a high mountain west of the aqueduct of Carioca: "volubilis 8-ped. Corolla alba limbo roseo hirto." *Burchell* 1847! Sao Domingos to Isl. Boa Viajem, *Burchell* 2853! Monte da Santa Theresa, *Bowie & Cunningham*!

This species is quite distinct from the preceding, especially in the oblong *fruits* with acute-acuminate foliaceous *calyx*-lobes.

NOTES ON SEDUM.—III.

By R. Lloyd Praeger.

(Continued from Journ. Bot. 1918, p. 152.)

In the present notes seven new species of *Sedum* are described, and three new varieties. The new species, which are all based on living material, are derived mostly from an interesting packet of seed received from the Rev. E. E. Maire in 1915, collected by him about Tong-tchouan, in Yunnan. These seeds germinated, producing nine species, and it is indicative of the great richness of the Yunnan *Sedum*-flora that, despite the large number of new species described from that area in recent years, four of these were new. The remaining species represented were *S. Celiæ* R. Hamet and *S. Leblancæ* R. Hamet, both described from specimens in the Paris Herbarium, collected in Yunnan by Delavay; *S. yunnanense* Franchet var. *valerianoides* R. Hamet (section *Pseudorhodiola* Diels), an interesting plant evidently common in Yunnan (see Notes from R. Bot. Gard. Edinb. viii. 139 *et seq.*); *S. trifidum* Wallich, a familiar Himalayan species of the *Rhodiola* section, not reported previously from China (the plants recorded as varieties of *S. trifidum* in Notes R. Bot. Gard. Edinb. v. 119, vii. 7, 11, 19, 181, 293, belong to *S. linearifolium* Royle (see Notes, vii. 399)); and the variable *S. indicum* R. Hamet (*Crassula indica* Decne) in several different forms, of which one is now described as new. Of the remaining new species, one comes from Bhutan, a plant of the well-marked *Rhodiola* section, which has its head-quarters in the Himalaya-Yunnan region; another from California, where it reinforces the *spathulifolium* group of N.W. North America; and the last is a plant from a garden source, allied to the group just mentioned, and probably collected in British Columbia. The new species will be figured later in the *Journal of the Royal Horticultural Society*.

Section Rhodiola, Series *Rhodiola* sensu stricto.

Sedum Cooperi, sp. nov. Species foliis cauleque *S. elongato* Wall. similis, etiam *S. bupleuroidi* Wall. consanguinea. Ab priore caule dimidio graciliore, foliis minoribus breviter petiolatis vel sessilibus, inflorescentia parce foliosa, floribus dimidio minoribus densius dispositis, petalis in parte superiore angustioribus, &c., differt. Ab *S. bupleuroide* foliis longioribus parte superiore dentatis (nec integris), inflorescentia densiore, floribus dimidio minoribus, squamis majoribus, &c., differt.

Herba perennis glabra. *Caudex* crassus, erectus, ramosus, ramis squamis coronatis. *Squamæ* late ovato-deltoideæ, acutæ, integræ, ad 1 cm. longæ, primo virides, deinde brunneæ, paleaceæ. *Caules* pauci, simplices, erecti, graciles, glabri, teretes, foliosi, 30–60 cm. longi, 2–3 mm. crassi. *Folia* alterna (nonnunquam subternata vel subopposita), glabra, quam internodia longiora, sessilia vel subsessilia, vix carnosa, obovata vel elliptica, in parte superiore dentata vel prope integra, apice rotundata vel subacuta, medio 4 cm. longa, 2 cm. lata, superiora minora, infima minutissima. *Inflorescentia* terminalis, laxa, 5–8 cm. longa et lata, ex ramis 2–4 brevibus, dichotomis, mammillatis, pauce foliosis composita. *Flores* 4- (nonnunquam 5- vel 6-) meri. *Flos* ♂ : *sepala* linearia, obtusa, carnosa, prope imum libera, viridia vel purpurea; *petala* oblongo-lanceolata, obtusa, concava, 2 mm. longa, sepalis dimidio longiora, patentia vel reflexa, plerumque purpurea; *stamina* petala æquantia, filamentis purpureis, antheris rubescentibus; *squamæ* amplæ, erectæ, parte superiore patulæ et latæ, apice truncato-retuso-emarginatæ, ·6 mm. longæ, purpureæ, nitidæ; *carpella* minutissima, obtusa, squamis multum breviora, viridescentia vel purpurascentia. *Flos* ♀ : *sepala* eis floris masculini similia; petala patula, sepalis similia et æquilonga vel paullo longiora; *stamina* o; *squamæ* eis floris masculini similes, sepalis et petalis paullo longiores; *carpella* erecta, lanceolata, sepalis et petalis $\frac{1}{4}$- vel $\frac{1}{2}$-longiora, viridia vel purpurea, stylis brevibus strictis crassis capitellatis coronata.

Hab. Bhutan: mossy rocks at 13,000 feet (Cooper, no. 3517). I have seen the plant at Kew, Edinburgh, Glasnevin, and the Bees Nursery near Chester. The description is taken from specimens which flowered at Glasnevin and in my own garden in 1918.

When the leaves are pseudo-ternate the plant somewhat resembles a slender *S. yunnanense* Franchet, but the inflorescence is totally different.

Section Rhodiola, Series *Crassipedes*.

Sedum crassipes Wall. var. nov. cholaense. A very robust and distinct variety was received, in the form of either roots or seeds, from Darjeeling and Edinburgh Botanic Gardens and from Lissadell Nursery. All appear to have had a common origin—the Chola Valley, East Sikkim, where the plant was collected by Cooper (no. 923). The unusual dimensions of the parts of the plant, coupled with its flowers, wholly green save for their conspicuous crimson scales, give it a very distinct appearance.

Typo robustior. *Caudex* 12–18 (nec 6–8) mm. diametro. *Inflorescentia* densior, bracteis longis involucrata. *Folia* ad 40 (nec 12–20) mm. longa, 4–5 (nec 1·5–3) mm. lata, prope inflorescentiam maxima. *Petala* erecta vel suberecta, lineari-lanceolata, obtusa, 10 (nec 6) mm. longa, sepalis fere duplo longiora, viridia (nec lutescentia). *Stamina* petala æquantia, antheris viridescentibus (nec luteis). *Squamæ* coccineæ (nec aureæ). *Carpella* gracilia, petalis parum longiora, ad 12 (nec 9) mm. longa.

Section Seda genuina.

Sedum dasyphyllum L. var. nov. Suendermanni.

S. dasyphyllum is a variable species, especially as regards size and the presence or absence of hairiness. I have grown a large series: apart from very large forms, both hairy and glabrous, which may be placed under sub-var. *macrophyllum* Rouy & Camus, the most distinct is a plant distributed by F. Sündermann, of Lindau, under the name *S. rivulare* (but *S. rivulare* Boissier = *S. melanantherum* DC., a quite different plant). It was collected by Sündermann in Spain—

I believe in the Sierra Nevada, but the locality is not stated in his Catalogue (for 1913), and the finder is not at present accessible. This form is so distinct that it deserves varietal rank. It is well distinguished by its densely imbricate leaves and abundant very large flowers, which in diameter are $1\frac{1}{2}$ times that of the type.

Typo major; *folia* ramorum sterilium dense imbricata, obovata, apice obtuse acutata, basi cuneata, dense glanduloso-hirsuta, carnosissima, supra plana; *inflorescentia* quam in typo major, ramosior; *flores* ampli, 11 mm. diametro, petalis 5–7 (plerumque 6).

The plant flowers in the garden in late July, six weeks later than the type.

Series *Spathulifolia.*

Sedum rubroglaucum, sp. nov. Species gregis boreali-americani cujus *S. spathulifolium* Hooker typicum est: petalis parte inferiore adnatis in sectione *Gormania* (genere *Gormania* Britton) reposita est. Ab *G. Watsoni* Britton inflorescentia brevi (nec elongata), petalis ovatis (nec lanceolatis), sepalis 6 mm. (nec 2·5–3 mm.) longis, &c., differt; ab. *G. obtusata* Britton (*S. obtusato* A. Gray) sepalis 6 mm. (nec 2 mm.) longis, petalis ovatis (nec oblongo-lanceolatis vel ovato-lanceolatis), 8–9 mm. (nec 5–6 mm.) longis, &c.; ab *G. Hallii* Britton foliis glaucis (nec viridibus), depresso-apiculatis (nec rotundatis nec retusis), sepalis ovatis (nec oblongo-lanceolatis), 6 mm. (nec 3 mm.) longis, petalis ovatis (nec oblongo-lanceolatis), &c.; ab *G. debili* Britton (*S. debili* S. Wats.) foliis petiolatis (nec sessilibus), ovatis (nec lanceolatis acuminatis), $\frac{1}{4}$-adnatis (nec pæne liberis); ab *G. oregana* (*S. oregano* Nutt.) foliis glaucis (nec viridibus), petalis ovatis (nec lineari-lanceolatis longe acuminatis); ab *Sedo spathulifolio* Hooker petalis $\frac{1}{4}$-adnatis (nec liberis), foliis amplexicaulibus, &c.

Herba humilis, perennis, sempervirens, atroviridis, glauca, rubrotincta. *Radices* fibratæ. *Caules* teretes, juveniles coccinei, veteres nigri. Rami steriles procumbentes, parte inferiore nudi, parte superiore rosulas laxas foliorum ferentes atque ramulos breves axillares stoloniformes emittentes. Rami floriferi erecti, ex centro rosularum orientes, 5–6 cm. alti. *Folia* opposita (nonnunquam alterna), glauca, carnosissima, breviter petiolata, circa 2 cm. longa, ·8 cm. lata, ·5 cm. crassa; lamina obovata, apice rotundata depresso-apiculata, supra plana vel concava, marginibus anterioribus distinctis in apiculum conjunctis, subtus multum convexa; petiolus brevis, basi latus, amplexicaulis, non calcaratus. *Inflorescentia* pauciflora, pedicellis flores vix æquantibus. *Flores* subnutantes, aurei, 1·5 cm. diametro. *Sepala* erecta, carnosissima, basi libera, ovata, subacuta, 5–6 mm. longa, viridia. *Petala* aurea, 1 cm. longa, parte inferiore cuneata erecta, parte superiore ovato-oblonga, erecto-patentia, apice apiculata vel obtusa, parte quarta inferiore adnata. *Stamina* petala æquantia, filamentis viridibus, antheris aureis. *Squamæ* multum latiores quam longiores, flavescentes. *Carpella* stamina æquantia, erecta, longa, gracilia, viridia, stylis brevissimis coronata.

Hab. California: Short Trail, in the Yosemite Valley. The plant was collected and forwarded alive by Prof. H. M. Hall in June, 1915, and flowered in the following year. The group to which it belongs has a well-marked N.W. American range.

Sedum anoicum, sp. nov. Sedum *S. spathulifolio* Hooker et *S. yosemitensi* Britton et speciebus nonnullis generis *Gormaniæ* Britton caule foliisque similis; folia eis *S.* (*Gormaniæ*) *oregani* Nuttall persimilia: sed species tres indicatæ luteifloræ sunt, hæc albiflora. *S. anoicum* foliorum glabrorum spathulatorum pallide viridium rosulis, inflorescentia laxa glanduloso-pilosa, floribus albis longe pedicellatis, facile distinguendum.

Herba humilis, repens, perennis, sempervirens, pallide viridis. *Radices* fibratæ. *Caules* graciles; rami breves, 2–7 cm. longi, glabri, diffusi, foliosi, apice rosulas laxas foliorum majorum et radices edentes; rosulæ apice caulem floriferum, basi ramos breves axillares diffusos steriles emittentes. Caules floriferi erecti vel adscendentes, graciles, 7–10 cm. alti, sparse foliosi, glanduloso-pilosi. *Folia* alterna, ea rosularum glabra, carnosa, supra plana, subtus subplana, basi cuneata vel attenuato-cuneata, sessilia, lucida, 1·5–2·5 cm. longa, 7–10 mm. lata; ea ramorum sterilium sub rosulis glabra, eis rosularum similia sed minora, percarnosa vel etiam subteretia; ea ramorum floriferorum eis sub rosulis consimilia, sed glanduloso-pubescentia, distantiora, sursum in bracteas minutas decrescentia. *Inflorescentia* paniculata, laxissima, glanduloso-pubescens, 6–12 flores longipedicillatos ferens; pedicelli 12–24 mm. longi ante anthesin decurvati; bracteæ paucæ, minutæ. *Flores* albi, 1 cm. diametro. *Sepala* carnosissima, ovato-oblonga, subacuta, 3 mm. longa, fere ad basim libera, viridia, rubropunctata, supra plana, glabra, subtus perconvexa, glanduloso-pubescentia. *Petala* oblongo-ovata vel oblongo-obovata, obtusa, 6 mm. longa, 3 mm. lata, ad basim suberecta, supra patentia, post apicem apiculum ferentia, dorso carina glanduloso-pubescente prædita. *Stamina* alba, petalis paullo breviora, filamentis supra attenuatis. *Squamæ* duplo longiores quam latiores, albescentes, apice truncatæ, retusæ. *Carpella* erecta, oblonga, flavo-alba, in stylos breves erectos abrupte contracta.

This distinct little plant is named the "Homeless Sedum," because I have failed to discover definitely its country of origin. I received it along with other stonecrops from the garden of Mr. Murray Hornibrook of Abbeyleix, Queen's County, who cannot supply its history. Mr. Hornibrook has imported many plants from British Columbia, and as the affinities of the present *Sedum* are entirely with species of western North America, there is a strong presumption that it belongs to the area mentioned.

Perhaps most nearly related to *S. Wootoni* Britton, from New Mexico and Arizona, which agrees in its spathulate leaves, stems glabrous below and puberulous above, and white flowers; but in that species the leaves are only half as long as in the present plant, the upper leaves are acute or acuminate (not blunt), the sepals narrowly oblong (not broadly ovate), and the petals oblanceolate acute (not elliptic blunt).

Series *Japonica*.

Sedum Mairei, sp. nov. Species sinensis, *S. Alfredi* Hance consanguinea, *S. Someni* R. Hamet quippiam similis; ab affinibus foliis amplis sessilibus integris obovatis, petalis ovatis acuminatis sepala apiculata papilloso-marginata paullo vel haud superantibus, distinguitur.

Herba perennis (vel fortasse biennis ?), glabra, subdecidua. *Radices* fibratæ. *Caules* ramosi, decumbentes vel adscendentes, nitidi, brunneo-purpurei; rami steriles breves (5–10 cm.), infra nudi, apice folia rosulata ferentes; rami floriferi 15–25 cm. alti, basi ramosi, ramorum parte inferiore foliis emarcidis membranaceis albis, parte superiore foliis vivis obtecta. *Folia* ramorum sterilium rosulata, alterna, sessilia, carnosa, plana, integra, oblongo-obovata, basi lata sed vix amplexicaulia, apice rotundata vel obtusa, ad 2·5 cm. longa, 1·2 cm. lata; ramorum floriferorum folia dimidio minora, obovata, sessilia, marginibus mammillatis, sursum in bracteas similes decrescentia. *Cymæ* terminales, trichotomæ, 2·5–5 cm. diametro, satis laxæ, ramis dichotomis erecto-patentibus, flore infimo brevi-pedicellato, reliquis sessilibus. *Flores* 5-meri, satis parvi, 6–10 mm. diametro, viridescenti-lutei. *Sepala* inæqualia, obovato-oblonga, apiculata, marginibus mammillatis et sæpe purpureo-punctatis, breviter calcarata, petalis parum breviora vel longiora, viridia, 3–5 mm. longa, 1 mm. lata. *Petala* ovata, acuminata, patentia, 4·5 mm. longa, 2 mm. lata, lutea. *Stamina* 10, petalis breviora, 3 mm. longa, lutea, infra petalis breviter adnata. *Squamæ* parvæ, parte inferiore anguste lineares, parte superiore pæne cordatæ, viridescentes. *Carpella* erecta, 3·5 mm. longa, viridescentia, in stylos breves attenuata, stigmatibus capitellatis.

Hab. Yunnan. Raised at Glasnevin in 1916 from seed sent by Rev. E. E. Maire from Tong-Tchouan, 2900 metres, in 1915. The plants flowered, one in October, 1916, and the rest in August, 1917. They died in the autumn of 1917, but I think this was probably due to over-flowering rather than to a natural biennial duration of the plant.

From the other species of *Sedum* of the large series *Japonica* which have also relatively broad leaves (ovate or spathulate) and yellow flowers, *S. Mairei* may be distinguished as follows:—

S. Alfredi Hance has ligulate (not ovate) petals three times (not slightly) longer than the sepals, rotund-truncate (not cordate-stipitate) scales, and carpels connate half way up (not nearly free).

S. Dugueyi R. Hamet is a minute plant with tiny crowded ovate-deltoid leaves.

S. Giajai R. Hamet is a small hairy plant, with leaves only $\frac{1}{4}$ inch long.

S. Moroti R. Hamet has blunt spurred obovate sepals, oblong-linear petals, terete scales.

S. Schoenlandi R. Hamet is easily separated by its hairy leaves, racemose inflorescence, and the presence of only five stamens.

S. Someni R. Hamet has only five stamens, and is described as annual. In some respects it appears to resemble *S. Mairei*, but it has sepals entire and very obtuse at the apex (not papillate-margined and apiculate), petals "subsemioblong" subactate, widest above the middle (not ovate, acuminate, widest one-third way up), and scales with the limb twice as broad as long (not as broad as long).

S. Esquirolii Léveillé and *S. viscosum* Praeger are hairy plants with long-stalked leaves and flowers.

Sedum triphyllum, sp. nov. Species sinensis sectionis *Japonicæ* Maximowicz, ramis sterilibus longis, ramis floriferis brevibus, foliis oblongo-oblanceolatis obtusis, inflorescentia cymosa densa perfoliosa, sepalis spathulatis vel lineari-spathulatis, squamis planis, ab speciebus aliis ternato-foliatis sectionis ejus distinguenda.

Herba glabra perennis sempervirens, late repens, e nodis radices copiose emittens. *Rami steriles* 15–22 cm. longi, foliosi, apicibus adscendentibus. *Rami floriferi* ramis sterilibus similes sed breviores vel haud altiores, simplices, foliosi, in parte superiore dense mammillati. *Folia* ramorum sterilium ternata, internodia æquantia vel superantia, integra, oblongo-oblanceolata, infra attenuata, subpetiolata, apice rotundata, plana, subcarnosa, marginibus mammillatis, pulchre viridia, subtus pallida, 15–20 mm. longa, 4 mm. lata, parte inferiore erecta, parte superiore patentia; calcar obtusum, plerumque deltoideum, nonnunquam bifidum; ramorum floriferorum folia eis ramorum sterilium similia, superiora sæpe alterna. *Inflorescentia* terminalis, perfoliosa, densa, plana, 3–5 cm. diametro, e ramis dichotomis tribus composita, flore infimo breviter pedicellato, floribus reliquis subsessilibus vel sessilibus; bracteæ coarctatæ, amplæ, foliis similes, calcaratæ, marginibus mammillatis. *Flores* lutei, 16 mm. diametro. *Sepala* inæqualia, obtusissima, fere ad imum libera, obtuse calcarata, majora spathulata, 7 mm. longa, minora spathulato-linearia, 4 mm. longa. *Petala* lineari-lanceolata, acutiuscula, 9 mm. longa, 2 mm. lata, apicibus cucullatis. *Stamina* 10, petalis paullo breviora, 8 mm. longa, epipetalina infra medium petalorum inserta, antheris aureo-rubris. *Squamæ* parvæ, quadratæ, aureæ. *Carpella* gracilia, erecta, viridescenti-lutea, 7 mm. longa, stylis gracilibus.

Hab. Yunnan. Raised from seed collected by Rev. E. E. Maire, on "rochers à mi-mont, altitude 2990 mètres," near Tong-tchouan, in 1915. Flowered at Glasnevin and in my own garden in August, 1917.

Related to *S. sarmentosum* Bunge, *S. lineare* Thunb., and *S. Chauveaudi* R. Hamet, all of which have also ternate leaves. From the two first it may be distinguished by its blunt leaves broadest near the apex, its copious axillary rootlets, its dense, very leafy inflorescence, and blunt broad-tipped sepals. It comes near *S. Chauveaudi*, but that plant has tall (12–18 cm.) erect flowering shoots (not short, ascending), short (3–6 cm.) barren shoots (not long, 18–22 cm.) smaller leaves, those of barren shoots about 10×3 mm., of fertile shoots about $9 \times 3{\cdot}5$ mm. (not all similar and about $15\text{–}20 \times 4$ mm.). In *S. triphyllum*, moreover, the flower-stems are densely mammillate (a character not mentioned in Hamet's full description of *Chauveaudi*), and the scales are flat (not subterete).

Sedum variicolor, sp. nov. Species sinensis caulibus perennibus brevibus erectis vel procumbentibus crassis, foliis planis integris oblongo-spathulatis deciduis, floribus pulchre aureis conspicuis in cymas latas laxas dispositis, carpellis margine interiore concavis, distinguenda.

Herba glabra, decidua, perennis. *Caudex* crassus, brevissimus, inferne radices fibrosas robustas superne caules multos emittens. *Caules* perennes, circ. 15 cm. longi, erecti vel diffusi vel procumbentes, minute tuberculati, circa 5 mm. crassi, inferne nudi atrobrunnei, ramos breves patentes foliosos steriles et floriferos consimiles emittentes. *Folia* alterna, nonnunquam subternata, subconferta, sessilia, plana, carnosa, integra, glabra, spathulata vel late oblanceolata, 2 cm. longa, ·6 cm. lata, basi cuneata, calcarata, apice obtusa vel subapiculata; calcar breve, truncatum. *Inflorescentia* plana, 5–7·5 cm. lata, ramis tribus patentibus plerumque dichotomis minute mammillatis. *Bracteæ* inferiores foliis similes, superiores lineares. *Flores* 1·5 cm. diametro, aurei, infimus pedicellum æquans, cæteri subsessiles vel sessiles. *Sepala* foliis similia, valde inæqualia, deltoidea vel oblongo-linearia vel oblongo-lanceolata vel oblongo-spathulata, obtusa, 3–10 mm. longa, carnosa, fere ad imum libera, non calcarata, pallide viridia *Petala* ovata acuminata, vel lanceolata, 7·5 mm. longa, patentia, pulchre aurea, mucronem brevem post apicem ferentia. *Stamina* petalis paullo breviora, erecto-patentia, filamentis aureis sursum angustatis, antheris rubescentibus. *Squamæ* quadratæ, subretusæ, pallide aureæ. *Carpella* gracilia, stamina æquantia, pallide aurea, primo erecta, margine interna concava stylisque contiguis, postea divergentia; styli longi, graciles. *Fructus* stellatus, 1 cm. diametro.

Hab. Yunnan. Raised from seed sent in 1915 by Rev. E. E. Maire from Tong-tchouan, labelled "Eboullis des rochers des pics, altitude 2800 mètres."

The flowers of the batch of plants raised showed a variety of colour unusual in *Sedum*. The petals varied from pale straw-yellow to deep orange, and in some the stamens and inner face of the carpels were crimson, and the scales flushed with red. The plant takes its name from this circumstance.

Section SEMPERVIVOIDES, Series *Sempervivoides* sensu stricto.

SEDUM INDICUM A. Hamet (*Crassula indica* Decne; *Sedum paniculatum* Wall.). A packet of seed sent in 1915 by Père E. E. Maire produced a crop of Sempervivum-like plants which displayed great variation in all their parts—leaves, stem, inflorescence, and all portions of the flower—as regards form, texture, and colour. The range of variation was greater, for instance, than that found among the British fruticose Rubi; but nevertheless it seems best to retain all under *S. indicum* as variants of a single polymorphic species, bestowing varietal rank on the most distinct undescribed departure from what may be taken as the type.

The species is a biennial, producing in the first year a leaf-rosette closely resembling those of some of the European Sempervivums (and found occasionally among Sedums, as in *S. sempervivoides* Fisch. and its allies from the Caucasus region, and *S. orichalcum* W. W. Sm. from Yunnan). From the centre of the rosette is produced in the second year a leafy simple or branched flower-stem bearing a large paniculate inflorescence of small whitish or reddish flowers, with five erect free petals and five stamens.

No diagnosis is attached to Wallich's name (*List*, no. 7227). Decaisne's description (in Jacquemont's *Voyage dans l'Inde*, iv. 61) is tolerably full, and most of the dried specimens which I have had an opportunity of examining agree fairly satisfactorily with it. The majority of the plants raised from Maire's seed may be referred to the same form, which may be taken as the type—plant glabrous, rosettes lax, leaves flat, alternate, spathulate, acuminate, stem 4–10 inches. The only differences of any moment between my series of the typical plant and Decaisne's description are that he describes the petals as lanceolate, subattenuate, and twice as long as the sepals, and his figure shows a campanulate flower with the tips of the petals tapering and erect; in my series the petals were oblong or oblong-lanceolate with recurved tips, and the flowers resembled in shape those of the lily-of-the-valley. C. B. Clarke's description (Fl. Brit. Ind. ii. 413) is very short; he describes the petals as "dull rose, scarcely twice the sepals."

The tips of the petals are erect in bud, and also after flowering, and tend to assume that position in drying; this no doubt accounts for the absence in all the descriptions of reference to their characteristic reflexed habit. A peculiar thickening on the upper part of the face of the fleshy petals is likewise undescribed, doubtless because in dried specimens it is obscure. This is a marked feature of the type as represented by Maire's plants. In longitudinal section the S-shaped petal is seen to increase in thickness from the tip to half way down, when it contracts abruptly to about one-third of its maximum thickness, and continues so to the base, the scale occupying the hollow thus formed. In front view the thickened portion shows a bluntly bilobed lower edge.

Two varieties have been described—var. *Forresti* R. Hamet (in Notes R. Bot. Gard. Edinb. v. 115; type in Herb. Edinb.), a tall green plant with very broad ovate-suborbicular acute leaves, of which all but the uppermost are opposite; and var. *yunnanense* R. Hamet (in Journ. de Bot. x. 284—*Crassula yunnanensis* Franchet) a densely hairy form with mucronate leaves. A number of Maire's seedlings are referable to this latter variety, of which I am able to amplify the description; it is a noteworthy form, almost worthy of specific rank. Franchet separated it from *Crassula indica* Decne mainly on account of its general pilosity and its mucronate leaves. In my plants the size of stem, leaf, and inflorescence was much less than in my plants of the type (Franchet says "Port et dimensions de *C. indica*"). The leaves were very thick, being so convex on the under side that the breadth was only from once to twice the thickness, not three to four times the thickness as in the type. Flowers rather larger than in type, calyx narrower, petals more erect at base, so that the corolla is narrower, and less reflexed at apex, making the whole petal much straighter; the peculiar thickening of the upper half of the petal, which is so marked a feature of the type, is quite absent. The whole plant, as stated by Franchet, is shortly pilose, even to the backs of the petals.

Another form deserving of varietal rank appeared in some numbers among the plants grown from Maire's seed. This was very uniform in character, forming dense glaucous (not lax glabrous) rosettes closely resembling those of *Sempervivum calcareum* Jord. and very short flower-stems, and having different petals. It may be defined as follows :—

Var. DENSIROSULATUM, var. nov. *Rosulæ* densæ, duplo latiores quam longiores. *Folia* quam in typo minora (circa 25 mm. longa, 8 mm. lata, 3·5 mm. crassa), spathulata, acuminata, valde glauca, apice purpurea. *Caulis* brevior (5–7·5 cm.) a basi ramosus. *Inflorescentia* congesta, rotundata, 5 cm. longa, 5 cm. lata. *Petala* rectiora, parte superiore minus incrassata. *Squamæ* angustiores.

In this variety the rosettes are formed of twice at many leaves as in the type (in which, moreover, the breadth of the rosettes is usually no greater than the length). This and the marked glaucescence of the purple-tipped leaves give the plant a very distinct appearance.

Series *Cepæa* sensu stricto.

Sedum viscosum, sp. nov. Species sinensis annua vel biennis, caulibus, foliis, bracteis, pedicellis, sepalis, petalis, carpellis pilis glandulosis viscosis dense obsitis insignis. Etiam foliis planis integris obovato-rhomboideis petiolatis, atque floribus longe petiolatis distinguitur.

Herba annua (vel biennis), mollis, pilosa, viscosissima. *Caulis* erectus, gracilis, sanguineus, 10–20 cm. altus, ramosissimus, ramis axillaribus adscendentibus, juventute brevissimus, foliis rosulatis obsitus. *Folia* alterna, plana, internodia æquantia aut superantia, mollia, carnosa, supra et subtus æqualiter glanduloso-pilosa, petiolata; petiolus linearis, 6 mm. longus; lamina obovato-rhomboidea, obtusa, 8 mm. longa, 6 mm. lata, apice puncto parvo purpureo ornata. *Flores* plurimi, pedicellati, foliis suboppositi, raro axillares, aurei; pedicelli gracillimi, ad 12 mm. longi. *Sepala* lanceolata, acuta, dorso glanduloso-pilosa, viridia, carnosa, in calcar non producta, 2·5 mm. longa, 1 mm. lata. *Petala* lineari-lanceolata, acuta, 5–5·5 mm. longa, 1·5 mm. lata, supra aurea, glabra, subtus glanduloso-pilosa, viridescentia, purpureo-punctata, post anthesin erecta, persistentia. *Stamina* 10, aurea, 3·5–4 mm. longa. *Squamæ* parvæ, late cuneatæ, minute emarginatæ, pallide luteæ. *Carpella* gracilia, erecta, oblonga, glanduloso-pilosa, luteoviridia, basi ipso connata, stamina æquantia, stylis gracilibus glabris coronata.

Seed received from Père E. E. Maire from Yunnan, its habitat being "murs humides, ombragés, de Kin-tchong-chan, alt. 2990 m." The plant flowered at Kew, Glasnevin, and in my own garden in 1916 and 1917, behaving often as a biennial, but very likely normally annual in duration. In its short life-period, habit, hairiness, stalked flat leaves and long-stalked flowers it agrees with a number of Chinese species—mostly white-flowered—which group themselves round the European *S. Cepæa* L. Such are *S. drymarioides* Hance, *S. filipes* Hemsley, *S. Silvestrii* Pampanini. In many respects *S. viscosum* resembles the small northern race of the variable *S. drymarioides* as described by Maximowicz (Bull. Acad. St. Pétersbourg xxix. 155), but it differs in its inflorescence not bifid, flowers more than twice as large, bright yellow patent (not campanulate) corolla, nearly erect (not stellate divergent) fruit; and all the parts of the plant are opaque, firm and stiff when dried, not lax and pellucid. It comes near *S. stellariæfolium* Franchet, which R. Hamet treats as a variety of *S. drymarioides*, and which may be the northern race of that species referred to by Maximowicz. These two plants agree with each other, and differ from *S. viscosum*, in their very small flowers—

drymarioides......	Sepal 1·5 mm. long.	Petal 3·5 mm. long.
stellariæfolium ...	,, 1·0 ,, ,,	,, 3·0 ,, ,,
viscosum	,, 2·5 ,, ,,	,, 5·0–5·5 ,,

S. stellariæfolium also appears to have the white or whitish flowers of *S. drymarioides*, very different from the bright yellow, persistent in dried specimens, of *S. viscosum*.

S. viscosum is also clearly closely allied to *S. Esquirolii* Léveillé, and *S. Bodinieri* Léveillé & Vaniot from Kouy-Tchéou, &c., two species quite inadequately described. But *S. Esquirolii* is stated to possess a simple (not much branched) stem, curved (not erect and thickened with the scars of the rosette leaves at the base); laminæ equalling (not twice as long as) the petioles, and petals four times (not two to two and a half times) the sepals and the elongate styles. *S. Bodinieri* is not described at all: only the differences between it and *S. drymarioides* are given; and it is impossible to compare it with any other species.

It is clear that in *drymarioides*, *stellariæfolium*, *viscosum*, *Esquirolii* and *Bodinieri*, we have a group of closely-allied forms, perhaps best treated as races of a single polymorphic species, perhaps sufficiently distinct to be ranked as several species. Access to copious material alone will decide their relationships.

A specimen in the National Herbarium, Dublin, labelled *S. drymarioides* and collected in Hupeh by A. Henry (no. 3709) is clearly referable to *S. viscosum*.

BIBLIOGRAPHICAL NOTES.

LXXIV. Baxter's 'British Phaenogamous Botany.'

William Baxter (1787–1871), as a capable and energetic young Scotchman, was appointed head-gardener or curator at the Oxford Botanic Garden in 1813, when twenty-five years of age. He received a small emolument from the University and lived in a small cottage (since enlarged) in the Gardens. He had the assistance of three labourers, and only the barest apologies for greenhouses; the establishment of the Garden at this time is figured in Mr. Günther's *Oxford Gardens*, p. 152. Much can be done with enthusiasm and five acres of land, and Baxter managed to grow from 4000–5000 species of plants, though the work was often heart-beaking, owing to the inefficiency of the equipment, and the possibility of the garden being largely submerged in flood-time. In such damp and mildewed environment Baxter took particular interest in mosses and fungus diseases; he was made an Associate of the Linnean Society in 1817: his *Stirpes Cryptogamæ Oxoniensis* was issued in 1825.

Oxford Botany at this time was at its lowest ebb: Dr. H. Williams, who occupied the Chair in succession to Sibthorp, was also Radcliffe Librarian; nothing is known of his botanical attainments; the only accommodation at the Gardens consisted of a building, originally built for a conservatory, in the oldest sense of the term, and still utilized as the Botanic Library. At that time it contained the herbarium and the books of Sherard, Dillenius, and Sibthorp, and also functioned as lecture-room when there were any classes. What practical instruction there was was left solely in the hands of Baxter, and given orally and informally. Access to a good collection of all the older literature was an essential factor in Baxter's success, and after twenty years of uphill labour he conceived the idea of himself publishing a work on floral types, which would serve the purpose of an elementary introduction to the systematic botany of the day; this to be issued on the lines of the subscription works, of the "coloured plate and one sheet of text" pattern, as seen in many standard works of the period, produced—like the *Botanical Magazine*—for "ladies, gentlemen, and gardeners"; the work to be carried out by local talent, and produced as cheaply as possible.

A trial part was issued as a prospectus in May, 1832, soliciting subscribers; it contained two plates (*Fritillaria* and *Tulipa*) with no text, but with some letterpress on the cover: this part is curiously reviewed as the real thing in Paxton's Hort. Reg. i. p. 655 (1832). The price was to be a shilling coloured and sixpence plain: and the work was designed to run to two volumes on "Elementary Types," two on Oxford genera, and two on the remaining genera of the British Flora, at an estimate of 500 or so. The labour of getting drawings in hand proceeded throughout the summer of 1832, and the first full parts were issued in September: each part was to contain four plates, with sheets of text, filled on both sides—and the work to continue steadily at the rate of a part per month. The issue was continued on these lines, and maintained with uniform output to the end of the series—ten years later; the total expenses averaged £300 each year. The cover was inscribed:—"*British Flowering Plants, drawn from Nature, and engraved under the direction of William Baxter, A.L.S., F.H.S., etc., Curator of the Oxford Botanic Garden.*"

The first plate was the Fritillary, abundant and well-known as "Snakes' Heads" at Oxford, which with the second plate, the Yellow Wild Tulip, are still admirably adapted as the simplest types of floral organization for a beginner to study: the other two plates represented the Avens and the Sweet Violet. The first plates were not particularly well-drawn, and were poorly coloured; in fact, the plain copies of the earlier figures are more satisfactory than the coloured ones; but essential details were figured separately, and the text was collated from the general run of contemporary floras (Smith, Curtis, Hooker, Withering, etc.) without any special originality beyond local records and stations.

At a later date (1837) the covers were inscribed:—"*Figures and*

Descriptions of the Genera of British Flowering Plants, with the Specified English Names, Linnæan Class and Order, Natural Order, Generic and Specific Characters, and References to the most popular Botanical Works, Localities, Time of Flowering, and Dissections showing the essential characters. William Baxter, F.H.S., A.L. and M.B.S." This applies to the extension beyond the first two volumes; and the price (possibly increased to other than the original subscribers) is given as, coloured 1/6, plain 1/- (Loudon's Gard. Mag. iii. p. 606.)

After the issue of twenty numbers, comprising eighty plates, by March 1834, these parts were issued as a completed volume, to which a preface (dated Feb. 25, 1834) is appended, explaining the object and scope of the work, and expressing gratitude for support already experienced. The full titlepage is now headed:—"*British Phaenogamous Botany*, or *Figures and Descriptions of the Genera of British Flowering Plants*, by W. Baxter, A.L.S., F.H.S., &c., Curator of the Oxford Botanic Garden, Oxford (Parker); Published by the Author." (The term *Phaenogamous* (cf. Lindley's Synopsis (1828) is used in contradistinction to his previous issue of *Cryptogamæ Oxoniensis*.)

The plates in the first volume are mostly rather poor; the majority are neither signed nor dated, and the work was distinctly an amateur production. The first plate dated is Jan. 1833; some of the earlier figures were touched up, revised, dated, and sometimes redrawn in later reprints, and so appear in the completed volumes, the revised ones being dated 1833. It is significant that Dr. Daubeny was appointed Professor of Botany on Feb. 8th, 1834, and botanical matters began immediately to improve; but whatever assistance Baxter may have had subsequently, he had got started and well on with the work, on his original lines, entirely on his own initiative. The financial side of the venture was in the hands of Parker, the well-known Oxford bookseller, who also attended to the disposal of the copies. The work was printed by King, of St. Clements, near the Gardens, and the figures were drawn by local artists. Isaac Russell, an Oxford glass-painter, drew over 200, and was entrusted with the best coloured figures; C. Matthews drew another 200, including all the Grasses and Sedges, as also inconspicuously coloured ones (Umbelliferæ, small Cruciferæ, &c.): some effective "natural" figures are signed Delamotte. C. Matthews engraved over 350, other engravers —Willis, Albutt, and Whessell—a few. The colouring of the plates was done by Baxter's daughters, and more especially by his daughter-in-law Mrs. W. H. Baxter; as the work ran to 600 coloured sets of figures, the labour was considerable.

The work proceeded steadily at the same rate throughout the years 1834–1835, though great changes involving rebuilding and re-arrangement were going on in the garden, and Baxter's time must have been fully occupied. It is clear that the maintenance of the output of a plate and text each week involved considerable ingenuity in looking after the specimens, as plants are only available in the summer months, or for a short time, and a stock requires to be held in reserve. A few older undated figures may thus appear in a later volume. After 1834, however, the plates are normally signed and dated, and the quality of the work is much improved; by 1835 the process had reached its full possibilities, and the same high standard was maintained to the end. A plate-size of about 7½ in. by 4½ was employed; the text included localities, times of flowering, floristic notes, economic and other uses, as also any medical particulars: when botanical information failed to fit the closely-printed two pages, some verses filled the gap without adding much to the literary effect.

The second series of 80 plates, completed in Nov. 1835, was then issued as Vol. II. with a dedication to Daubeny (dated Oct. 17, 1835). Vol. III. 80 plates (161–240) completed by March 1837, was dedicated to the Rev. J. S. Henslow, Professor of Botany at Cambridge (dated June 12, 1837). Vol. IV. 80 plates (241–320) ran to the end of 1838, and was dedicated to Dawson Turner (dated Feb. 18, 1839). Vol. V. 80 plates (321–400) spread over 1839, to March 1840, was dedicated to William Borrer (Oct. 24, 1840). Vol. VI. continued to finish the work, which ran on to 509 plates, ended in March 1843. The last volume of 109 plates (401–509) was dedicated to Charles Empson of Bath (May 15, 1843); very complete lists, indices, and appendices, of lvii pages were added, including an index to a hundred gems of verse rescued from various sources.

The work being thus brought to a satisfactory conclusion accounts were settled up; it is interesting to find that after an outlay of about £300 a year in current expenses, the sale of copies had more than balanced the expenditure, and Baxter received a substantial sum as his half-share of the profit (1845). The full and continuous run of the paper-backed parts, thus serially issued, was regarded as the first edition; completed sets of volumes are inscribed second edition on the title-page of the first volume only. A few special 'presentation-copies' of this second edition contain as Frontispiece a portrait of Baxter by Burt, engraved by Whessell. Baxter sold out his remaining interest in the work to Parker in 1849; a reprint of the whole in 1856 was issued by the latter; but this was in no sense a third edition, although it is so entered by Pritzel, with the dates 1834–1843, who is followed by Jackson in his Guide (1880). Baxter retired from the Gardens in 1851, on a small pension (he was not a member of the University), and lived respected by a large circle of friends, dying at the age of 84 in 1871. The copper-plates remaining in the hands of Parker were in existence until the early part of 1918, when they were sold for munitions for their value as metal.

On analysing the factors that led to the production of these volumes, it may be said that, in spite of the poetical interpolations, the almost unavoidable adoption of the make-up of 'plate and text' popular at the time, and the enormous amount of unnecessary references which indicate a reverence for authorities, the work represents a definite advance in the teaching of the science, with simplified descriptions and floristic and biological notes. The utilization of *all* genera of British flowers—or even the 160 of the first two volumes—may be a mistake from this standpoint; but Baxter wished to cover the whole range of the British Flora. The idea that in the whole province of floral botany, the British Flora was but a small affair, had not been as yet appreciated by British botanists, and broad generalizations were still wanting. To cut the types down to one per order, in the manner of Daniel Oliver (*Lessons in Elementary Botany*, 1864: *Illustrations of the Principal Natural Orders of the Vegetable Kingdom*, Oliver and Fitch, 1874—102 Flowering Plants, plain or coloured), was the next stage of more strictly educational work; but Baxter deserves to be credited with the first step, made under conditions of minimum equipment.

Many of the figures attain a high order of merit, those by Russell being the more elegant in design; many British weeds are beyond much decorative treatment; as examples of the work at its best may be noted Russell's figures of Glaucium (131), Caltha (153), Foxglove (113), Columbine (221), Linnaea (340), Rubia (185), Inula (265), Cyclamen (505); or the Hop (342), Ash (382), Martagon (501) of Matthews. Much of the coloured work is an improvement on Sowerby's *English Botany*; the more detailed dissections and schemes of floral parts are often extremely good (cf. *Lemna* (424), *Alnus* (193), *Carpinus* (234), Oak (371), *Castanea* (485): these, though small, are preferable to the coarse work of Fitch in Oliver's types of orders, and are on a plane quite different from the current issue of *The Cambridge British Flora*. The text presents no special novelty beyond local records, being a compilation from existing literature; but it undoubtedly packs far more into the regulation two pages than any other flora, and is still useful as a store-house of odd points of interest culled from ancient literature. Older reviews of the work state the same facts: "The plates equal in excellence to any that have been published, and the letter-press far superior to that of most British Floras" (Loudon, 1835); "One can hardly name a more suitable present for a young person" (Gard. Chron. 1843). Above all the work was distinctly cheap and of honest value: *cf.* Maund's *Botanic Garden*, 4 coloured plates (small) 1/6 a month: Sowerby's *English Botany*, cheap-edition, 2/- a month: *Curtis's Botanical Magazine*, 8 plates, 3/6 a month: the *Botanical Register*, 8 plates, 4/- a month: Paxton's *Magazine of Botany*, 8 plates, 5/- a month. The special character of the work is its steady output, continued over a number of years on the part of quite a few people; as the product of a small university town, it in many respects runs parallel with the sixteenth-century work of Fuchs and his men. Baxter's draughtsmen were similarly non-botanical artists to begin with, and the improvement in their work is very marked. Many of the plants are identical, and it is interesting to compare the similarity of treatment—*e. g.*, Strawberry, Iris, Oxalis, Coltsfoot, Daisy. If the work does not appear more remarkable as a novelty in Botany, it is because the framework of the design was too rigorously based on the subscription-principle and the vogue of the day. The detailed description of a suitable series of types of common plants, in handy form, similarly arranged as a sequence through the families, is still a desideratum, apparently beyond the efforts of British Botany. Although not included in Prof. F. W. Oliver's *The Makers of British Botany* (1913), Baxter in common with many other worthy botanists (as Borrer, Dawson Turner, Greville) has a niche in its history and he did his share in advancing the science in a period of considerable depression.

For further information cfr. *Oxford Gardens*, Günther, p. 22 (1912), ; *Gardeners' Chronicle*, 1843, p. 560 ; 1871, p. 1426 (Obituary Notice) ; Loudon's *Gardener's Magazine* 1835, p. 394 ; 1837, p. 606 ; *Horticultural Register*, 1833, p. 33.

Biographical notes in Druce's *Flora of Berkshire* (1897), p. clxii ; *Report of Ashmolean Society*, Oxford (1903), p. 22.

Much matter for the present note has been rendered available by the courtesy of Messrs. Parker, Turl St., Oxford, and of Mr. John Jefferies, Littlemore.

A. H. Church.

THE MYCETOZOA OF BEDFORDSHIRE.

By James Saunders, A.L.S.

The Mycetozoa occupy an anomalous position in the organic world, having sometimes been grouped with plants, at others with animals. This may be due to the changes of form through which they pass in accomplishing the metamorphoses associated with their life-history. In what may be regarded as the initial stage, they float in the atmosphere as microscopic spores. When these fall on decayed vegetation they eventually throw off their cell-walls and assume an amoeba-like condition. Those of the same species have apparently an affinity, and form masses, usually small, of motile plasmodium. This is the assimilating stage, during which formative material is accumulated by ingestion. The circulation of these contents is singular and probably unique. The movement is a streaming which changes its direction at intervals of about two minutes. When it has assimilated sufficient material, sporangia are formed, each of which contains a number of spores often running into thousands. These are distributed by both organic and inorganic agencies, and again pass through a series of metamorphoses.

Except where otherwise specified, the species in the following list occur on dead or rotten wood.

Ceratiomyxa fruticulosa Macbr. ; Luton Hoo, Woburn Sands.

Badhamia capsulifera Berk. On fir logs ; Leighton, Luton.—*B. utricularis* Berk. On decayed wood or living fungi ; Chiltern Green, Pepperstock.—*B. nitens* Berk. : Caddington, Luton Hoo, Woburn Sands.—*B. macrocarpa* Rost. ; Flitwick.—*B. panicea* Rost. ; Luton Hoo, Stopsley.—*B. lilacina* Rost. On sphagnum ; Flitwick Marsh.—*B. foliicola* Lister. On decayed straw ; Nether Crawley. *Miss Higgins*, Warden Hills.—*B. rubiginosa* Rost. On decayed wood and leaves, Leighton ; var. *dictyospora*, *Miss Higgins*, Woburn Sands.—*B. ovispora* Racib. On decayed straw ; Nether Crawley, *Miss Higgins*, Stopsley.

Physarum leucopus Link. On moss and dead leaves : Luton, *Miss Higgins* ; Flitwick.—*P. citrinum* Schum. ; Luton Hoo, *Miss K. Higgins* : Pepperstock.—*P. penetrale* Rex. Near Luton, *Miss K. Higgins*.—*P. psittacinum* Ditm. Luton Hoo.—*P. viride* Pers, Woburn Sands, Luton Hoo ; var. *aurantium* Lister. Luton, Ampthill: var. *incanum* Lister. Woburn Sands, *Miss Higgins.*—*P. straminipes* Lister. On decayed straw; Chaul End, Dunstable.—*P. nutans* Pers. Luton, Flitwick. Subsp. *leucophæum* Lister. Luton Hoo, Stopsley.—*P. pusillum* Lister. On leaves and dead wood; Rundley Wood.—*P. compressum* Alb. & Schwg. Luton, Chaul End.—*P didermoides* Rost. Mon. On decayed straw. Chaul End: var. *lividum* Rost. Flitwick, Chaul End.—*P. cinereum* Pers. On dead leaves; Chiltern Green, Flitwick.—*P. vernum* Somm. (See Journ. Bot. 1897, 210.) On decayed straw; Bedford, Kitchen End.—*P. bivalve* Pers. and *P. contextum* Pers. On dead twigs and leaves; Flitwick.—*P. bitectum* Lister. Ampthill.—*P. conglomeratum* Rost. Flitwick Marsh.—*P. virescens* Ditm. Ampthill: var. *nitens*. Woburn Sands.

Fuligo septica Gmel.; frequent.—*F. muscorum* Alb & Schwein. Woburn Sands.—*F. cinerea* Morg. On dead leaves and straw. Flitwick, Stopsley.

Craterium minutum Fries. On dead leaves and twigs; frequent.—*C. leucocephalum* Ditm.; Luton Hoo.—*C. aureum* Rost.; Flitwick, Luton.

Leocarpus fragilis Rost. On dead leaves and twigs; Ampthill, Luton Hoo.

Diderma hemisphericum Hornem. On dead leaves and twigs; Flitwick.—*D. effusum* Morg.; frequent.—*D. spumarioides* Fries.; Ridgmont, Sundon.—*D. niveum* Macbr. On turf, twigs, &c.; Flitwick, Woburn.—*D. testaceum* Pers. On dead leaves; Flitwick.—*D. floriforme* Pers.; Woburn Sands.

Diachæa leucopoda Rost. and *D. subsessilis* Peck. On dead leaves in swampy coppices; Flitwick, rare.

Didymium difforme Duby; frequent.—*D. Clavus* Rost.; Chiltern Green, Luton.—*D. melanospermum* Macbr.; Woburn Sands, *Miss Higgins.*—*D. nigripes* Fr.; Ampthill, *Miss Higgins*; Woburn Sands, Luton: var. *xanthopus* Lister; Nether Crawley, Flitwick.—*D. squamulosum* Fr.; Leagrave, Woburn Sands.—*D. Trochus* Lister; Nether Crawley, Luton.

Mucilago spongiosa Morgan; Harlington, Luton Hoo.

Lepidoderma Carestianum Rost.: var. *Chailletii* Lister; Luton, Flitwick.

Stemonitis fusca Roth.; Chiltern Green, Ampthill: var. *confluens*; Luton, *Miss Higgins.*—*S. splendens* Rost.; var. *flaccida* Lister; Woburn.—*S. flavogenita* Jahn; Woburn Sands, Flitwick.—*S. ferruginea* Ehrenb.; Luton, Flitwick.

Comatricha nigra Schroeter. On dead leaves; frequent.—*C. laxa* Rost.; Ampthill.—*C. typhoides* Rost.; Ampthill, Luton: var. *heterospora* Rex.; Luton.—*C. pulchella* Rost. On dead leaves; Ampthill, Chiltern Green.—*C. rubens* Lister; Flitwick.—*C. elegans* Lister; Woburn Sands, *Miss Higgins.*

Enerthenema papillatum Rost.; Luton, Woburn Sands.

Lamproderma columbinum Rost.; Luton.—*L. scintillans* Morgan; Chiltern Green, Luton.—*L. violaceum* Rost.; Luton, Nether Crawley.

Lepidoderma tigrinum Rost. On dead leaves; Leighton, *Miss*

Lister, Luton, Flitwick.—*Lamproderma arcyrionema* Rost. On dead leaves; Luton.—*L. columbinum* Rost.; on firwood and moss; Leighton, *Miss Lister*.—*L. violaceum* Rost.; Luton Hoo.

Amaurochæte fuliginosa Macbr.; Flitwick, rare.

Brefeldia maxima Rost.; Ampthill, rare.

Lindbladia effusa Rost.; Aspley, rare.

Cribraria aurantiaca Schrad.; Flitwick, Ampthill.—*C. argillacea* Pers.; Luton Hoo, Woburn.

Dictydium cancellatum Macbr.; Luton Hoo, Chilton Green; var. *anomalum* Meylan; Woburn Sands.

Licea flexuosa Pers.; Flitwick, Woburn.

Tubifera ferruginosa Gmel.; Woburn Sands.

Dictydiæthalium plumbeum Rost.; Luton Hoo.

Enteridium olivaceum Ehrenb.; Barton-le-clay, Chiltern Green.

Lycogala flavo-fuscum Rost.; Ampthill, *C. Crouch*.—*L. epidendrum* Fries.; frequent.—*Reticularia Lycoperdon* Bull; Luton Hoo, Flitwick.

Trichia affinis de Bary and *T. persimilis* Karst.; Luton Hoo, Flitwick.—*T. scabra* Rost.; Luton Hoo, Woburn.—*T. contorta* Rost. and var. *inconspicua* Lister; *T. decipiens* Macbr.; *T. Botrytis* Pers. and var. *munda* Lister; Luton Hoo.

Hemitrichia Vesparium Macbr.; Chiltern Green.—*H. clavata* Rost. and *H. leiotricha* Lister; Luton Hoo, Ampthill.

Arcyria ferruginea Sawter.—*A. cinerea* Pers. and *A. pomiformis* Rost.; Luton Hoo, Flitwick.—*A. denudata* Sheldon; Ampthill.—*A. incarnata* Pers. and *A. nutans* Grev.; Ampthill and Woburn.—*A. Oerstedtii* Rost.; Markham Hills.—*A. insignis* Kalchbr.; Luton Hoo.

Perichæna depressa Libert and *P. corticalis* Rost.; Luton Hoo.—*P. vermicularis* Rost. On leaves and bark; Nether Crawley.

Margarita metallica Lister; Ridgmont, *C. Crouch*.

Dianema Harveyi Rex and *D. depressum* Lister; Luton Hoo.

Prototrichia metallica Massee; Luton.

NOTES ON JAMAICA PLANTS.

By William Fawcett, B.Sc., & A. B. Rendle, F.R.S.

(Continued from Journ. Bot. 1917, p. 271.)

EUPHORBIACEÆ.

Phyllanthus (Section *Euphyllanthus*).

Phyllanthus minor, sp. nov. *Herba* inferne lignosa, 1·5–2 ped. alt., glabra. *Folia* membranacea, obovato-elliptica apice obtusa vel rotundata, basi cuneata, 6–15 (–19) mm. l., 4–8 mm. lat.; nervis lateralibus utrinque 2–4; *petioli* 1 mm. l.; *stipulæ* subulatæ, 1 mm. l. *Flores* solitarii aut in axillis fasciculati; pedicelli graciles foliis breviores, 4–5 mm. l. *Flores masculi*: *Sepala* 5, rotundata, ·6 mm. diam. *Disci glandulæ* 5, breviter obovatæ, truncatæ. *Filamenta* 5, libera; antheræ verticaliter birimosæ. *Flores feminei*: *Sepala* 5 ovata, costa viridi, ·6 mm. l., usque ad ·9 mm. in fructu. *Urceolus* hypogynus integer. *Styli* liberi, graciles, semitrifidi, ramis patentibus aut reflexis. *Capsulæ* depresso-globosæ, 2 mm. diam. *Semina* 3-gona, dorso semicircularia, brunnea, minute papillosa, ·8 mm. l. *P. nummulariæfolius* Britton, in Journ. Torr. Bot. Club, xliv. 36 (1917) (non *Poir.*). Types in Herb. Jam.

Hab. Hope Grounds, 700 ft. *Harris*! 12,123, 12,157, 12,208.

This species most closely resembles the Tropical African *P. nummulariæfolius* Poir., from which it is at once distinguished by the short pedicels (shorter than the leaves), and the smaller flowers.

(Section *Xylophylla.*)

Phyllanthus inæqualiflorus, sp. nov. *Frutex* aut *arbor* usque ad 20 ped. alt. *Coni squamæ* ramulorum apice triangulares, acutæ vel acuminatæ, circ. 3 mm. l. *Ramuli penultimi* decidui 6–12 cm. l., 1–1·5 mm. lat., lineares, compressi. *Ramuli florigeri* (phyllocladia) distichi, lanceolati vel anguste oblongi, apice obtusi, 4–5½ cm. l., utroque latere crenaturis supra medium 5–8 parvis crenulati, nervis parallelis subremotis lineati. *Pedicelli* utraque crena 1–4, 3–5 mm. l. *Flores masculi*: *Sepala* 6, ovato-elliptica, 2 mm. l. *Disci glandulæ* 6, stipitatæ, magnæ, planæ, circulares, peltatæ, columnam staminalem æquantes. *Stamina* vix 1 mm. l.; filamenta fere ad apicem inter sese connata; columna circ. 5 mm. l.; antherarum loculi divergentes. *Flores feminei*: *Sepala* obovato-oblonga aut elliptica vel rotundata, vix 3 mm. l. *Urceolus hypogynus* lobatus, circ. ·3 mm. l. *Ovarium* circ. 1 mm. l. *Styli* connati; columna erecta ovario dimidio brevior; lobi 3, breves, lati, patentes, infra medium in lacinias 2–3 lineares recurvas divisi. *Capsulæ* ignotæ. Types in Herb. Mus. Brit. et in Herb. Jam.

Hab. Holly Mount, Mt. Diablo, *Harris*! 8988.

Near *P. speciosus* Jacq., but distinguished by the large female flowers much exceeding the male, and by the united styles.

Phyllanthus Coxianus, sp. nov. *Frutex* 10 ped. alt. *Coni squamæ*: stipulæ triangulari-ovatæ, obtusæ, 3–4 mm. l.; folia rudimentaria lineari-lanceolata, acuminata, 3–4 mm. l. *Ramuli penultimi* decidui 8–17 cm. l., 1–2 mm. lat., lineares, compressi. *Ramuli florigeri* (phyllocladia) distichi, elliptici, utrinque angustati, apice sæpius subacuminati, vel lanceolati vel oblanceolati, 6–9 cm. l., 1·5–2 cm. lat., utraque latere crenaturis fere supra medium 14–7, subapproximatis crenulati, nervis parallelis subremotis lineati. *Pedicelli* utraque crena 1–4, 3–6 mm. l. *Flores masculi*: *Sepala* 6, inæqualia, elliptica vel obovato-elliptica, exteriora circ. 1·4 mm. l., interiora usque ad 2·2 mm. l. *Disci glandulæ* 6, sessiles, spongiosæ. *Stamina* duplo quam sepala breviores; filamenta supra medium inter sese connata; columna ·6–1 mm. l.; antherarum loculi connati. *Flores feminei*: *Sepala* 6, inæqualia, exteriora elliptica, circ. 1·5 mm. l., interiora late obovato-elliptica vel rotundata, circ. 2 mm. l. *Urceolus hypogynus* duplo quam ovarium brevior. *Ovarium* triplo quam sepala brevius. *Styli* connati; columna erecta triplo vel quadruplo quam ovarium brevior, ramulis columna multo longioribus, ad dimidium in lobos 2 aut 3 patentes lineares divisis, vel etiam dichotomis. *Capsulæ* ignotæ. Types in Herb. Mus. Brit. et in Herb. Jam.

Hab. In a garden, St. Ann, *Prior*! Ramble, Claremont, 1700 ft., *Fawcett & Harris*! 7025.

This species is named in honour of the late Hon. H. E. Cox, owner of the estate on which it was found.

Also near *P. speciosus* Jacq., but has somewhat larger flowers, the anther-cells united, a larger female disc, and styles united at the base.

PHYLLANTHUS LATIFOLIUS Sw.

There has been some confusion with regard to this species. The specific name originated with Linnæus (Mantissa 221, 1771), who gives a short diagnosis, but definitely refers to the description by Patrick Browne—"characterem generis ex hac specie Brownii." This can only refer to *Phyllanthus* no. 1 of Browne, which alone includes a floral description, Browne's species no. 2 containing only a specific diagnosis.

From Browne's description it is evident that the disk in the female flower does not form a continuous ring or cup, but is reduced to minute glands equal in number with the sepals, which glands Browne describes as 5 very short stamens with subrotund anthers situate round the base of the ovary.

A sheet in Herb. Banks (Herb. Mus. Brit.) with specimens from Jamaica from Masson and others, is written up by Swartz *Xylophylla latifolia*, and is probably the plant on which Swartz's first reference to *X. latifolia* (*Prodromus* 28) is based. We regard this plant as conspecific with Browne's (i. e., *X. latifolia* L.). Swartz in his subsequent descriptions (Obs. Bot. 113, 1791, and Fl. Ind. Occ. 1109) evidently refers to the same species, as he describes the disk in the female flower as Browne does, and cites Browne's description. He also cites Plukenet's *Phytographia*, t. 36. f. 7, and Sloane, Cat. 16 & Hist. i. 80; there are good specimens from Sloane in Herb. Sloane which agree with the plant in Herb. Banks. In Fl. Ind. Occ. Swartz transferred the species to *Phyllanthus*. Grisebach seems to have had a correct view of the species, as a specimen of McNab's in Herb. Edinburgh is written up by him as *Phyllanthus latifolius*.

Mueller (DC. Prodr. xv. 2, 431) in describing *P. latifolius* Sw. refers to the female flower as having a deep cup-shaped entire disk equal in height to the ovary. His description is based solely on a specimen from Swartz in the Stockholm Herbarium. We have not seen this specimen, but there is in Herb. Banks one collected by Swartz in Jamaica which he has named "*Xylophylla latifolia* var.," in which the female flowers have this cup-shaped disk. We regard this as a new species (*P. Swartzii*). Urban (Symb. Ant. iii. 290) has been misled by Mueller's description of the female flower, and has redescribed the original *X. latifolia* as a new species, *P. isolepis*.

In the Linnean Herbarium there is a sheet with two specimens without flowers named in Solander's hand *Phyllanthus Epiphyllanthus*. Smith has written below the one on the left "Phyllanthus n. 2. Br."—this specimen is *P. angustifolius* Sw.: below the other he wrote "Ph. no. 1, Br."—this is *P. latifolius* Sw. Linnæus probably received these specimens from Patrick Browne, but the usual indication in his handwriting is absent.

Phyllanthus glabellus, comb. nov. The plant described by Grisebach (Fl. Brit. W. Indies, 34) as *P. tremulus* is identical with a specimen in the Linnæan Herbarium from Jamaica collected by Browne, named by Linnæus *Croton glabellum*, and described by him in Amœn. v. 409. This necessitates a change of name. There are good specimens of the same species in Herb. Banks from Jamaica, collected by Wright, and from Philip Miller's Herbarium, named by Solander *Croton glabellum* L.

No fewer than three species have been included by Linnæus under the name *Croton glabellum* L. In order of date these are:—

(1) *C. glabellum* L. Syst. ed. 10, 1275 (May, June. 1759) based on Sloane, Jam. ii. t. 174. f. 1. The specimen is in Herb. Sloane, and is the plant generally known as *Croton lucidus* L., the first description of which appears a few lines below on the same page of the *Systema*. *C. glabellum* L. Syst. is therefore a synonym of *C. lucidus*.

(2) *C. glabellum* L. Amœn. v. 409 (1760), based on the specimen in Herb. Browne referred to above.

(3) *C. glabellum* L. Sp. Pl. ed. 2, 1425 (1763). Linnæus's description is based on the plant of the *Amœnitates* to which a reference is given (i. e., *Phyllanthus tremulus*). But Linnæus cites also Brown. Jam. 348, and Sloan. Jam. 139, Hist. ii. 30, t. 174, ff. 3 & 4 (in error for f. 2). The Sloane specimen (in Herb. Mus. Brit.) is the plant generally known as *C. glabellus*, and Browne's description may refer to the same species. That Browne is not referring to the specimen in Herb. Browne subsequently named *C. glabellum* by Linnæus is indicated by his reference to the plant as aromatic.

Linnæus considered *Croton* to be of the neuter gender and invariably wrote *glabellum*.

Securinega.

Adelia Acidoton L. (Syst. ed. 10, 1298 (1759)) is based on *Acidoton* (Browne, Hist. Jam. 355), and is described in the *Amœnitates* (v. 411, 383); there is a specimen in the Linnean Herbarium from Browne, named by Linnæus. The plant in question is *Securinega Acidothamnus* Muell. Arg. in DC. Prodr. xv. pt. 2, 451 (1866), (*Flueggea Acidothamnus* Griseb. in Goett. Nachr. 164 (1865)). Grisebach (Fl. Brit. W. Ind. 42) cites Browne's plant (*Adelia Acidoton* L.), which, however, he had not seen, under *Acidocroton adelioides* Griseb., a totally different plant. Mueller cites *Acidoton* Browne as a synonym of *Securinega Acidothamnus*, but omits reference to *Adelia Acidoton* L., which he refers to *Acidocroton adelioides* in his lists of excluded species under *Ricinella* (p. 732), and *Bernardia* (p. 924), but does not cite it later in his description of *Acidocroton adelioides* (p. 1042). The name of the species is therefore Securinega Acidoton.

SHORT NOTES.

Chara fragilis and C. delicatula. In Braun's account of the Characeæ in Cohn's Krypt. Flor. Schles. (1876) *Chara delicatula* Agardh was treated as a species apart from *C. fragilis* Desv., of which it had previously been generally regarded as a variety. In Braun and Nordstedt's *Fragmente einer Monographie der Characeen* (1882) it was treated as a subspecies, and this latter course was followed in the ninth edition of Babington's *Manual.* We have lately been examining a considerable number of specimens of the two plants, and the characters which separate them appear to us sufficiently important to warrant their being treated as distinct species. *C. fragilis*, using the name in the restricted sense, has only rudimentary stipulodes, the primary and secondary cortical-cells of equal size, and no apparent spine cells: *C. delicatula* has well-developed stipulodes of one or both series, the primary cortical-cells distinctly larger than, often twice the diameter of, the secondary cells, and spine-cells clearly discernible though usually only papilliform. It was not until some years after an attempt to work out the distribution of the British Charophytes was begun, that the difference between the two sections of *C. fragilis* (*sens. lat.*) was appreciated; hence a number of the earlier records cannot be apportioned to either, and their separate distribution is therefore only imperfectly known. We shall be glad if British and Irish botanists will collect and examine specimens of any of these plants they may come across, with a view to completing the record of their respective comital distributions.—J. Groves and G. R. Bullock-Webster.

Impatiens glandulifera Royle. This is not recorded in Prof. A. H. Trow's *Flora of Glamorgan.* It grows abundantly in the meadows on either side of the river Ely for a distance of two miles west from the village of Peterston. A specimen from that locality has been added to the National Herbarium at the Cardiff Museum.—F. Blount Mott.

Juncus effusus spiralis (J. Bot. 1918, 358). This form is exceedingly abundant in Orkney—about every third *effusus* one comes across in the valleys of the mainland is *spiralis.* In 1906 I sent specimens to Prof. Balfour, at whose suggestion I wrote a note which is published in Trans. Bot. Soc. Edinb. xxiii. 233.—Magnus Spence.

REVIEW.

The Flora of the Northern Territory. By Alfred J. Ewart, D.Sc., Ph.D., F.L.S., and Olive B. Davies, M.Sc., with appendices by J. H. Maiden, F.R.S,, I.S.O., and by A. A. Hamilton and Edwin Cheel. Melbourne: McCarron, Bird & Co., 1917. Pp. viii, 287 : 24 plates.

Although bearing date 1917, copies of this volume only reached England towards the end of last year. The title is in some respects a misnomer, inasmuch as some of the omitted species have hitherto been recorded only from the Kimberley District or the country to the south and south-west comprised within the tropic. The reason for this would appear to be that Bentham in the *Flora Australiensis* included all this country in the term "North Australia," a fact sometimes overlooked by the compilers. The publication may be welcomed as an incentive to further exploration of this, even now, little-known part of the island continent. Its value as a handy guide would have been increased if the help of some one having access to the London herbaria had been secured, as those herbaria contain a large number of records either not known to or not noticed by Bentham. Especially is this the case with Robert Brown's and Allan Cunningham's collections, which, in spite of more recent labours, still remain the most important and fruitful in this special field. Moreover, access to the types of those collectors would have obviated mistakes into which the compilers could scarcely have fallen had they been more fortunately circumstanced with regard to the old material in question.

Although of necessity largely a compilation, the volume contains descriptions of new genera and species during the expedition by Gilruth and Spencer and the Barclay expedition, the dates of which are not stated. There are four new genera—two in Gramineæ (*Spatha* and *Setosa*), one in Caryophyllaceæ (*Rossittia*), and one in Convolvulaceæ (*Carpentia*): all of Ewart's. The first two names (the former is not in the index) are in opposition to the Vienna Laws, which are unfortunately ignored in other respects—*e. g.* the descriptions throughout are in English only, and are thus, by the Laws, not entitled to recognition. The novelties are illustrated by twenty-seven plates, which, though useful, leave a good deal to be desired as to execution: the large Roman figures on some of them are unnecessarily aggressive.

In its general get-up, indeed, the book is very unsatisfactory: we have seldom seen a volume in which the arrangement and typography offer so much ground for unfavourable criticism. The descriptions are given in clavis form, but the ordinary method by which the name of the species is separated from the description and brought out to the end of the line, the name itself being printed in different type from the text, is here ignored: the names are continuous with the text and the type is the same as that employed for it. Seeing that Bentham's *Flora Australiensis* must have been constantly in the hands of the compilers it seems almost incredible that the obvious convenience of its arrangement should have been ignored in favour of one for which nothing can be said. The resources of typography have not been utilized, the important aid to clearness which is afforded by a judicious use of black type—here reserved for the names of orders—has not been recognized, though almost every modern Flora illustrates its advantages. "The Flora of the Northern Territory" stands at the head of each page, which should be, as it is in all well-planned Floras, made a source of useful information. On the other hand, information is sometimes given which seems useless: of what gain can it be to those who use the book to know that for *Panicum*, for example, fourteen generic names have been employed? The space thus occupied—which in the aggregate is considerable—would have been better employed in adding useful bibliographical references, which are conspicuously absent. Here, again, there is a curious absence of system: the names and authorities are usually all in roman type, but sometimes all in italics.

There is no need to pursue a criticism which might be indefinitely extended, and which is undertaken in the hope that it may influence future publications from the same source; but a word must be said as to the Appendix on the Myrtaceæ, contributed by Mr. Edwin Cheel, which, whether regarded from a literary or a botanical standpoint, seems to us equally remarkable. *Melaleuca Leucadendron* and its limitations or extensions present much room for differences of opinion, but we cannot think that Mr. Cheel's efforts will do much to elucidate the difficulties presented. Mr. Cheel's views on nomenclature may be illustrated by a sentence which also indicates his literary style: writing of *Melaleuca Leucadendron* var. *coriacea* (*M. coriacea* Poir.), he says: "I have not seen the original specimens named by Poiret, but have taken up his name for this variety as it seems to be appropriate, and will cause less confusion than would be the case if Cavanilles's name '*quinquenervia*' was taken up as it should according to the rules of priority, owing to the fact of other varieties having five-nerves" (p. 297). Such entries as "coriacea, Poir, suppl. 3, 685 (non Salisb.), See. D.C., Prodr." and "var. angustifolia, Linn., Fil. and Pers. (1807)" are examples of citation which might easily be multiplied.

BOOK-NOTES, NEWS, ETC.

At the meeting of the Linnean Society on Feb. 6, two papers were submitted by Mr. N. E. Brown. The first dealt with a new species of *Lobostemon* in the Linnean Herbarium, to which Mr. Brown's attention had been directed by Mr. Lacaita. The sheet was inscribed by Linnæus *Echium argenteum*, but the plant could not be identified with any specimen of that species in the herbaria of the British Museum and Kew, or at the Cape: it is entirely different from *E. argenteum* Berg. (*L. argenteus* Buek), with which Linnæus supposed it to be identical. The plant, localised by Linnæus "montibus nigris" (Zwartberg) and collected at least 147 years ago, does not appear to have been found by any subsequent collector. In the second paper Mr. Brown described numerous old and new species of *Mesembryanthemum*, prefacing the descriptions with a history of the genus from the time of Haworth, who published four accounts of the genus between 1794 and 1821. Haworth's descriptions, though mostly from plants cultivated by himself or at Kew, are often insufficient for determination: but a large number of his species are represented in the series of excellent coloured drawings by two young gardeners, George Bond and Thomas Duncannon, who were employed at Kew by Aiton between 1822 and 1835 to draw plants cultivated there, and of whom some account will be found in *The Garden* for Jan. 24, 1880—reprinted in the third Supplement to this Journal for 1912 (p. 14). The drawings, mostly by Bond (who was alive in 1880), number about 2000, of which about a fourth represent *Mesembryanthemum*.

The recently issued part of the *Flora of Tropical Africa* (vol. ix. part 2, "1918") continues Dr. Stapf's monograph of the *Andropogoneæ*. The genus *Andropogon* is restricted on lines already laid down in the first part of the volume: a large number of the species formerly referred here are transferred to *Hyparrhenia*, here apparently first treated as a genus although it was adopted as a section by Hackel in his monograph. The name stands as "[N. J.] Anderss. (name only), in Nov. Act. Soc. Scient. Upsal. Ser. 3, ii. 254 [1856]"; it may, we think, be questioned whether it can claim recognition, as it stands only in synonymy: "*Anthistiria Pseudo-Cymbaria* Steud. = Est Hyparrheniæ sp." A new genus—*Dybowskia*—is established for *Andropogon Dybowskii* Franch. The species, of which a large proportion are new, are described at great length—many occupy a page or more: it is not quite easy to see for whose benefit these minutely detailed descriptions, testifying as they do to the carefulness which characterizes Dr. Stapf's work, are intended, as the botanist will, we think, find sufficient for his purpose in the keys to the species, which are very full; their extent must materially hinder the completion of the *Flora*, which was begun fifty years ago. We presume that steps have been taken, as in the case of the Floras of Madras and Jamaica, to secure the validity of the new names by the publication of a Latin diagnosis, in accordance with Art. 36 of International Rules: we note that the adjectival form of names of persons is spelt with a small initial (see Art. 26, Rec. 10).

The contents of the *Journal of Genetics* (vol. viii. no. 1) issued January 22 are mainly botanical. They include papers "On the Origin of a Mutation in the Sweet Pea," by Prof. R. C. Punnett; On Hybridization of some Species of Salix" conducted by S. Ikeno at Tôkyô (with plate); and "Studies of Inheritance in the Japanese Convolvulus," by B. Miyazawa (with coloured plate).

Science Progress for January contains a comprehensive summary of recent botanical research by Dr. E. J. Salisbury, the notices of plant physiology being contributed by Mr. Walter Smith. In the interests of the reader we venture again to call the attention of the editor, Sir Ronald Ross, to the singularly unhelpful and unilluminative headings of the right-hand pages, which with very little trouble might be made of great assistance to those who consult the Review.

Botanical Abstracts is the title of a new botanical journal, which has been set on foot by American botanists to take the place of the *Botanisches Centralblatt*, which, for various reasons connected with the War, has become unsatisfactory. It will be conducted by an editorial board, the various sections being undertaken by specialists.

We have received two numbers of the *Bulletin of Scientific and Technical Societies*, which is issued fortnightly at Burlington House at the cost of 6*d*. by the Conjoint Board of Scientific Societies. Each number contains a diary of meetings to be held in the fortnight succeeding its publication, with titles of the papers to be read at each and an indication of future meetings. Communications regarding it should be sent to Prof. R. A. Gregory, 10 St. Martin's Street, W.C. 2.

MISCELLANEA BRYOLOGICA.—VI.

By H. N. Dixon, M.A., F.L.S.

(Continued from Journ. Bot. 1916, p. 359.)

Chætomitrium Deplanchei Duby, and its allies.

Chætomitrium Geheebii was described by Brotherus in Oefv. af Finska Vet.-Soc. Foerh. xxxvii. 165 (1895), from Queensland and Papua. It is there stated to be allied to *C. torquescens* Bry. Jav., *C. depressum* Mitt., and *C. Deplanchei* Duby. The differentiating characters from these species are not mentioned. In the key to *Chætomitrium* in the *Musci* Brotherus makes the following distinctions:—

Seta faintly papillose only near the summit; branches flattened; leaves scarcely concave ...	*C. Deplanchei.*
Seta clearly papillose for some distance downwards; branches scarcely flattened; leaves very concave	*C. tahitense.* *C. Geheebii.*

C. Geheebii Broth. is recorded by Brotherus and Watts in the "Mosses of the New Hebrides" (Journ. Proc. Roy. Soc. N.S. Wales, xlix. 146), as collected by Bowie in Tongoa Santo (under the numbers 110 *b* and 177 in Herb. Watts), and a sterile specimen of this (No. 177) was sent me by the Rev. W. W. Watts. I have also in my collection a specimen of what is clearly the same gathering (Tongoa Santo, leg. Bowie) sent me by Mr. G. Webster (No. 581): this is in fruit, and comparison with the description of *C. Geheebii* showed one or two distinct differences from that. *C. Geheebii* should have a seta of 1 cm., scaberulous throughout except at the base; the capsule sub-horizontal, curved, and the leaf margin erect. The New Hebrides specimen showed setæ considerably above 1 cm., reaching to 1·5 cm., scaberulous only at the apex; the capsule erect or nearly so, and practically symmetrical, not or scarcely curved; while the leaves had the margin distinctly reflexed, especially near the apex, where the leaf is suddenly contracted in the curious way characteristic of several species of this genus. Correspondence with Rev. W. W. Watts established the fact that these differences existed in his specimens also, and it seemed clear that the New Hebrides plant represented an allied but distinct species, probably new. Mr. Watts consulted Dr. Brotherus on the matter, but communications were entirely cut off by the war, and have not yet been re-opened.

Before describing it as new, I thought it necessary to compare the allied Oceanic species, especially *C. tahitense* (Sull.) and *C. Deplanchei* Duby. A sterile specimen of *C. tahitense* at Kew showed a very similar plant, but with the leaves much shorter and more shortly acuminate and less contracted below the apex, and the margin very little reflexed.

I then examined *C. Deplanchei* in the British Museum collection. The specimen in Herb. Hampe showed leaves almost exactly like those of *C. tahitense*, and differed also from Bowie's New Hebrides plant in the perichætial leaves narrower, more plicate, and with the apex still more remarkably ciliate-laciniate than they are there. The seta, just 2 cm. long, is finely papillose about half-way down, though faintly only.

This appeared to show a distinct difference in both species as regards the leaves, from both *C. Geheebii* and the New Hebrides plant, and in *C. Deplanchei* at least as regards also the fruiting characters. An examination of the specimens of *C. Deplanchei* in Bescherelle's herbarium, however, put an entirely different complexion on the matter. There are several gatherings represented, of Deplanche's and Vieillard's, from Lifou or New Caledonia (the labelling "Nouv. Caledonie" in some cases and probably in all includes the Island of Lifou); and these, while clearly all belonging to the same species, showed a great and unexpected degree of variation. The seta varies from 1 cm. to 1·75 cm. on the same tuft; the capsule is usually suberect and symmetrical, but may be, on the same plant, also decidedly inclined and curved; the seta is usually papillose only near summit, but may be (as in Hampe's specimen) more or less papillose below. The leaf-point varies much in degree of acumination, &c., one specimen showing many leaves quite identical with Bowie's plant, while others approach very nearly the form and character of Hampe's specimen and *C. tahitense*. The perichætial leaves also exhibit a good deal of variation in width, degree of plication, and in extent of ciliation. I do not find any marked difference in the concavity of the leaves between the various plants. There can be no question at all that both *C. Geheebii* and the New Hebrides moss come within the range of *C. Deplanchei*.

As to the position of *C. tahitense*, I am not quite so clear. As far as the vegetative characters go, it might certainly be identical with *C. Deplanchei* as represented by the plant in Hampe's herbarium. But Sullivant describes the perichætial bracts as ciliate-dentate, and as "very strongly papillose at back." In *C. Deplanchei* the outer bracts are papillose, and are moderately ciliate-dentate above; the inner are smooth, and have the margins very strikingly fringed and lacerate with branched and re-branched cilia, frequently ending in a bi- or tri-cuspidate tip, reminding one of the processes of certain species of *Staurastrum* or similar Desmids. Sullivant's figure of the perichætial bract of *C. tahitense* does not indicate any structure of the sort, and the description, ciliate-dentate, is somewhat ambiguous. If, however, the bract figured were an outer one, and the description of the dorsal papillæ applied to that, it would represent very nearly an outer bract of *C. Deplanchei*. At the most, I think, even if the bract figured represented an inner one, the difference would hardly be sufficient for a specific character, especially bearing in mind the somewhat wide range exhibited by the perichætial bracts of the New Caledonian moss, and I suggest for it a varietal rank for the present, while fully anticipating that further examination of the fruiting plant may finally relegate it to the synonymy of *C. Deplanchei*.

The synonymy will then stand thus:—

Chætomitrium Deplanchei (Besch.) Duby MS. c Jaeg. & Sauerb. Adumbr. ii. 273 (1875–6).

Syn. *Holoblepharum Deplanchei* Besch., Fl. bryolog. Nouv. Caledon. 227 (1873).

Chætomitrium Geheebii Broth. in Oefv. af Finska Vet.-Soc. Foerh. xxxvi. 165 (1895).

Distrib. New Caledonia, North Queensland, Papua, New Hebrides.

Var. *tahitense* (Sull.).

Bracteæ perichætiales brevius ciliatæ, tantum ciliato-dentatæ, dorso alte dense papillosæ.

Syn. *Holoblepharum tahitense* Sull. in Amer. Expl. Exped. Wilkes, 1859, p. 22, t. 23.

Chætomitrium tahitense Mitt. in Fl. Vit. p. 392 (1871).

Distrib. Tahiti.

Paris, Ind. Ed. ii. 343, has several errors in his citation of this species.

Gymnostomum oranicum Rehm.

The Hymenostoma and their allies of South Africa are difficult to grasp, and will probably not be satisfactorily elucidated without an examination of C. Mueller's types at Berlin. One misconception may as well be cleared up, however. Rehmann issued No. 19, Musci Austr.-Afr. as *Gymnostomum oranicum.* C. Mueller published this in Hedwig. xxxviii. 112, as *Weisia* (*Hymenostomum*) *oranica* Rehm., but makes no reference in his description to the capsule orifice beyond the terms "theca . . . microstoma . . . annulo nullo."

On examination of Rehmann's No. 19, however (Bloemfontein, Orange Free State), I find a peristome distinctly present. The 16 teeth are very minute, very little exserted above the capsule mouth, and sometimes not at all, very narrow and pale; but they are regular, articulate, linear, smooth and hyaline. It is therefore a true *Weisia*, not *Hymenostomum.* The dioicous inflorescence appears to be the principal character by which it can be separated from *W. viridula* (L.).

Anœctangium scabrum Broth.

Among some mosses collected by Wm. Leighton in 1917 on Mt. Meru, German East Africa, at 5–6000 ft. altitude, sent to me for determination by Mr. T. R. Sim of Maritzburg, were two gatherings of a minute *Anœctangium*, one shorter and much more dense and compact, but both belonging to the same species. They agreed with the description of *A. scabrum* Broth. precisely, and with an original specimen of Holst's gathering at Kew; they also agree with the description of *A. pusillum* Mitt., with the sole exception that Mitten (in Journ. Linn. Soc., Bot. xxii. 305) describes his species, collected by Bishop Hannington on Kilimanjaro, as "nervo . . . . . dorso laevi," and notes "a small species, which agrees very nearly with *A. Mariei*, Besch., from Nossibé; but the apices of the leaves are wider and their nerve is not papillose."

Feeling some doubt as to the distinctness of the two, I asked Mrs. Britton to allow me to see a specimen of *A. pusillum*, and she kindly sent me part of the original gathering. As I rather expected, the nerve is distinctly, though finely scaberulous at back, and the plant is exactly identical with *A. scabrum* Broth. Mitten's misdescription is, I think, easily explained, while unfortunate. He compares his species with *A. Mariei* Besch. Now *A. Mariei*, which according to Cardot (M. de Madagascar, p. 215) is identical with *Barbula indica* (Schwaeg.) Brid. (*Trichostomum orientale* Willd.), is a species with the back of the nerve very highly and strongly scabrous or almost tuberculate, compared with which the nerve of *A. pusillum* might not unreasonably appear smooth. Smooth, however, it is not, and Mitten's description of it as such has not unnaturally led Brotherus, in the absence of specimens (which existed only in Mitten's herbarium), to re-describe the plant as *A. scabrum*. *A. scabrum* must, however, fall into the synonymy of *A. pusillum* Mitt.

Taxithelium gottscheanum (Hampe) Broth.

Hampe (in Linnæa, 1874, p. 568) described this Philippine Is. species as *Hypnum Gottscheanum*. Subsequently he was led to suppose it to be identical with *T. capillipes* Broth. (*H. capillipes* Bry. Jav.), and he has corrected the labelling of all the three specimens in his herbarium to "*H. capillipes*" and "*capillipes* Bry. jav." I do not know that he ever published this correction, but even if he has not done so it may be well to remark that the identification is certainly erroneous. *H. capillipes* has the cells scarcely visibly papillose; the papillæ are so delicate, indeed, that they at first escaped the notice of the authors of the *Bryologia Javanica*, and it is only in a supplementary note on p. 228 that they add "Folia quam subtilissime punctulata, nec lævia." The Philippines plant, on the other hand, has the leaf cells very distinctly, not to say highly, papillose, almost to the base, and it would be quite impossible for this to be overlooked, and Hampe's species may certainly stand.

Hypnum scabrellum Lac. and its allies.

Lacoste in the *Bryologia Javanica* described *Hypnum scabrellum* from sterile specimens collected by Korthals in Sumatra, and a Celebes specimen in the Leyden Herbarium; adding "Flores et fructus ignoti." The inflorescence has been considered as probably dioicous. It is the *Sematophyllum scabrellum* of Par. Ind., but Cardot has shown good reason for considering it identical with the Samoan *S. lamprophyllum* of Mitten, a name which therefore has the priority.

Beccari issued No. 37 of his "Crittogame di Borneo," a fertile plant from Sarawak, as *H. scabrellum*; and Hampe, in describing Beccari's plants in Nuov. Giorn. Bot. ital. iv. 284, describes the fruit of this plant under that name. An examination of Beccari's plant, however, shows that it is not identical with Lacoste's species, and Hampe's description of the fruit must therefore not be taken as descriptive of *S. scabrellum*, i.e. *S. lamprophyllum*. Beccari's plant, to begin with, is autoicous; the leaves are considerably wider than in. *S. lamprophyllum*, the alar cells are quite different, not indeed showing the characteristic inflated cells of *Sematophyllum*, usually consisting of a single large inflated cell and several much smaller irregular thick-walled ones. The upper cells show regularly seriate, fine, acute papillæ; the perichætial bracts also are markedly papillose. In view of the character of the alar cells, and the seriate papillæ of the upper ones, I have little doubt that the plant is not a *Sematophyllum*, but a *Trichosteleum*.

The fruit of the true *S. lamprophyllum* is to be seen on the plant issued by Max Fleischer as *Pungentella scabrella* (Lac.) C. M., No. 389, Musci Frond. Archip. Ind. Ser. viii. from West Java. This agrees in habit, leaf-form, and basal cells with the *H. scabrellum*. The perichætial leaves are comparatively short, erect, rigid, finely but shortly subulate, practically entire, and smooth. Seta about 1 cm., scaberulous above. No male flowers appear, the plant is undoubtedly dioicous. No. 5417, Perak, coll. Wray, in Herb. Mus. Brit., also appears to be the correct plant.

In Journ. Linn. Soc., Bot. xliii. 321, I referred to *S. lamprophyllum* (Mitt.), a plant of Rev. C. H. Binstead's from Borneo, which, however, I find must also be considered distinct, as the fruiting characters do not agree with those of Fleischer's No. 389. Especially it is autoicous, and the perichætial bracts are sharply and rather closely denticulate. It appears to be undescribed, and may be diagnoted as follows :—

Sematophyllum decipiens Dixon, sp. nov. Habitu *S. lamprophylli* Mitt., sed paullo robustius, foliis latioribus, ovato-lanceolatis, concavis, marginibus erectis, acumine breviuscule subulato, denticulato. Autoicum. Flores masculi, numerosi, parvi. Bracteæ perichætiales magis abrupte angustius acuminatæ, sat conferte denticulatæ, dorso sublæves. Seta perbrevis, circa 5 mm. longa, capillaris, lævis; theca minuta, ·75 mm. longa, horizontalis.

Hab. Damp rock in jungle, Sapong, near Tenom (No. 211 *b*).

The autoicous inflorescence removes it from the otherwise nearly allied species; the denticulate perichætial bracts also from *S. lamprophyllum*; the wider leaves from *S. subulatum* (Hampe); the smooth seta, scaberulous cells and larger capsule from *S. microthecium* Broth. & Paris.

Ceylonese Mosses.

Two or three corrections need to be made in my paper in Journ. Bot. 1915, 257, on the Rev. C. H. Binstead's Ceylon mosses.

P. 259.—*Dicranoloma leucophyllum* (Hampe) Par. var. *Kurzii* Fleisch. appears to be rather a varietal form of *D. brevisetum* (Doz. & Molk.) Par.

P. 289.—*Trachyloma indicum* Mitt. This agrees quite well with a New Guinea specimen determined by Mitten as his species. Fleischer has, however, pointed out that this species has been confused with *T. tahitense* Besch., a closely allied species with less glossy, shorter pointed leaves and quite distinct areolation. To this latter he refers Ceylonese specimens collected by himself; and I find that both the New Guinea plant and Binstead's No. 304 from Ceylon must be referred there also *.

P. 289.—*Pterobryopsis Walkeri* Broth. (No. 302). This must be referred to *P. frondosa* (Mitt.) Fleisch.

P. 291.—*Stereophyllum papillidens* Card. ined. Thériot (Ann. Conserv. de Genève, xx. 15) refers this plant (No. 38) to *Stereophyllum indicum* (Bél.) Mitt., a much misunderstood species, which *S. papillidens* Card. closely resembles, but which has some real distinction in the cell structure.

Bryum Bescherellei Jaeg.

The New Zealand species of the Erythrocarpa and allied groups are very difficult, and present some very perplexing problems. I am looking forward—with no great appetite for the task—to attempting to solve these in the near future, and I have no intention of anticipating that task now; but one complication may be cleared away at once. Authors in dealing with the New Zealand Brya (Brotherus, Jaeger, Bescherelle, Paris, C. Mueller) have displayed much ingenuity in differentiating two plants, *B. erythrocarpoides* Hampe & C. Mueller, and *B. erythrocarpoides* Schimp. For the latter Jaeger, followed by Paris, &c., has altered the rame to *B. Bescherellei*, to avoid duplication, while C. Mueller in Hedwig. xxxvii. 90 (1898), ignoring these authors, has quite unnecessarily re-christened it *B. torulosicollum*.

It does not appear that any of the authors concerned have taken the trouble to compare the two plants with one another, none of them at any rate make any comparison between them; they appear to have assumed that, as Schimper saw a difference, it was "theirs not to reason why." The evidence for there being two distinct plants concerned does not therefore appear, *prima facie*, to be very weighty, and what is to be said of it, when the fact is, so far as I can see, that Schimper himself never saw any difference between them!

Bescherelle (Flore Nouv. Caled. in Ann. Sc. Nat. 5 Ser. xviii. p. 214 (1873) describes *B. erythrocarpoides* Schimp. in herb. as a new species, based on New Zealand specimens ex herb. Schimper, leg. Knight, and New Caledonian ones leg. Krieger, 1866; and all subsequent authors have assumed this to be a different thing from *B. erythrocarpoides* Hampe & C. M. (1853). Bescherelle makes no reference to the earlier *B. erythrocarpoides*, and all the evidence goes to show he had overlooked it. No specimens of the New Caledonian plant are to be found in our collections, but Knight's plant, "N.Z. 1867," the type of the supposed *B. erythrocarpoides* Schimp. is labelled by Schimper himself in his herbarium "*B. erythrocarpoides* Hpe. & C. M." The whole trouble seems to have arisen from a lapsus calami of Schimper, as the only New Zealand specimen in Bescherelle's herbarium is labelled "*B. erythrocarpoides* Sch." [in Schimper's hand] "N. Zélande, Herb. Schimp." (in Bescherelle's hand); and this is identical with a specimen in the British Museum

* Thériot, I find, considers this plant distinct from *T. tahitense*, and names it *T. Fleischeri*, to which therefore all the above plants must be referred (*cf.* Bull. de l'Acad. Internationale de Géogr. bot. 1910, p. 100).

collection labelled in Schimper's own hand "*Bryum erythrocarpoides* Hpe. & C. M., 156, N. Zealand [ex herb. Hpe.]."

The bottom is therefore knocked out of *B. Bescherellei* Jaeg. Comparison of Knight's N.Z. plant and the original (Australian) *B. erythrocarpoides* Hampe & C. M. at first sight, it is true, suggests a difference, as the latter has rather wider, paler capsules with a quite obtuse lid, whereas the No. 156, N. Zealand has dark purple brown capsules with acute, apiculate lids, points which might constitute a difference; but as the latter plant is labelled *B. erythrocarpoides* Hpe. & C. M., and is from Hampe's own herbarium, it is clear that both plants fall under the same species according to Hampe's own thinking. And further, New Zealand plants showing an intermediate form of lid occur in Schimper's herbarium as "*B. erythrocarpoides* Hpe. & C. M., Tauranga, leg. Hutton, 1866." These have exactly conical, obtuse lids, and others highly convex and distinctly apiculate, on the same gathering, and show that Hampe and Schimper were quite right in uniting them under *B. erythrocarpoides* Hampe & C. M.

A further difference might appear to consist in the inflorescence, as Bescherelle describes his "*B. erythrocarpoides* Schimp." as synoicous, while all the other plants are dioicous. The New Zealand specimens on which Bescherelle bases his species (leg. Knight) are, however, certainly *not* synoicous, and it appears that Bescherelle was deceived in this respect (*cf.* Brotherus, *Musci*, p. 589). In that case, *B. erythrocarpulum* C.M., which according to the author is differentiated from Bescherelle's New Caledonian plant principally—probably entirely—on the ground of its dioicous inflorescence, must clearly fall into the same synonymy.

The matter may be summed up thus :—(*a*) there is no difference between *B. erythrocarpoides* Hampe & C. M. and *B. erythrocarpoides* Schimp.; (*b*) Schimper never supposed there was any.

The synonymy will then stand thus—with further synonyms probably to be added later :—

Bryum erythrocarpoides Hampe & C. M. in Linn. 495 (1853).

Syn. *B. erythrocarpoides* Schimp. e Bescherelle in Ann. Sci. Nat. 5 Ser. xviii. 214 (1873).

B. Bescherellei Jaeg. Adumbr. i. 627 (1873–4) nec *B. Bescherellei* Ren. & Card. in Bull. Soc. roy. Belg. 1891, ii. 188.

B. torulosicollum C. M. in Hedwig. xxxvii. 90 (1898).

B. erythrocarpulum C. M. *op. et loc. cit.*

Barbella levieri (Ren. & Card.) Fleisch. c. fr.

Meteorium Levieri was described by Ren. & Card. in Bull. Soc. roy. Belg. xli. pt. 1, p. 78, from sterile plants collected in the Sikkim Himalayas, and from Japan, and subsequently recorded from Formosa. A plant sent to me from the N.Y. Bot. Garden, from Mitten's herbarium, "Meteorium, Pathkay *, Griffith" agrees vegetatively with

* The second syllable is uncertain,—on another label it was transcribed Pathkoi.

the Formosa plant, the only difference being that the branches are more equal and more regularly pinnate. The plant is in fruit, and it differs notably from most species of the genus *Barbella* in the seta, which is longer than usual, and in the peristome. In most of the species the seta is only as long as the capsule, or 2–3 times as long; in only two or three it is considerably longer (*B. comes* 3–5 mm., *B. Kurzii* 6 mm.). Here it is fully 10 mm., and sometimes 12 mm. long, thin, rugulose-papillose in the upper part. The peristome characters are still more marked, as the outer teeth are densely transversely striolate for a great part of their length, a character not hitherto found in *Barbella*, where they are at most striolate only near base. In view of the vegetative structure, however, this character is not sufficient, I think, to remove the plant to any other genus.

"EPIPACTIS MEDIA (Fries!)" Bab.

By Colonel M. J. Godfery, F.L.S.

The history of the above name is very curious. Leighton says (Fl. Shropsh. p. 434, 1841) "Mr. Babington has directed my attention to a plant which we gathered in 1835 in the woods on the west side of Bomere pool, and which we supposed at the time to be *E. latifolia*, but which he has recently determined to be *E. viridiflora* Reich." (Fl. Germ. Exc. p. 134, 1830). He then quotes Babington's description, as follows:—"2. *E. viridiflora* Reich. Leaves ovato-oblong, the upper ones lanceolate acute; the lower bracteas longer than the flowers; the terminal division of the lip triangular-cordate acute, as long as the lanceolate petals and sepals. *Reich. Icon.* f. 1142. *Reich. Fl. Excurs.* n. 891. *Petermann, Fl. Lips.* 641. Narrower and more elongated in all its parts than *E. latifolia*, only the lowest *leaves* ovate, the intermediate ones lanceolate, and the upper ones lanceolato-attenuated and merging gradually into the linear-lanceolate *bracteas*. *Flowers* 'green tinged with purple'; *peduncle* shorter than the downy *germen*. Lobe of the *lip* longer than broad, crenate. Woods at Bomere pool, Salop, and Luton, Kent." The above is practically identical with Babington's description of *E. media* Fries (Man. Brit. Bot. p. 295, 1843). It is clear, therefore, that he first considered the Bomere plant to be *E. viridiflora* Rchb., and later published it as *E. media* Fries. The reason for this may be gathered from Leighton, who says, further on, "Fries (Nov. Mant. alt. p. 54) considers *E. viridiflora* Reich. as a variety 'floribus viridibus' of his own *E. media*." Fries, however, does not quite say this. He wrote "E. media (b) floribus-viridibus Reich. ic. f. 1142, sec. Koch." He does not say that from personal observation *he* considered them the same, but that, to judge from Koch, *E. viridiflora* is the same as his green-flowered *media*.

I think we are justified in concluding that Fries did not personally know *E. viridiflora*, as, if he had done so, he would have given it as a synonym without qualifying it with the words "according to Koch."

The fact that he did so qualify it shows that he was not sure of it from his own knowledge, and transferred the responsibility to Koch. Rouy tells us that *E. viridiflora* is often confused with the variety of *atrorubens* with yellowish green or green flowers (Fl. de France, vol. xiii. p. 204), and there can be no reasonable doubt that Fries intended his "*b. floribus viridibus*" to refer to these green-flowered forms of his own *E. media*. Koch names the latter *E. latifolia β. rubiginosa* (Syn. Fl. Germ. et Helv. pp. 694–5) and adds:—"Haec quoque occurrit floribus virentibus, ad quam *E. viridiflora* Rchb. ic. 9, f. 1142, et *Serapias latifolia viridiflora* Hoffm. referendæ sunt." From this it is clear that he regarded Fries's (b) floribus viridibus as referring to green-flowered forms of *E. atrorubens*, and that he fell into the error mentioned by Rouy of confusing the latter with *viridiflora*. Koch evidently had not arrived at a final and considered opinion as to how many species existed in the genus *Epipactis*, for he gives *atrorubens* as a variety of *E. latifolia*, and admits that further observations are necessary to determine whether it is a distinct species or not. It is no matter of surprise, therefore, since he was confessedly unable of his own knowledge definitely to separate *E. atrorubens* from *E. latifolia* as a species, that he was also unable to distinguish green-flowered forms of *atrorubens* from *viridiflora*, for, on account of their colour, the resemblance of both these latter plants to *E. latifolia* is more obvious than that of typical red-purple *atrorubens* itself. His attitude of mind was hesitating, but it is evident that he provisionally regarded *latifolia*, *atrorubens*, and *viridiflora* as one and the same species, and would thus be very likely to consider *viridiflora* as identical with green-flowered forms of *atrorubens*. Babington was clearer sighted, for he recognized both *atrorubens* and *viridiflora* as distinct species, but he unfortunately allowed himself to be misled by Koch, and, abandoning his correct identification of *viridiflora*, described the Bomere plant as *E. media* Fries. This error led on to another, for it blinded him to the fact that the true *E. media* Fries really did grow in England, and he actually described it as a new species under the name *E. ovalis* Babington. Fries himself tells us that his *E. media* "(c) floribus roseo-rubris" is identical with *E. atrorubens*, so that this fact is beyond dispute.

I am much indebted to the kindness of Mr. R. F. Burton of Longner Hall, Salop, who, at my request, was good enough to explore the woods of Bomere pool, with a view to ascertain what species of *Epipactis* still grow there. He says:—"To-day (Aug. 15th, 1918) I walked over to Bomere pool and right round it, and round Shomere (about 300 yards this side of it). The chief plants, not counting trees, are sphagnum-patches, with nettles, *Digitalis*, Dog Mercury, blackberries, and bracken on the sides above the sphagnum, containing, as far as I could see, very few Orchidaceæ. I enclose the only samples of *Epipactis* in sight." Unfortunately, when these specimens arrived, the flowers were withered, owing to the heat, but on dissection, the position of the anther on the summit of a distinct stalk, its projection over the upper edge of the stigma, and the presence of a V-shaped incision in the wall of the column between the anther and the stigma, were visible, and these are the distinguishing characteristics of *E. viridiflora*. As Mr. Burton found no other kinds of *Epipactis* at Bomere, and as Babington originally identified his Bomere plants as *viridiflora*, these facts may be regarded as fairly conclusive proof that his original identification was correct. This is confirmed by Babington's description, which, as far as it goes, exactly fits *E. viridiflora* var. *leptophylla* (Journ. Bot. 1919, p. 39), with the exception of the words "flowers green tinged with purple." This is a very minor point; Mr. Stephenson mentions that in his forma *vectensis* (Journ. Bot. 1918, p. 1) they are sometimes so tinged, and they frequently are so on the Continent.

The drawing of *E. media* in E. B. S. 2775, was made from a specimen of *E. purpurata* (*E. violacea*) (E. B. ed. ix. 124) from Woburn Abbey, Bedford. We have therefore this anomalous position—a plant identified as *E. viridiflora* Rchb. by Babington was published by him as *E. media* Fries, and illustrated in E. B. by a drawing of *E. violacea*! When the third edition of E. Bot. was published, the plates from the Supplement were embodied therein; the reproduction of No. 2775, however, as I noticed at Kew, instead of adhering to the subdued colours of the original, was printed with bright reds and yellows, and is thus very far removed in appearance from *E. violacea* (which it originally represented) and suggests a much over-coloured *E. latifolia*. Perhaps it was partly due to this that the idea arose that Babington's *E. media* was a plant nearly resembling *latifolia*, but differing from it by longer and narrower leaves, and rugose, instead of smooth bosses on the lip.

So we find it appearing in the 14th ed. of Hayward's *Botanists' Pocket-book*, as *Helleborine latifolia c. media* Druce. The same work recognises *E. violacea* as a separate species under the title *H. purpurata* Druce, so that it appears to have been overlooked that the E. B. S. plate of *E. media* was drawn from a specimen of *E. purpurata*.

In 1917 Mr. Druce, at my request, very kindly sent me two or three specimens of *media*. I was unable to detect any difference between them and *E. latifolia*, the ostensible one being that the bosses of the lip were rugose in *media* and smooth in *latifolia*. In his letter accompanying the specimens, Mr. Druce said: I think, however, the plicate-rugose bosses are not sufficiently distinctive characters to be of specific value." With this I entirely agree.

In a wood near Eashing, Surrey, where only *E. latifolia* grows, rugose hunches were more common than smooth ones. The difference is a slight one—in the one the epidermis is wrinkled, in the other it is sufficiently expanded to smooth out the wrinkles. It is curious to note how, in course of time, the name *E. media*, given by Babington to *E. viridiflora*, has become transferred to ordinary *E. latifolia* with rugose hunches. Fries in his *Mantissa* says of his *E. media*: "carina plicato-crenata, quo certissime differt a *E. latifolia* in qua . . . . carina non plicato crenata." Probably it was from this that the idea arose that Babington's *media* was separable from *latifolia* by its rugose hunches, and this was strengthened by the E. B. S. plate 2775, as pointed out above.

To sum up, the plant which Babington described as *E. media*

Fries, was in reality *E. viridiflora* Reich., and the first record as a British plant is Leighton's, on the specimens found by him and Babington in 1835. The subsequent application of the name *E. media* to specimens of *E. latifolia* with rugose bosses appears to have been founded on a misapprehension, and the term *E. media* should now disappear from British botany, except as a synonym of *E. atrorubens*.

AQUATIC ANGIOSPERMS:

The Significance of their Systematic Distribution.

By Agnes Arber, D.Sc., F.L.S.

It is generally recognized that the primæval forms of vegetable life were probably aquatic, and that it is only in the highly evolved group of the Seed Plants that a terrestrial habit has become firmly established. It follows that any aquatics met with among the Spermophytes must be regarded as descendants of terrestrial ancestors, which have reverted in some degree to the aquatic habits of their remote forbears. That this view is tenable, and that the Aquatic Angiosperms cannot trace their ancestry in an unbroken aquatic line from some far away algal progenitor, is demonstrated by the fact that their floral organs, in the vast majority of cases, belong to a decidedly terrestrial type.

From a study of the mode of systematic distribution of aquatic families and species among the Angiosperms, certain general conclusions may be deduced. The most obvious and striking feature is the relative paucity of hydrophytes, in comparison with terrestrial plants. Contrasted with those that live on land, the number of aquatic families is so small as to be almost negligible, and even when all the individual hydrophytic genera and species are added, the sum total is relatively insignificant. This result is, however, hardly surprising when we consider that the Phanerogams are essentially a terrestrial stock, and are distinguished from the Cryptogams by their aerial mode of pollination, which has won for them the freedom of the land. Under these circumstances, the reversion to aquatic life could hardly be expected to occur on any great scale. It must also be remembered that the entire area of the fresh waters of the globe is very small as compared with the land surfaces, and that thus the aquatic Angiosperms occupy a much more restricted field than their terrestrial compeers.

The mode of systematic distribution of aquatics among the Angiosperms shows every possible variety. Among the Dicotyledons there are cases in which only one species of a terrestrial genus is aquatic (e. g. *Polygonum amphibium*), and others in which a number of species in a genus are hydrophytic while some are terrestrial (e. g. *Ranunculus* with its aquatic sub-genus *Batrachium*). Again, an entire genus of an otherwise terrestrial family may be aquatic (e. g. *Hottonia* among the Primulaceæ), or several genera of family may be aquatic (e. g. *Jussieua*, *Ludwigia*, etc., among the Onagraceæ, and *Limosella, Hydrotriche*, etc., among the Scrophulariaceæ). Finally, an entire family may be aquatic and contain no terrestrial forms (*e. g.* Podostemaceæ). A family given over wholly to aquatic life may include a number of genera (*e. g.* Nymphæaceæ and Podostemaceæ) or a single genus (*e. g.* Ceratophylleæ and Callitrichaceæ). Among the Monocotyledons, on the other hand, we meet with more cases of entire families leading a water life (*e. g.* Lemnaceæ, Pontederiaceæ, and various families belonging to the Helobieæ), but there are fewer instances of individual aquatic genera and species belonging to families which are mainly terrestrial, though these occasionally occur (e. g. *Glyceria aquatica* of the Gramineæ).

When one genus or species in an otherwise terrestrial family has taken to aquatic life, this may well be held to indicate that the habit is a recent one; but when a whole family containing a number of genera is found to be hydrophytic, it is hardly possible to avoid the conclusion that the differentiation of the genera has occurred since the adoption of the aquatic habit, which, on this view, must be very ancient. The only other alternative, namely, that all the genera have been evolved in the course of terrestrial life, and that they have all subsequently and independently taken to the water, seems too far-fetched to be considered seriously. A scrutiny of the characters of those aquatic families which contain a number of highly individualized genera confirms the notion that such families adopted aquatic life at a relatively early stage in the course of evolution of the Angiosperms. The Nymphæaceæ show characters that are markedly primitive among the Dicotyledons, and the Podostemaceæ, though not standing so low in the scale of floral evolution, yet appear to be a very old phylum related to the Rosales and Sarraceniales. That is to say, the only Dicotyledonous families which are exclusively aquatic and also contain a number of distinct genera, belong to the more primitive groups among the Polypetalæ, and hence may be regarded as ancient lines which took to the water before they had diverged widely from the ancestral type.

Among the Helobieæ, the Alismaceæ are probably nearest to the ancestral stock. This family shows characters which are in many ways decidedly Ranalean, and which suggest that the Helobieæ represent a branch that took to the water at a very early stage in the evolution of the Monocotyledons, while they still retained features recalling the Ranalean plexus from which they sprang. That they are descended from a geophytic ancestor is suggested by the characteristically abbreviated main axis, which in many cases does not elongate except to form the stalk of the inflorescence. It is also perhaps conceivable that the enlarged hypocotyl of the embryo recalls an ancestor which possessed a hypocotyledonary tuber, resembling that of *Eranthis hiemalis*, the chief difference being that in the Helobieæ the storage of food in the hypocotyl has been shifted back to a pre-germination stage, owing perhaps to the exigences of aquatic life. It may be recalled in this connexion that tuberous hypocotyls are common among Ranunculaceæ with concrescent cotyledons, that is to say, among forms which certain botanists would interpret as supplying indications of the characters of the original Monocotyledonous stock.

The idea that the Helobieæ are descended from a very ancient group of Angiosperms and have inhabited the water for a correspondingly long period, is ratified by the fact that this series consists of a whole plexus of related families, some of which have departed widely from the original type; it contains forms as far asunder, for instance, as *Alisma* with its many Ranalean features and *Naias* which represents the very acme of floral reduction.

The fact that the Nymphæaceæ and the related Ceratophylleæ on the one hand, and the Helobieæ on the other, have taken to aquatic life with such conspicuous success suggests that the original Ranalean stock from which they both sprang may have been particularly well adapted to water life. In the Ranunculaceæ the tendency to aquatic habits in the case of the genus *Ranunculus* is obvious; besides the definitely aquatic sub-genus *Batrachium*, the Buttercups include a number of forms, such as *R. sceleratus* and *R. flammula*, which are capable both of land and water life. The singularly slight difference in general anatomy between the terrestrial and aquatic species of *Ranunculus*, suggests that the land forms are of a type which does not require great changes of structure in order to succeed in water life.

It is a remarkable fact that the Sympetalæ—the most highly evolved group of Angiosperms—has produced no entirely aquatic family, nor any single aquatic species which has become so far adapted to water life as to have acquired submerged hydrophilous pollination. The very large family of the Compositæ, which may perhaps be classed as the ultimate term of the Sympetalous series, contains apparently less than half-a-dozen aquatic members. Exactly the same is true of all the earlier cohorts of Engler's Archichlamydeæ, which, on the present writer's view, represent the more advanced and reduced forms of the series. The families which are generally known as Polypetalæ (the later cohorts of Engler's Archichlamydeæ) and which, on this view, include all the more primitive Dicotyledons, are markedly richer in aquatic types. It would hardly be going too far to say that independent aquatic families are chiefly characteristic of the Ranalean plexus, and of its derivatives—both Dicotyledonous and Monocotyledonous—while among the more advanced Polypetalæ and the Sympetalæ, the sporadic occurrence of aquatic types and their close relation to terrestrial forms, indicate that the water-habit has been acquired comparatively recently. It is always possible that those individual genera and species among the Sympetalæ which are aquatic at the present day, may each, in some future age, be represented by an entire aquatic family; for such groups as the Helobieæ, Nymphæaceæ and Podostemaceæ may owe their richness in genera and species partly to their ancient birth and to the length of time that has elapsed since they took to the water. But, on the other hand, a member of the Sympetalæ embarking at the present day upon an aquatic career, may possibly be handicapped, as a potential ancestor, by the high degree of specialization it has attained in its previous terrestrial life. The members of the primæval Ranalean plexus may have possessed a greater plasticity in correlation with their lower degree of specialization. It must also be remembered that the more primitive Angiosperms, which entered the water at an early period, had merely to take possession of an undisputed field, whereas plants embarking on an aquatic life at the present day are exposed to acute competition from the numerous well-established hydrophytes with which the fresh waters of the world are already so fully stocked.

Balfour Laboratory, Cambridge.

ALABASTRA DIVERSA.—Part XXX.*

By Spencer Le M. Moore, B.Sc., F.L.S.

(Continued from Journ. Bot. 1918, p. 212.)

1. Plantæ Rogersianæ.—IV.

The following is a further instalment of notices concerning and descriptions of Archdeacon Rogers's African plants. The localities are chiefly Rhodesian and Northern Transvaal, and there are a few specimens from Bechuanaland. Among the Transvaal localities the little-known Zoutpansberg Division figures prominently, especially its extreme northern portion coming within the tropic of Capricorn. The Bechuanaland plants were collected by Mr. C. C Harbor, and some of those from tropical Transvaal by Dr. C. E. Moss when with Archdeacon Rogers: for the rest we have tô thank the Archdeacon himself.

Thanks are hereby rendered to Mr. J. R. Drummond for kindly determining the *Grewia* and to Mr. J. Hutchinson for the description of a new *Phyllanthus*—a genus with which he is well acquainted as the result of careful study. The sequence observed, it may be mentioned, is that of the *Flora of Tropical Africa*.

Grewia rhytidophylla K. Schum.

Zoutpansberg Div., Messina (tropical); *Moss & Rogers* 17, 101.

Two good specimens of this little-known species; the type is from East Africa. Burret, the latest monographer of the genus, has reduced it to *G. fallax* K. Schum., but Mr. Drummond does not share this view.

Vepris zambesiaca, sp. nov. *Ramis* rigidis subteretibus striatis ramulos breves fertiles foliatos pubescentes hac atque illac emittentibus; *foliis* alternis petiolatis (petiolo anguste alato) trifoliolatis griseo-pubescentibus foliolis sessilibus oblongo-ovatis vel oblongo-lanceolatis obtusis nonnunquam emarginatis ima basi cuneatim angustatis membranaceis; *paniculis* satis laxis foliola circiter æquantibus pubescentibus; *floribus* 4-meris pedicellatis; *calyce* cupulari denticulato pubescente; *petalis* ovato-oblongis obtusis glabris; *staminibus* (anne semper?) 7 antheris ovato-oblongis obtusis apice ipso obscure mucronulatis quam filamenta paullulum longioribus; *ovarii* rudimento bene evoluto; *floribus* ♀ ignotis.

Rhodesia, Livingstone, N. bank of Zambesi; No. 7486.

* Types of the species here described are in the National Herbarium.

Folia in toto 4–5 cm. long.; petiolus 1–2 cm. long., sub foliolorum insertione 1–1·5 mm. lat.; foliola plerumque 2·5–3 × 1·2–1·7 mm., lateralia quam intermedium paullulum minora, omnia glandulis translucentibus subsparsim prædita. Panicula 2–3 × 2 cm. Pedicelli graciles, 1–2 mm. long. Calyx 1 mm., petala 2·5 mm., filamenta 1 mm., antheræ 1·5 mm. long. Ovarii rudimentum superne angustatum, 2 mm. long.

Differs from *V. glomerata* Engl. (*Toddalia glomerata* F. Hoffm.) chiefly in the smaller leaflets, the very narrowly-winged petioles, the open inflorescences, and the more numerous stamens with relatively shorter filaments.

COMMIPHORA LUGARDÆ N. E. Br.

Zoutpansberg Div., Messina; No. 20762.

The type is from the Kwebe Hills near Lake Ngami; this is therefore a considerable extension to the range of the species.

PSEUDOCADIA ZAMBESIACA Harms.

Messina: No. 20764.

New to the Transvaal; the most southerly habitat so far reported for this rare and curious plant.

Canthium dictyophlebum, sp. nov. Inerme, glabrum; *ramis* validis cortice dilute brunneo obductis: *foliis* majusculis petiolatis late ovatis obovatisve apice obtusissimis nisi rotundatis basi rotundatis vel obtusis sæpeque plus minus obliquis papyraceis utrinque glabris pag. sup. perspicue reticulatis: *floribus* 5-meris in cymas paucifloras foliis multo breviores digestis pedicellis calyci circiter æquilongis insidentibus; *ovario* turbinato calycem truncatum obscure 5-denticulatum æquante; *corollæ* tubo late cylindrico calycem plane excedente intus juxta medium pilorum annulo reflexorum munito quam lobi lanceolati obtusiusculi paullo longiore; *staminibus* ori corollæ insertis; *stigmate* ovoideo apice obtuso longitrorsum sulcato.

Belgian Congo, Elisabethville; No. 10085.

Folia usque ad 17 × 11 cm., sæpius vero ±10 × 7 cm., supra in sicco brunnea eleganterque reticulata, subtus griseo-viridia reticuloque parum visibile: petiolus validus, 2–2·5 cm. long. Stipulæ 3 mm. long. Cymæ circa 2 cm. long. Ovarium 1·25 mm., calyx 1·25 mm. long. Corolla 6 mm. long.; tubus 3·5 mm. long., 2·5 mm. lat.: limbus 2·5 mm. long. Antheræ lanceolatæ, acutæ, 2 mm. long. Stigma 2 mm. long.

Evidently close to *C. Randii* S. Moore, but the foliage and flowers differ in several respects.

Canthium amplium, sp. nov. Inerme, *ramis* sat validis cortice pallido irregulariter striatulo circumdatis; *foliis* amplis petiolatis obovatis vel obovato-oblongis apice obtusissimis nisi late rotundatis basi obtusis papyraceis supra glabris necnon mox leviter nitidulis subtus griseo-tomentosis; *stipulis* a basi lata in filamentum sat longum extenuatis; *cymis* foliis brevioribus pedunculatis plurifloris griseo-puberulis pedicellis quam calyces longioribus brevioribusve; *ovario* turbinato calycem breviter 5-dentatum excedente; *corollæ* fere usque medium divisæ tubo late cylindrico intus juxta medium pilorum annulo gaudiente lobis 5 lanceolatis obtusiusculis; *staminibus* corollæ faucibus insertis; *stigmate* ovoideo apice breviter bifido longitrorsum prominenter sulcato.

N.W. Rhodesia, Chilanga; No. 8446.

Folia pleraque $\pm$ 10×8 cm., nonnunquam usque ad $\pm$ 6 × 4 cm. reducta; petioli circa 6 mm. long. Stipulæ 6 mm. long., glabræ. Cymæ circiter 4 cm. long.; harum pedunculus $\pm$ 2 cm. Pedicelli 1·5–4 mm. long. Ovarium 2·5 mm., calyx 1 mm. long. Corollæ tubus 4·5 mm. long., 3 mm. lat.; lobi 3 mm. long. Antheræ lanceolatæ, acutiusculæ, 2–2·5 mm. long. Stigma 2 mm. long.

Like the last in general appearance, but easily distinguished by the foliage and longer many-flowered cymes as well as by certain floral details. There is a specimen of this at Kew under the same number.

Fadogia Livingstoniana, sp. nov. Suffrutex erectus, *caule* (sec. exempll. duo nobis obvia) simplici ima basi nudo ceterum folioso angulari glabro; *foliis* ternatis oblongo-oblanceolatis apice obtusis ipso mucronatis basi in petiolum gradatim desinentibus opacis membranaceis glabris reticulo obscuro donatis; *stipulis* lanceolatis acuminatis; *cymis* foliis manifeste brevioribus pedunculatis sublaxe plurifloris sparsim breviterque hispidulo-pilosis; *pedicellis* filiformibus quam calyx longioribus; *floribus* 5-meris; *ovario* subgloboso, 2-loculari; *calycis* segmentis ovarium excedentibus linearibus acutiusculis mox patentibus; *corollæ* extus sparsim strigilloso-pilosæ tubo calycem facile superante subcylindrico (superne parum coartato) intus basin versus pilis reflexis munito lobis lanceolatis acuminatis tubum leviter excedentibus; *staminibus* faucibus affixis antheris ovatis acutis; *stigmate* pileiformi.

Rhodesia, Livingstone; No. 7466.

Planta circa semispithamea. Folia 6–9 cm. long., 1·5–2·3 cm. lat., in sicco viridia; petioli circa 7 mm. long. Cyme 2·5–3·5 cm. long. Ovarium 1·25 mm., calycis segmenta 2 mm. long. Corolla 8·5 mm. long.; tubus 4 mm. long., inferne 2·5 mm., superne 2 mm. lat.; lobi 4·5 mm. long. Antheræ 1·5 mm., stigma vix 1 mm. long.

Nearest to the South African *F. Zeyheri* Sond. The smaller, opaque, faintly reticulate leaves, hispidulous inflorescences and narrower calyx segments are among its chief peculiarities.

Pavetta bechuanensis, sp. nov. *Ramis* sat validis ad nodos aliquantulum tumidis cortice pallido obductis; *foliis* brevipetiolatis oblongo-obovatis obtusis basi obtusis membranaceis pag. sup. fere glabris pag. inf. præsertim in nervis subtiliter griseo-pubescentibus; *stipulis* inferne latis superne angustatis dorso griseo-pubescentibus diutule persistentibus; *cymis* axillaribus pedunculatis laxe plurifloris uti pedicelli calycem plane excedentes necnon ipsi calyces ovariaque subtiliter pubescentibus; *ovario* subgloboso calyci breviter 4-dentato æquilongo; *corollæ* glabræ tubo anguste cylindrico calycem multo excedente lobis oblongis obtusissimis tubum semiæquantibus; *stigmate* clavato apice breviter bifido.

Bechuanaland, Mochudi; *C. C. Harbor* (Herb. Rogers., 6690).

Folia usque 10×6 cm., etsi sæpe minora, sc. $5–6·5 \times 3·5$ cm., opaca, supra in sicco fuscescentia, subtus pallidiora; petioli 8–10 mm. long. Stipulæ usque 8 mm. long. Cymæ circa 5×6 cm.; horum pedunculus 1·5–3 cm. long. Pedicelli graciles 3–4 mm. long. Ovarium 1 mm., calyx 1 mm. long. Corollæ tubus 10 mm., lobi 5 mm. long. Antheræ lineari-oblongæ, apiculatæ, maxime tortæ, 4·5 mm. long. Stylus usque ad 13 mm. ex corolla eminens; stigma 2 mm. long.

Near *P. Schumanniana* F. Hoffm., but with several important floral peculiarities.

Pavetta Harborii, sp. nov. Suffrutex ramosus; *ramis* ascendentibus sat robustis mox glabris corticeque pallido circumdatis; *foliis* subsessilibus oblanceolatis apice basique obtusis membranaceis supra minute pubescentibus deinde glabrescentibus subtus subtiliter griseo-tomentosis; *stipulis* ovatis acuminatis tardius dehiscentibus; *cymis* axillaribus subsessilibus laxe plurifloris; *pedicellis* calycem æquantibus breviterve superantibus; *ovario* subgloboso uti pedicelli calycesque subtiliter griseo-tomentoso; *calyce* campanulato breviter 4-dentato dentibus deltoideis acutis; *corollæ* 4-meræ glabræ tubo calycem ter excedente cylindrico lobis ovato-oblongis obtusis tubum circiter semiæquantibus; *stigmate* clavato apice bifido.

Bechuanaland, Mochudi; *C. C. Harbor* (Herb. Rogers, 6869).

Planta verisimiliter 1–2-spithamea. Folia pleraque $2·5–4 \times 1–1·5$ cm., in sicco grisea; stipulæ plerumque 3–4 mm. long. Cymæ circa $2 \times 2·5$ cm. Pedicelli 2–3 mm. long. Ovarium 1 mm., calyx 2 mm. long. Corollæ tubus 7 mm. long., lobi 4 mm. Antheræ lineares, apiculate 3·25 mm. long. Stylus crassiusculus, usque 4 mm. exsertus; stigma 2 mm. long.

Still nearer *P. Schumanniana* F. Hoffm. than the last. The smaller pointed leaves of thinner consistence, the calyx with acute teeth and the narrower tube to the corolla are points worth mentioning.

Pavetta cataractarum, sp. nov. *Ramulis* inferne nudis cortice pallido obductis superne foliosis minute pubescentibus; *foliis* majusculis obovatis vel lanceolato-obovatis obtusis basi in petiolum abbreviatum cuneatim angustatis membranaceis supra glabris subtus minute pubescentibus; *cymis* ad apicem ramuli subsessilibus densifloris; *floribus* 4-meris pedicellis calycem superantibus insidentibus; *ovario* abbreviato cylindrico uti pedicellus calyxque griseo-pubescente; *calycis* segmentis oblongo-lanceolatis obtuse acutis; *corollæ* glabræ tubo cylindrico-infundibulari calyce dimidio longiore lobis late oblongis obtusis tubum semiæquantibus; *stylo* longe exserto; *stigmate* clavellato.

Rhodesia, Victoria Falls; No. 5553: also at Kew from the same locality; *Allen*, 94.

Folia pleraque $13–17 \times 5·5–8$ cm., in sicco griseola; petioli 1·5–2 mm. long. Stipulæ 5 mm. long. Cymæ florentes $3–4 \times 5$ cm. Pedicelli usque 7 mm. long. Ovarium vix 2 mm., calycis segmenta 5·5–6 mm. long. Corollæ tubus 8 mm. long., inferne 1·5 mm. sub limbo 2 mm. lat.; lobi 4 mm. long. Antheræ 3·5 mm. long. Stylus usque 10–12 mm. exsertus; stigma 1·5 mm. long.

Allied to *P. Oliveriana* Hiern, but with, among other features, larger leaves, congested inflorescences and much smaller flowers.

Pavetta conflatiflora, sp. nov. *Ramulis* inferne nudis corticeque pallido circumdatis superne foliosis necnon minute pubescentibus; *foliis* majusculis obovatis vel obovato-lanceolatis apice rotundatis ipso obtusis basi in petiolum brevem extenuatis membranaceis supra glabris subtus minute pubescentibus; *stipulis* late ovatis acutis dorso pubescentibus; *cymis* axillaribus longipedunculatis densifloris; *pedunculis* foliis plane brevioribus puberulis; *pedicellis* calyci circa æquilongis uti ovaria calycesque griseo-pubescentibus; *ovario* abbreviato cylindrico; *calycis* segmentis 4 oblongis obtusis ovarium $1\frac{1}{2}$-plo excedentibus; *corollæ* glabræ tubo cylindrico calycem circa ter superante lobis ovato-oblongis obtusissimis tubum vix semiæquante; *stigmate* clavellato.

Rhodesia, Livingstone; No. 13535.

Folia profecto evoluta 14–16 × 7–8 cm., in sicco grisea; petioli circa 1 cm. long. Stipulæ 5 mm. long. Cymæ 2 × 2·5 cm. Pedunculus usque 7 cm. long. Pedicelli circa 3 mm. long. Ovarium 1 mm. long. Calycis segmenta 2·5 mm. long. Corollæ tubus 7 × 1·5 mm.; lobi 3 mm. long. Antheræ oblongæ, breviter apiculatæ, 3–3·5 mm. long. Stigma 2·5 mm. long.

At first sight remarkably like the preceding: the more congested axillary inflorescences and flowers with a shorter calyx and corolla afford an easy means of distinction.

Tripteris auriculata, sp. nov. Herba erecta glanduloso-pubescens, *caule* robusto simplici sat crebro folioso subtereti striato; *foliis* amplis oppositis (perpaucis ultimis alternis) petiolatis ovatis acutis basi (ultimis exclusis) auriculis latis amplexicaulibus præditis margine conspicue indurato-dentatis leviter crassiusculis; *capitulis* mediocribus paniculam oligocephalam folia superantem constituentibus; *involucri* campanulati phyllis ovato-oblongis acutis margine sat late scariosis; *ligulis* circa 13 bene exsertis apice tridenticulatis; *achæniis* fertilibus involucro circiter æquilongis muricatis alis tribus mediocriter latis indutis.

Transvaal, The Downs, Pietersburg Div.; No. 20243.

Caulis adusque 5–6 mm. lat. Folia pleraque 4–5 × 2·5–4 cm., in sicco griseo-viridia; petioli lati, 4–8 mm. long. Paniculæ longit. 10 cm. attingentes vel etiam excedentes; pedunculi proprii sub fructu 2–5 cm. long. Bracteæ lineari-lanceolatæ, ± 10 mm. long. Involucra 8 × 10 mm.; phylla 2 mm. lat. Ligulæ flavæ, lanceolato-oblongæ, 4-nerves, 11 mm. long. Fll. int corollæ vix 4 mm. long. Achænia 8 mm. long.; alæ 2·5 mm. lat.; achænia abortiva 3 mm. long.

When not in flower this might almost be taken for *Osteospermum moniliferum* L. The affinity is with *T. amplexicaulis* Less. The petioled foliage and broad involucral leaves serve to separate it on sight from broad-leaved specimens of *T. amplexicaulis*.

Ipomœa Hackeliana Hallier fil.
Bechuanaland, Mochudi; *C. C. Harbor* (Hb. Rogers, 6518).
Apparently the first notice of this as a South African plant.

Anisotes Rogersii, sp. nov. Frutex, *ramis* subteretibus cortice cinereo obductis hac atque illac ramulos abbreviatos copiose foliosos emittente ceterum nudis; *foliis* parvis subsessilibus obovato-oblongis obtusissimis basi cuneatis firme membranaceis utrinque minute pubescentibus; *floribus* subsessilibus in axillis ramulorum solitariis binisve; *bracteis* bracteolisque calyce brevioribus oblongo-subulatis obtusis dorso carinulatis uti calyx pube grisea minuta indutis; *calycis* segmentis bracteolis similibus nisi longioribus paullulumque latioribus; *corollæ* extus piloso-pubescentis labio antico 3-denticulato quam posticum breviter bifidum paullo breviore; antherarum loc. sup. basi mucronulato loc. inf. distincte calcarato; capsula —.

Zoutpansberg Div., Messina; No. 19349.

Ramus vetustus 7 mm. diam.; rami juniores 2–3·5 mm. diam. Folia pleraque 10–15 mm. long., 5–7 mm. lat., in sicco læte viridia, sub lente subtiliter foveolata. Bracteæ bracteolæque longit. 2 mm. levissime excedentes. Calyx 3 mm. long.; segmenta 3-nervia nervis dorso prominulis. Corolla 3·7–4·5 cm. long.; labium anticum circa 2·3 cm., posticum 2·5 cm. long. Filamenta glabra, 23 mm. long.; antherarum loc. sup. 3 mm., loc. inf. 3·5 mm. long. Ovarium griseo-tomentosum, 2 mm. long. Stylus glaber.

Close to *C. parvifolius* Oliv. from British East Africa, the chief differences being the smaller leaves of the new plant, shorter and somewhat diversely-shaped bracts, bracteoles and calyx segments, shorter pubescent corolla, distinctly spurred lower cell of the anthers and tomentose ovary.

(To be continued.)

NOTES ON THE FLORA OF NORTHERN CHESHIRE.

By R. S. Adamson.

The following notes are the result of more or less casual observations on the Cheshire flora made in the course of excursions from Manchester during the past three years. It is now 20 years since Lord de Tabley's *Flora of Cheshire* was published (1899), and since that time only few notices have appeared on the plants of the county. These (*e. g.*, Druce, J. Bot. xlv. 1907, p. 354, and xliv. 1906, p. 426, and Drabble, J. Bot. xlviii. 1910, p. 152, and xlv. 1907, p. 103) refer to the Southern and Coastal Districts, while the present observations are almost confined to the N.E. part of the county. New records are distinguished by an asterisk (*). The numbers refer to the divisions of the county as given in the *Flora*. Where a new divisional record is made the number is preceded by an asterisk. Plants which have no claim to be considered native are enclosed in square brackets [ ].

Anemone nemorosa L. 2. Bollin Valley, 1918, a blue-flowered plant, which appears to be var. *cærulea* DC.—*Aquilegia vulgaris* L. 1. Railway banks near Middlewood, but probably of garden origin.

Papaver Rhœas L. Rare and generally a casual. 1. Wilmslow, 1914–1916. 2. Sale, 1915. *P. dubium* L. 2. Much the commoner species.

Nasturtium amphibium Br. 1. Wilmslow. *2. Bollin Valley near Hale.—*Cardamine hirsuta* L. var. **umbrosa* Lec. & Lam. 1. Disley. 2. Cotterill Clough.—[**Sisymbrium Irio* L. 2. Casual or waste ground, Sale, 1915.] *S. officinale* Scop. var. *leiocarpum* DC. *2. Timperley. *3. Cuddington.—*Erysimum cheiranthoides* L. 1. Drained peat moss, Lindow Common.

Viola Riviniana Reichb. var. *diversa* Greg. 1, 2, 3. The commonest form; f. *nemorosa* Neum. 2. Bollin Valley. f. *minor* Murb. 1. Hill pastures.—*V. canina* L. 1. Bosley. 3. Delamere Forest.

Stellaria neglecta Weihe var. *umbrosa* Opiz. *1. Alderley. 2. Bollin Valley.—*Sagina nodosa* Frenzl. 1. Canal banks between Poynton and Macclesfield.—*Spergula arvensis* L. 1, 2, 3. Common. *S. sativa* Boenn. 1, 2.

Hypericum dubium Leers. *1. Banks of R. Mersey, Cheadle; R. Bollin, Wilmslow.

Tilia cordata Mill. *1. Woods in Goyt Valley near Marple, possibly native. Frequently planted in suburban districts.

[*Impatiens parviflora* DC. 1. Gatley.]

Vicia Cracca L. var. **latifolia* Neilr. 2. Arley.

Potentilla procumbens Sibth. 1, 2, 3. Not uncommon except on hills.—*P. procumbens* × *reptans*. 1. Adlington. *P. erecta* × *reptans*. 1. Middlewood.—*P. Anserina* L. var. *discolor* Wallr. Common. Var. *concolor* Wallr. 1. Marple.—*Alchemilla vulgaris* L. 1, 2, 3. All var. *pratensis* Pohl. Var. *alpestris* Pohl. occurs on hills in Lancs. and Derbyshire, but has not been noted for Cheshire.

Chrysosplenium alternifolium L. *1. Woods near Wilmslow.

Callitriche autumnalis L. 2. Rostherne Mere.

Epilobium tetragonum Curt. *1. Marple. *E. roseum* Schreb. 2. Sale.

Sium erectum Huds. *1. Canal, Poynton.—*Peucedanum Ostruthium* Koch. 1. A large patch by roadside, Poynton, 1918.—*Heracleum Sphondylium* L. var. **angustifolium* Huds. 1. Kettleshulme.

Galium palustre L. var. *Witheringii* Sm. *1. Styal. *2. Rostherne Mere.

Chrysanthemum segetum L. 1. Wilmslow.—*Matricaria suaveolens* Buchenau (*cf.* J. Bot. xliv. 1906, p. 426). *1. Cheadle. *2. Sale. Apparently spreading rapidly.—*Taraxacum palustre* DC. *3. Delamere Forest.

Jasione montana L. 1. Taxal, abundant between Macclesfield and Chelford. 3. Delamere.

[*Rhododendron ponticum* L. Spreading by seed. 1. Northenden, Alderley. 2. Tatton Park.]

Calluna vulgaris Hull. var. **Erikeæ* Aschers. 1. Head of Goyt Valley. Var. *hirsuta* Presl. 1. Lindow Common. 3. Delamere Forest, abundant with every stage of intermediate.

Symphytum officinale L. 1, 2, 3. By cottages, generally var. *patens* Sibth.—[*S. asperrimum* L. 1, 2. A garden stray.]—*Myosotis cæspitosa* Schultz. *1. Ponds near Poynton; R. Bollin above Wilmslow. Not mentioned in Flo. Chesh. Recorded in Green, Flo. Liverpool, for 3, 4, 5. *M. repens* Don. 1. Wooded streams on hills.—*Echium vulgare* L. 2. A single plant by railway, Sale, 1916, but not since.

Veronica scutellata L. 1. Middlewood.

Galeopsis speciosa Mill. 1. Timperley.

Chenopodium album L. var. *integerrimum* Grey. 1, 2, 3; Var. *spicatum* Koch. 1, 2, 3; Var. *virescens* Wahlb. 1, 2. *Ch. rubrum* L. var. *blitoides* Wallr. 2. Waste ground, Sale.—*Atriplex patula* L. var. *linearis* Moss & Wilm. 1; Var. *erecta* Lange. 1, 2; Var. *bracteata* Westerl. 1, 2.

Polygonum aviculare L. 1, 2, 3; Var. *angustissimum* Meisn. 1, 2. *P. æquale* Lindm. 1, 2, 3. *P. nodosum* Pers. *1. Heald Green.—*Rumex Hydrolapathum* Huds. 1. Marple, Poynton, Hazel Grove. **R. alpinus* L. 1. By farm and roadside on ridge above Taxal.

Ulmus glabra Huds. Common. *U. campestris* L. 1, 2, 3. S. and Central Cheshire, not on hills. [*U. stricta* Lindl. Planted occasionally. 2. Altrincham. × *U. hollandica* (Mill.) Moss. 1, 2. Planted.]

Betula alba L. 1. Alderley Edge, Lindow Common. 2. Castle Mill. 3. Delamere Forest, where much more abundant than *B. pubescens*. *B. alba* × *pubescens*. 1. Lindow Common. 3. Delamere.—*Alnus glutinosa* Gaertn. 1, 2, 3. Apparently all var. *microcarpa* Rouy.

Carpinus Betulus L. Not native. 1. Seeding in old quarries near Macclesfield.—*Quercus Robur* L. Common except on hills. *Q. sessiliflora* Salisb. Hills and scattered over plain. *Q. Robur* × *sessiliflora*. 1. Mottram Hall. 3. Delamere. [*Q. Cerris* L. 1. In plantations near Harrop.]—[*Castanea sativa* Mill. Seeding at 1. Alderley Edge. 3. Delamere Forest.]

Salix viminalis L. var. *linearifolia* Wimm. & Grab. 1. R. Bollin above Wilmslow. *S. repens* L. var. *ericetorum* Wimm. & Grab. 1. Lindow Common. 7. Rudheath. Var. *fusca* Wimm. & Grab. 3. Hatchmere. The following hybrids have been noted:—*S. purpurea* × *viminalis*. 2. Osier Beds, Rostherne; *S. aurita* × *caprea*. 1; *S. aurita* × *cinerea*. 1; *S. aurita* × *repens*. 1.

Populus canescens Sm. 1, 2, 3. But nowhere native. *P. tremula* L. Var. *sericea* Döll. 1. Lindow Common. 2. Rostherne. 3. Delamere; Var. *glabra* Syme. 1. Marple. *P. nigra* L. var. *betulifolia* Torrey. 1. Cheadle, Northenden, Heald Green. 2. Tabley. Always by streams or rivers and in similar situations in S. Lancs. It looks native. Also frequently planted in towns and gardens. [*P. italica* Moench. Planted. × *P. serotina* (Hartig) Moss. Very commonly planted.]

Orchis maculata L. 1, 2, 3. All var. *genuinus* Reichb. (*O. ericetorum* Linton).

Juncus effusus L. var. *compactus* Lej. & Court. 1. Common on hills. *J. conglomeratus* L. Very rare or absent on hills, not uncommon in lowlands. 1, 2, 3. ×*J. diffusus* Hoppe. *1. Rainow, 1913. *J. subnodulosus* Schrank. 2. Bog at N. end of Rostherne Mere. *J. articulatus*×*sylvaticus*. 3. A plant from Delamere Forest is apparently this hybrid.

Acorus Calamus L. *1. Pond in village, Woodford. 2. Ringway.

Elisma natans Buchenau. *1. Canal near Pott Shrigley.—*Sagittaria sagittifolia* L. *1. Canal about Poynton and S. towards Macclesfield.

**Potamogeton prælongus* Wulf. 1. Canal, Poynton. *P. perfoliatus* L. *1. Canal between Poynton and Adlington. *P. pusillus* L. *1. Canal at Marple.

Scirpus setaceus L. *3. Hatchmere.

Cladium Mariscus Br. *3. Hatchmere.

Carex divulsa Stokes. *1. Lindow Common. *C. pallescens* L. 1. Wilmslow. *C. helodes* Link. 1. Wet wood, Saltersford. *C. binervis* Sm. *2. Bollin Valley near Castle Mill.

Poa compressa L. *1. Stone work of canal, Marple, 1918.—*Glyceria aquatica* Wahlb. 1. Macclesfield and Peak Forest canals.—*Festuca bromioides* L. 1. Roadsides at Hazel Grove, Poynton, etc.

**Ceterach officinarum* Willd. 1. One plant discovered by Professor W. H. Lang in a wall at Over Alderley, 1918.—*Nephrodium Thelypteris* Desv. 3. Hatchmere.—*Botrychium Lunaria* Sw. 1. Hill pastures above Disley.

Ophioglossum vulgatum L. 1. Locally abundant as at Marple, Poynton, etc.

ILFRACOMBE MOSSES AND HEPATICS.

By Cecil P. Hurst.

The mosses and hepatics below were collected during the spring, summer, and autumn of 1917, in and around Ilfracombe and on Braunton Burrows, which are in North Devonshire (v.c. 4). In compiling the following list, which contains eighteen new vice-comital records, the arrangement and nomenclature of the *Census Catalogue of British Mosses* (1907) and the *Census Catalogue of British Hepatics* (1913) have been followed, and I am very greatly indebted for kind assistance and notes to Messrs. H. N. Dixon, W. Ingham, H. H. Knight, W. E. Nicholson, and J. A. Wheldon. On the much frequented Capstone Hill at Ilfracombe perhaps the most common mosses are *Grimmia maritima* (conspicuous in fruit during the autumn and winter months), *Trichostomum mutabile* var. *littorale* and *Zygodon Stirtoni*, while *Weisia verticillata* grows in a rock cleft, and the rare *Tortula atrovirens* var. *edentula* is found in some quantity at one place on the Parade; upon Lantern Hill, near the harbour and in the heart of the town, the rare fruit of *Zygodon Stirtoni* is produced and well-marked plants of *Tortula atrovirens* var. *edentula* occur. Noteworthy additions to North Devon are the mosses *Grimmia subsquarrosa, Coscinodon cribrosus, Tortula atrovirens* var. *edentula, Pleurochæte squarrosa* and *Bryum Warneum* and the hepatics *Riccia commutata* and *Moerckia Flotowiana.* Calcareous rocks appear on the coast to the east of Ilfracombe, and this is strongly reflected in the moss flora, *Weisia verticillata, Trichostomum crispulum, Brachythecium glareosum* and other calcicolous species making their appearance, while the hepatic *Lophozia turbinata,* always indicative of lime, grows in sheets by the roadside. c.fr. = with fruit. * = new vice-comital record.

Mosses.

Pleuridium axillare Lind. Very sparingly around a puddle on the top of Windcutter Hill, near Lee; this has been found between Stoke and Hartland, N. Devon, by Mr. Frank Savery.

Dichodontium pellucidum Schp. Wet rocks in the rivulet on coast between Ilfracombe and Lee, just before it falls down the cliffs; also by a road runnel in the Chambercombe Valley.

Dicranella varia Schp. forma. A rather curious plant grew on wet clay on the top of Windcutter Hill near Lee, which had the tiny erect capsules of *D. rufescens* with the leaves of *D. varia.* Mr. Knight wrote, "I was quite prepared to find that your *Dicranella* was *rufescens* until I examined the leaves under the microscope. They were certainly those of *D. varia,*" and again he wrote, "The capsules are nearly erect, but the leaves in your plant have the margins narrowly revolute and entire and the narrow cells of *varia.* In *rufescens* the margins are plane, denticulate in upper part and cells larger. *Rufescens* is much less common than *varia,* though both here (Cheltenham) and in S. Wales I have not found it very uncommon."

**Campylopus fragilis* B. & S. In small quantity among grass near Mortehoe.—*C. brevipilus* B. & S. In small quantity in one place on the coast between Mortehoe and Mortehoe Point, a young state; the hair-points were difficult to find.

Dicranum Bonjeani De Not., forma. A very curious form which has been distributed through the Moss Exchange Club grew on the thatch of an outhouse at Cheglinch, a hamlet near the village of West Down, Ilfracombe; about it Mr. Dixon wrote: "I have never associated var. *juniperifolium* with the bright green soft habit of the *D. Bonjeani* you send; it is usually rigid, dark brown or blackish, with rather rigid leaves. In the general leaf direction, however, and character of leaves, it comes very near it. I should be inclined to call it a form, in some respects very near var. *juniperifolium.*"—*D. majus* Turn. This fine species grew for nearly half a mile in a hedgebank bordering a wood about half a mile west of Bratton Fleming railway station with *Plagiothecium undulatum* and *Hylocomium loreum,* the three species fruiting very freely for a long distance.

Grimmia maritima Turn. Occurred abundantly and fruited profusely on rocks on the coast to the west of Ilfracombe but was scarce or absent on the coast to the east of the town where the rocks are calcareous; it was plentiful on Capstone Hill and also grew on Lantern Hill, close to the harbour.—*G. trichophylla* Grev. On Hillsborough and common along the coast to the west of Ilfracombe, sometimes very dwarf.—**G. subsquarrosa* Wils. In fair plenty on siliceous rock by the roadside at Upper Warcombe Farm between Lee and Mortehoe; plentifully on a bank on the coast between Mortehoe and Woolacombe; plentifully on rocks on the coast between Mortehoe village and Mortehoe Point. Mr. Dixon wrote:—"I think your *Grimmia* must be referred to the type form of *G. subsquarrosa*. Var. *edinensis* is a very short, dense form—a starved state probably, just as *G. Stirtoni* is probably a starved state of *G. trichophylla*." In 1910 Mr. G. Wrey found it fruiting near Torquay, in November 1917 I noticed it bearing capsules very sparingly on the coast near Mortehoe. Mr. F. Rilstone sent me from Polperro (v.c. 2) a plant about which Mr. Dixon wrote:—"Certainly one of the transitional forms connecting *G. trichophylla* and *G. subsquarrosa*; in some respects nearer the former, but the basal cells show a decided tendency to be of the *subsquarrosa* form." Mr. Frank Savery found *G. subsquarrosa* at Anstey's Cove near Torquay; for its strange occurrence with other aberrant species on the Wiltshire sarsen stones near Marlborough, see Journ. Bot. 1916, 19.

Rhacomitrium fasciculare Brid. Rock on coast between Ilfracombe and Lee.—*R. heterostichum* Brid. Large tufts occurred on rock in Freshwater Bay between Ilfracombe and Lee (*teste Dixon*).—*R. lanuginosum* Brid. Mr. F. A. Brokenshire sent me this from near Shoulsbarrow Common on the edge of Exmoor.—*R. canescens* Brid. Damp ground by roadside near Spreacombe.

**Coscinodon cribrosus* Spruce. In some quantity on the west and east sides of Freshwater Bay halfway between Ilfracombe and Lee; the fruit is not rare in June and July. Here it grows on three stone walls, as well as in places thickly encrusting the rock crevices; it also occurs in seams on inaccessible perpendicular faces of the cliffs. Some of the cushions were very large; the delicate pale green colour of this moss when wet contrasts strongly with the grey velvety mouse-skin-like appearance when dry. New to the South of England, the nearest station appearing to be in the Lake District; a Welsh locality near Barmouth is well known.

Ptychomitrium polyphyllum Fürn. c.fr. plentiful on walls in the Sterridge Valley; also c.fr. on walls by roadside between Mullacott Cross and Ilfracombe.

Pottia recta Mitt. c.fr. on bare ground by the sea near Mortehoe (*Knight*).—*P. intermedia* Fürnr. Bank by roadside between Mortehoe Railway Station and Woolacombe.—*Tortula ambigua* Ångstr. Bank near Ilfracombe.—*T. aloides* De Not. c.fr. bank on road between Ilfracombe and Combemartin; also c.fr. bank between Woolacombe and Mortehoe.—*T. atrovirens* Lindb. Rather plentiful on the coast on banks between Woolacombe and Mortehoe; also on clay on the coast near Saunton. Mr. Dixon referred to var. *edentula* (B. & S.) Par. (1906) plants from Saunton and also from Capstone and Lantern Hills, Ilfracombe. Of the Saunton plants he wrote:—"Some of it is var. *edentula* and some is not. This shows the unsatisfactory status of the var." Of the Capstone Hill plants he wrote:—"Your *T. atrovirens* has the peristome very variable, but for the most part considerably reduced, and I should place it under var. *edentula*." Of the Lantern Hill plants he wrote:—"This is the extreme form of the var., and it is interesting to know that all forms exist in that locality from the almost gymnostomous to the well developed peristome." For an account of this see Journ. Bot. 1916, 272.—*T. lævipila* var. *lævipilæformis* Limpr. Fairly plentifully on trees by a small watercourse on the road between Watermouth Castle and Berrynarbor; also on a tree near Watermouth Castle. Mr. Dixon writes:—"Your *T. lævipila* may certainly be referred to the var. as it has a marked border to the leaves as well as the foliose gemmæ. I have frequently found it associated with *T. papillosa*, and am inclined to think that both prefer a larger amount of moisture than the normal form of *T. lævipila*. I suppose the var. *lævipilæformis* may have a rather southern distribution; it seems to become much commoner in the South both within Britain and also outside, but I am inclined to think it takes very little to turn the type into the var.!"—*T. ruraliformis* Dixon. Abundant on Braunton Burrows, also plentiful on the Woolacombe dunes; Mr. W. Watson of Taunton tells me it fruits on Braunton Burrows, and I noticed young setæ at Woolacombe. Mr. Wheldon writes:—"An anomaly is that although *T. ruraliformis* is very abundant on our (Lancashire) dunes, it never fruits there now, although I believe it did so formerly, but on the Welsh coast it is not at all rare with capsules." The fruit occurs in fair quantity on the Burnham-on-Sea sandhills in Somerset (v.c. 6).

(To be concluded.)

BIBLIOGRAPHICAL NOTES.

LXXV. "Madeira Flowers."

Such points of interest as may be connected with the two books which form the subject of the following notice are perhaps literary rather than botanical: but as both volumes were thought sufficiently connected with botany to find a place in Pritzel's *Thesaurus* and Dr. Daydon Jackson's *Index*, and the authors are, in accordance with our rule, included in our *Biographical Index*, a note upon them may be worth printing.

It is surely somewhat remarkable that two books by members of the same family living in the same island should be issued in the same year (1845) from the same printing and publishing house (Reeve Brothers), each similarly bound in green cloth with a floral device in gold on the cover and differing only in size; and that neither should contain any reference to the other! Moreover, the object in publishing in each case was not dissimilar: Mrs. Penfold's *Madeira Flowers, Fruits, and Ferns* was produced "to gratify those visitors and residents who take an interest in [Madeiran] productions"; Mrs. Augusta J. Robley's *Selection of Madeira Flowers* (folio), "dedicated to her mother, Mrs. Jane Wallas Penfold," was "the humble offspring of a wish to gratify some friends who have kindly flattered me by thinking my paintings worthy of publication."

"Drawn and coloured from Nature" appears on the titlepage of each book, and the scientific descriptions in both are from the pen of the Rev. W. L. P. Garnons (†1863), then "of Sidney College, Cambridge," though the "local information" in the former was written by Mrs. Penfold.

The plates in both books are well drawn, although, as might be expected, botanical details are wanting; all were lithographed by the same hand ("R. E. B."). From a literary standpoint, Mrs. Penfold's quarto volume is the more ambitious production: it contains 20 plates, of which no list is given—Mrs. Robley's work is also deficient in this respect. We learn from the preface (dated February, 1845) at her request wrote for the volume, two years before its publication, some verses (to which his autograph in facsimile is appended). These appear in Knight's edition of the *Poetical Works of William Wordsworth* (viii, 156) with the following heading:

"To a Lady

"in answer to a request that I would write her a poem upon some drawings that she had made of flowers in the island of Madeira."

I can find no reference to Mrs. Penfold in any Wordsworth biography, nor does it appear from her preface that she was acquainted with him. She remarks in her preface that "the flowers he names do not all correspond with those subsequently selected, and this indeed is the case, as they alluded to common British plants—heart's-ease, speedwell, star-of-Bethlehem and forget-me-not. It is fair to say that the Laureate confesses his unfitness for the task imposed on him: the poem begins:—

"Fair Lady! can *I* sing of flowers
That in Madeira bloom and fade,
I, who ne'er sate within their bowers,
Nor through their sunny lawns have strayed?"

"Much valuable assistance" is acknowledged from the Rev. R. T. Lowe (1802–74), who was at that time English chaplain in Madeira; for "the arrangement and description" of the ferns Mr. Henry Webb—entered as "of Clapham" in the subscription list headed by two duchesses which is prefixed to the volume—was responsible. Mr. Garnons's descriptions are in Latin and English. *Amaryllis Belladonna*, the subject of the first plate, is also represented in a "vignette" preceding the titlepage, showing its habit of growth in October, "completely covering the hills and valleys with [its] bright blossoms." *Nothochlæna Marantæ* (t. iv.) which had been thought to be confined to one locality, was "found by the writer among the mountains of the Alegria district, at the Arco de Calheta, and in the neighbourhood of the pretty village of Madelina:" Mrs. Penfold had property "at the Alegria" (see text to t. xv.).

The only note of interest is that on *Salvia splendens* (t. x.), which "was introduced into Madeira by Mrs. Penfold of the Achada, and, from a small plant from England, it has been propagated all over the island, so that it now forms the principal ornamental shrub in most cottage gardens. In some places hedges are made of this beautiful plant, which blossoms nearly throughout the whole year in such profusion that the eye can scarcely bear to rest on its brilliant colour. The Portuguese make a bright rose-coloured dye for articles of dress from the petals, and the renowned feather-flowers made by the nuns at Santa Clara Convent own (*sic*) much of their brilliancy to colours extracted from this flower." We learn from R. T. Lowe (Bot. Mag. t. 3296) that Mrs. Penfold imported seeds from Brazil in 1828, and that *Cleome dendroides*, the subject of the plate, was raised from such seeds. The drawing for this plate was by Miss M. Young, who contributed many figures of Madeira plants to Hooker for Bot. Mag. vol. lxi. (1834): she was a friend of Lowe (whose initials in this volume are often wrongly given as "*J.* T."), who expresses warm approval of her work, which is indeed of a far higher order than that of either of the ladies now under consideration: he does not mention either book in his *Manual Flora of Madeira.* Mrs. Robley's book, which marked her "debut as an artist," contains eight plates, the text of which I think was entirely supplied by Mr. Garnons; her own share in the volume is confined to a brief preface (dated March, 1845) of eight lines. The text contains nothing of interest; it is noted that *Strelitzia* (t. i.) was introduced into Madeira by Mrs. Penfold, from whose plant have been propagated all that are in the island. The plates show less artistic feeling than those in Mrs. Penfold's book: t. vii, representing *Lilium candidum* and two Amaryllises, is very badly grouped.

The books, copies of which are in the library of the Department of Botany, are apparently somewhat rare: neither is in the British Museum Catalogue and only the latter in that of Kew. Mrs. Robley's appears to be the less known, as it does not appear in the bibliography appended to the *Flora do Archipelago da Madeira* of Señor C. A. de Menezes (Funchal, 1914) in which Mrs. Penfold's is entered.

James Britten.

P.S.—Thinking that some of the foregoing information might interest a wider circle than is reached by this Journal, I communicated it to *The Times Literary Supplement* (March 6): the note there printed elicited one or two points of interest which may be appended here. Mr. A. L. Soper, of Messrs. Lovell Reeve & Co., tells me that both books appeared in the "List of Scientific Works published by Reeve Brothers" issued in 1846, and that the price of each was a guinea. Mr. Gordon Wordsworth of The Stepping Stones, Ambleside—a grandson of the poet—writes that he possesses a copy of *Madeira Flowers* inscribed: "Wm. Wordsworth Esq^{re} from the Author"; he has no information as to Mrs. Penfold's relations with his grandfather, so does not think they can have been intimate. Mrs. May, of Ridge Hill, Macclesfield, tells me that the Wallases were an old Cumberland family settled near Penrith; in the latter end of the eighteenth century one of them went to Madeira and entered the firm of Cossart, Gordon, & Co., and marriages took place between the families. Mrs. Penfold's second (? maiden) name being Wallas suggests that her request to Wordsworth may have been prompted by the recollection of an early friendship between her people and his.

SHORT NOTES.

Pulteney's References to the Flora Londinensis. Dr. B. D. Jackson and the late W. A. Clarke have between them fairly well cleared up the chronological puzzles and the sequence of plates in the *Flora Londinensis* of Curtis. In Dr. Jackson's first note (Journ. Bot. 1881, 310) he refers to "a MS. of Pulteney seen by Mr. Pryor, but which I have not been able to verify." Mr. Clarke (Journ. Bot. 1895, 113) says that it "is, I believe, to be found in a copy of the first edition of Hudson's Fl. Anglica in the library of the Linnean Society." But neither he nor anyone else appears to have looked up the matter to verify it. In taking down this volume for some other reference, I noticed by chance the so-called "MS. of Pulteney." It consists of eight lines (four in ink, and four in pencil) on the inside of the front cover of Pulteney's own annotated copy of Hudson's work "ex Dono Authoris," afterwards owned by "Jno. Jones, Gray's Inn." The eight lines are as follows:—

> "The first no. of the Flora Londinensis was published in May 1775. The Plants of the Work are all marked in this Book with a C, as far as no. 67.
>
> No. 60 Nov. 1788
> — 65 June 1791
> — 66 June 1792?
> — 67 [*no month*] 1793."

Apparently therefore, 402 out of the whole number of 432 plates were issued from May 1775 to the end of 1793. "No. 60" of the MS. is quoted as "no. 59, in fasc. 5" in Dr. Jackson's note, which is probably correct, as Clarke says the numbering of plates ends with fasc. v,—not being carried on through fasc. vi., though some of the plates are dated. To what extent Pulteney's MS. Fl. Anglica in the Botanical Department of the Natural History Museum is based on his annotated copy of Hudson in the Linnean Library I do not know.—Frederic N. Williams.

Plants in Flower at the End of December, 1918.—Several notes on this subject have appeared in various periodicals, and it may may be of interest to give some observations made in the neighbourhood of Taunton, Somerset. On December 20th, whilst engaged in field-work amongst the bryophytes, I was so struck by the number of plants still flowering that I made a list of those observed. This list during the remaining part of the year reached the surprising total of 73, and could have been considerably extended if specially secluded nooks had been explored, or if grasses, sedges, and other plants with inconspicuous flowers, had been examined more carefully. No sedges and only three grasses are included in the list. The weather had been very mild even for the west of England, and accounts for this large total.

The plants found flowering fall into three groups:—(1) Those usually flowering in Somerset during this period; (2) Spring plants which have had their times of flowering accelerated; (3) Late-flowering plants.

In the first group the Gorse (*Ulex europæus*) was the only one having a limited flowering-time. The other plants noticed are in flower with us at almost any period and include *Capsella Bursa-pastoris*, *Cardamine hirsuta*, *C. flexuosa*, *Stellaria media* (only with three or five stamens, the ten-stemmed *S. neglecta* is more limited in its flowering-period with us), *Cerastium vulgatum*, *Taraxacum officinale*, *Bellis perennis*, *Senecio vulgaris*, *Lamium purpureum*, *Linaria Cymbalaria*, and *Poa annua*.

The spring flowers include *Ranunculus Ficaria*, *Viola odorata*, *Potentilla sterilis*, *Petasites fragrans* (apparently quite a wild plant in Somerset), *Daphne Laureola*, *Mercurialis perennis*, and *Corylus Avellana*. The Primrose must also be included here, though stragglers are often found flowering in secluded dells right through the winter months. A locality for the Snowdrop was visited, but no flowers were seen.

The stragglers, or third group, include the following:—*Ranunculus Flammula*, *R. repens*, *Sisymbrium officinale*, *S. Thalianum*, *Lychnis dioica*, *Stellaria Holostea*, *S. graminea* (the former is not uncommon during mild winters, but the latter was a surprising find), *Arenaria serpyllifolia*, *Sagina procumbens*, *Reseda Luteola*, *Geranium Robertianum*, *G. columbinum*, *Malva sylvestris*, several *Rubi*, *Geum urbanum*, *Spiræa Ulmaria*, *Fragaria vesca*, *Vicia sepium*, *Hedera Helix*, *Chærophyllum temulum*, *Anthriscus sylvestris* (probably better placed in the second group), *Senecio Jacobæa*, *S. erucifolius*, *S. sylvaticus*, *S. squalidus* (naturalized in Taunton and in flower from the end of April), *S. aquaticus*, *Chrysanthemum Parthenium*, *Achillea Millefolium*, *Crepis capillaris*, *Leontodon autumnale*, *Lapsana communis*, *Picris hieracioides*, *Matricaria Chamomilla*, *Sonchus oleraceus*, *S. asper*, *Veronica persica* (*Buxbaumii*), *V. arvensis*, *V. Chamædrys*, *V. didyma*, *Lamium album*, *Prunella vulgaris*, *Chenopodium album*, *Rumex conglomeratus*, *Euphorbia Peplus*, *E. exigua*, and *Dactylis glomerata*.—W. Watson.

Potamogeton acutifolius Link. On p. 17 I gave the northern limit of this species as 60° 12′ N. lat., from Hagström's book. On checking these limits I find I have a specimen named as *P. zosterifolius* Schum., from Finland—"Karelia Onogensis. Schunga. Aug. 1888. A. O. Kihlman." This is 62° 30′ N. lat. In Hjelt's Consp. Fl. Fenn. 3, p. 540 (in Act. Soc. Fauna et Flora Fenn. v. 1895) *P. zosterifolius* is recorded from Schunga by Norrlin: this is two degrees farther north, and records the species from Finland.

Arthur Bennett.

New Variety of Nitella flexilis. In 1884 a *Nitella* was discovered in Cambridgeshire by the late Alfred Fryer, which, though monœcious, much resembled *N. opaca* in its dense fruiting heads, its large antheridia, and the more or less mucronate tips to the secondary branchlet rays. It was so markedly protandrous in character that when first collected, early in May, it had the appearance of being the male plant of a diœcious species. It was originally observed in the Old Bedford River at Sutton Gault, but was subsequently found to occur in a number of stations in the adjacent fenlands of Cambridgeshire and West Norfolk, and in one locality in Huntingdonshire. Specimens collected by G. R. B.-W. in the original station and near Mepal in 1896, were circulated in Charac. Brit. Exsicc. No. 59, as a doubtful form of *N. flexilis* var. *nidifica*. A further examination has led us to regard it as a distinct variety, for which, in honour of its discoverer, who did so much for the investigation of the aquatic plants of the Fen country, we propose the name of

Var. Fryeri. Perspicue protandra. Antheridium multo majus quam antheridium in typo, c. 800 μ diametro. Verticilli fructificantes capita densa plus minusve formantes. Radii secondarii sæpe mucronati. Oogonia 660–745 μ longa, 550–610 μ lata, c. 500 μ crassa. Cellulæ spirales 6–7 convolutiones exhibentes et versus apices multo tumifacientes. Oospora 500–520 μ longa, 425–450 μ lata, 375 μ crassa, fusca-rubra aut fusca-rubida aut pæne nigra, 5–6 strias promulas crassas exhibens sæpe alis latis et conspicuis versus apicem. Membrana crassima et semirigida.

In stature and habit this variety resembles *N. opaca* rather than *N. flexilis*. It is somewhat rigid and often much incrusted. A similar plant was collected by Wahlstedt and by Olsson in 1864, at Lund in Sweden, and was distributed by the former in Nordstedt & Wahlstedt's Charac. Skand. Exsicc. No. 10, under the name of *N. flexilis* f. *nidifica incrustata*.

J. Groves and G. R. Bullock-Webster.

REVIEW.

Coniferous Trees for Profit and Ornament: being a concise description of each species and variety, with the most recently approved nomenclature, list of synonyms, and best methods of cultivation. By A. D. Webster. Constable & Co., pp. xx, 298, 28 plates. Price 21*s.* net.

This is not the whole of Mr. Webster's title, as he has seen fit, in somewhat archaic fashion, to set forth the subjects of half-a-dozen of his chapters on the title-page. Although the preface starts off with the enormous cost of our British imports of timber, the main subject of the book is the growth of ornamental conifers in this country; and the illustrations, excellent as they are, show only young specimen trees. At the present period of paper-famine, a book has to justify its appearance: it should, one might say, "meet a felt want"; and we are not sure either that there was need for "a cheap, handy, and concise popular guide to hardy Conifers as cultivated in this country," or that (if such a want existed) Mr. Webster's book can be said to meet it. The late Mr. Kent's *Manual of the Coniferæ*, published for Messrs. Veitch, was, especially in its second edition, a fairly adequate, satisfactory, and, for its size, inexpensive work, and it is to be regretted that it should have gone out of print; but at the present time more interest certainly attaches to the possibilities of the cultivation of a small number of species on a large scale for profit than to the merely æsthetic requirements of the pinetum; nor can the present work be considered "cheap" at a guinea.

It would be difficult for Mr. Webster or anybody else to overestimate the indebtedness of the arts and manufactures to the *Coniferæ*, but it is assuredly saying a little too much to include petroleum among their products (p. xv); *per contra*, *Pinus Pinaster* is omitted from the enumeration of turpentine-yielding species on p. xvi, whilst Mr. Webster's knowledge of the commercial position of the products of the group appears incomplete when he says that "it is hardly likely that pine nuts will ever find much favour in this country." With reference to our present-day needs, a mis-statement of geological results which suggests "*Araucaria* and members of the pine family" as occurring "in the Devonian and Carboniferous series" (p. xix) is of small moment; nor, perhaps, is it of much consequence that Mr. Webster puts *Ginkgo* in the Order *Taxaceæ*; but his speaking (p. 2) of the "fruit" of that Order, and of the "ovary" of Gymnosperms in general (p. 1), together with his particularising certain species of Pine as having two seeds at the base of each cone-scale, suggests an insufficient knowledge of the anatomy of these plants. The description of the foliage of *Taxodium* on p. 171 as "pinnate leaves . . . arranged in horizontal rows on each side of the midrib," is another illustration of the same thing.

It may be doubted whether the author is justified in including the species of *Torreya* among hardy conifers; and in some other cases anyone acquainted with the forms in cultivation may be inclined to doubt whether the descriptions, which are obviously taken from actual specimens, are correctly assigned. Arboriculturists who favour Conifers for ornamental planting may find the remarks on the cultivation of each species, by a man of Mr. Webster's long practical experience, of value; and there are many interesting notes on particular specimens, such as those of Collinson's planting at Mill Hill, scattered through the book, though more might have been done in this direction.

The book is well got up; but it is unfortunate that the name of the genus is not put at the head of each page, since on opening the volume in the middle of the series of C's, you may be in *Cedrus*, *Cryptomeria*, *Cunninghamia*, or *Cupressus*; worse still, in the longer series of P's you do not know whether you are among Piceas or Pines.

G. S. Boulger.

BOOK-NOTES, NEWS, ETC.

The *Gardens' Bulletin Straits Settlements* (ii. nos. 3–4, 1918) contains an account by Mr. I. H. Burkill of the establishment and history of the Botanic Gardens, Singapore, with notes on Henry James Murton and Nathaniel Cantley (d. 1888) (1853–81), who preceded Mr. Ridley as Curators: an account of the Herbarium was published by Mr. Ridley in the *Annual Report on the Gardens* for 1889. In the *Journal of the Straits Branch*, R.A.S. (no. 79) Mr. Burkill has a note on the murder of James Motley, which occurred at Bangkal, Labuan, on May 1, 1859.

The recently issued parts of the North American Flora (Dec. 30, 1918) contain the conclusion of Axel Rydberg's monograph of the *Rosaceæ* (vol. xxii. pt. 6) with additions and corrections to the volume, and the first part (vol. xxxii. pt. 1) of the *Rubiaceæ*, by Paul Carpenter Standley: in this numerous new species are described, including four of the hitherto monotypic *Acrosynanthus*.

The issue of *Notes from the Royal Botanic Garden, Edinburgh*, dated November 1918, contains the first instalment of a series of papers on the "Regional Spread of Moisture in the Wood of Trees," by Mr. W. G. Craib, wherein "Deciduous-leaved Trees during the late Autumn to early Spring" are considered. The paper is accompanied by five coloured plates and as many diagrams illustrating Moisture Spread in *Acer Pseudoplatanus*.

A leaflet (no. 326) on "Injurious Weed Seeds" recently issued by the Department of Agriculture is noteworthy for its excellent illustrations from drawings by Miss Bertha Reid. The plants figured are *Rumex crispus*, *R. Acetosella*, *Cuscuta Trifolii*, *Daucus Carota*, *Geranium dissectum*, *G. molle*, *Silene inflata*, and *Lychnis vespertina*: in each case the main figures are accompanied by drawings of seeds and of seedlings in various stages.

Botanists as well as gardeners will be glad to hear that the preparation of a new edition of Pritzel's *Icones botanicarum Index*, second only to the same author's indispensable *Thesaurus*, has been begun, and has made considerable progress. It is nearly ten years ago since several influential Fellows of the Royal Horticultural Society urged the preparation, but after some discussion the project fell through. It was revived after the International Horticultural Show held in the grounds of Chelsea Hospital in 1912, when Mr. E. A. Bowles, F.L.S., an active member of the Council of the Royal Horticultural Society, succeeded in getting that body to set aside £250 towards the expenses of the new edition, with a sum of £200 annually against the amount, then estimated at £3000. The war prevented any serious attempt at making a start, but two committees were set up, one chiefly of cultivators and the other mostly of botanists, to thresh out the problems connected with the venture. Ultimately last year (1918) the plans were drawn up, and Dr. Otto Stapf, Keeper of the Herbarium and Library at Kew, agreed to act as Honorary Director, and, with the consent of Sir David Prain, to make use of the material available at that establishment, with its extensive library and trained amanuenses. The bulk of the new edition is estimated at twice that of the original, on practically the same lines.

The Garden, which often contains matter of botanical interest, reprints in its issue of March 15 an article from *The Journal of Heredity* in which the supposed hybrid origin of the Loganberry is called in question. This popular fruit "came to light about 1881 in the grounds of Judge J. H. Logan, of Santa Cruz, California: it was described by him as a natural hybrid, which appeared spontaneously, and he believed that the parents were the Auginbaugh (a variety of *Rubus vitifolius*, a wild Blackberry of California) and a red Raspberry, probably the variety Red Antwerp, since the two were growiug together in his yard." The hybrid origin, first called in question by Mr. W. O. Backhouse, economic botanist to the Argentine Government, is now doubted by others as well as by horticulturists, whose views are set forth at length in *The Garden*.

MYCETOZOA RECORDED AS BRITISH SINCE 1909.

By G. Lister, F.L.S.

Ten years have passed since the third and latest edition of the *Guide to the British Species of Mycetozoa*, published by the Trustees of the British Museum, appeared. In the preparation of a new edition, many changes had to be introduced in order to adapt the nomenclature to modern requirements, making it agree with that used in the second edition of the *Monograph of Mycetozoa*, published in 1911, and also to incorporate much additional information that has been obtained. Owing to the cooperation of many observers, five genera have been added to the British list and thirty-five species, bringing the number up to 181. For convenience of reference it may be useful to give a few notes on the additional species and varieties, on where and by whom they were found, and on some points of nomenclature.

Badhamia nitens Berk. var. *reticulata* G. Lister, in Trans. Brit. Mycol. Soc. v. 71, pl. 1. figs. 2, 2 *a*, *b*, 1914. This variety differs from the typical form in the plasmodiocarp habit of the sporangia and the more loosely clustered paler spores, which have a cap of minute, not coarse warts. The one British gathering was made by my father and myself in November 1888 on an old log at Uplyme, Devon. It has been recorded from Poland, Ceylon, and Japan.

B. affinis Rost. This inconspicuous species has been found repeatedly on the mossy bark of living trees ever since Nov. 1899, in East and West Aberdeenshire, by the Rev. W. Cran. For years it was put aside as a doubtful form, closely allied to *B. orbiculata* Rex, from which it differs chiefly in shape and of which it may be only a variety. It has been obtained from Pennsylvania and Japan.

Physarum globuliferum (Bull.) Pers. The one British record consists of a gathering made by the Rev. W. Cran, at Ballogie, Aberdeenshire, October 1913. The sporangia and lime-knots are not pure white, but have a slight brownish shade, suggesting a close relationship with *P. murinum* Lister, a species which differs in no other respect but its brown colour, and which might be regarded as simply a variety of *P. globuliferum*; for convenience of reference, however, it would seem better to keep the brown *P. murinum* as a distinct species, as well as the yellow, orange-red, purple-red, lilac, and blue forms of the "*globuliferum*" group, each of which has its separate specific name.

P. pulcherripes Peck. A fine typical gathering was made by Miss M. Rea in September 1916 in the grounds of Sir John Ross at Rosstrevor, County Down, on a stump in a larch wood (see *Irish Naturalist*, xxvi. 58, 64); this is apparently the only record for the species beyond the United States.

P. luteo-album Lister. This handsome species has been found repeatedly since 1910 in an alder copse at Uplyme, S.E. Devon, in early spring. It was also obtained in some abundance last January by Mr. N. G. Hadden at Porlock, Somerset, on dead leaves in a wood of larch and birch. It has been recorded from the south of France, Holstein, and Colorado.

P. nucleatum Rex. Found for the first time in Britain by Dr. A. Adams near Looe, Cornwall, July 1911, on dead wood. Mr. N. G. Hadden has also obtained it near Lynton, N. Devon, in August 1915 (see Journ. Bot. 1916, p. 200).

P. carneum G. Lister & Sturgis. Found in abundance by Mr. H. W. Howard in Bramble thickets, near Thorpe, Norwich, in late summer and early autumn 1916, 1917, and 1918 (see Journ. R. Microscop. Soc. 1917, p. 265, pl. xviii.). Except a gathering made near Lisbon by Dr. C. Torrend in December 1907, the only other record for *P. carneum* is Colorado.

P. brunneolum (Phill.) Massee. A single growth was found by Miss M. Rea near Lisburn, County Down, July 1917. The specimen consists of glossy brown hemispherical or elongated sporangia on a dead herbaceous stem; the spores have not matured well, but enough have developed to leave no doubt as to the identity of the species.

P. brunneolum has been obtained from California, Chili, New South Wales, and Portugal.

P. auriscalpium Cooks. First found in Britain by the Rev. W. Cran in August 1912 on a mossy trunk near Skene, Aberdeen, in which district he has repeatedly obtained it since, and also at Lesmoir, W. Aberdeenshire. Members of the Mycological Society found it in the Altyre Woods, Elginshire, in September 1912.

P. crateriforme Petch. Mr. Cran has obtained this repeatedly on the bark of living trees since 1904, near Skene, Aberdeen. It has also been recorded from Ceylon, Japan, Antigua, and S. Nigeria.

P. connatum (Peck) Lister. A single gathering of what appears to be this species was made in November 1898 by Mr. Edgar Saunders; otherwise *P. connatum* has hardly been recorded beyond N. America.

P. vernum Somm. var. iridescens, nov. var. This small iridescent form is very constant, and appears regularly on dead leaves, especially holly-leaves, in Epping Forest, Essex, in autumn and winter. It is distinguished by the sporangia being scattered and having scanty or no deposits of lime in their walls, by the lime-knots enclosing unusually large lime-granules, and by the dark brownish-purple spores having a pale patch of dehiscence. It has been found in Bedfordshire, Hertfordshire, Norfolk, Nottinghamshire, and North Devon, and also in Holstein.

Fuligo septica Gmel. var. rufa (Pers.) G. Lister. This dull red variety is not uncommon and has long been recognized. Mr. H. J. Howard finds from his experience that it always arises from cream-coloured plasmodium. For convenience, it would seem well to mark it with a varietal name.

F. septica var. candida (Pers.) G. Lister. The white variety is more abundant than the red, and arises from a white or cream-coloured plasmodium.

Diderma arboreum G. Lister & Petch in Journ. Bot. 1913, p. 2, pl. 524. fig. 2. The first British gathering of this arboreal species was made by Mr. Cran in Oct. 1910 near Skene, Aberdeen, and on most succeeding years he has found it there in late summer and autumn. Dr. A. Adams also obtained an extensive growth, on a mossy beech-trunk, near Looe, Cornwall, in July 1917. It has been recorded from Ceylon and Japan, and recently Mr. A. R. Sanderson has found it at Petaling, Federated Malay States, on the trunks of *Hevea brasiliensis*.

D. DEPLANATUM Fries. In the British Museum Catalogue this is described as a subspecies of *D. niveum* Rost.; as, however, it is a constant form, always having a scattered plasmodiocarp habit, it seems better to retain for it the name given by Fries, and to regard *D. niveum*, with its crowded hemispherical sporangia, as a separate species. *D. niveum* is very abundant on the Alps in spring, and has not been found in Britain.

D. RADIATUM (L.) Lister var. *umbilicatum* (Fries). The type of *D. radiatum* in the Linnean Herbarium has brown sporangia dehiscing with petal-like lobes: transitional forms occur connecting it with what was described by Fries as *D. umbilicatum*, a form with pale drab sporangia which burst irregularly. As M. Meylan has pointed out, this pale variety deserves some distinction; whether it is regarded as a separate species or as a variety of *D. radiatum* is a matter of little consequence ("Myxomycètes du Jura" in Ann. du Conservatoire de Genève, 1918, p. 312).

D. RADIATUM var. *montanum* Meylan (*op. cit.* p. 312). In this variety the outer layer of the sporangium-wall is white and separates easily from the membranous inner wall; the spores are usually rather smaller than in the typical form, and measure 7 to 9 μ instead of 9 to 11 μ.

D. ASTEROIDES Lister was first found in Britain in October 1910 by Mr. W. H. Burrell, who gathered it on the stems of *Equisetum palustre* on marshy ground on Flordon Common, Norfolk. It has since been obtained by Mr. W. B. Allen in Shropshire and by Mr. N. G. Hadden in West Somerset. It was also found in abundance in a deep bed of holly-leaves in woods at Cawdor, Nairnshire, in September 1912, by members of the British Mycological Society. Outside Britain it has been recorded from Portugal, the South of France, Switzerland, N. Germany, and Colorado.

LEPTODERMA IRIDESCENS G. Lister in Journ. Bot. 1913, p. 1, pl. 524. fig. 1. This was first found in March 1892 on pine bark and needles at Leighton Buzzard, Bedfordshire, and was named by my father provisionally *Lamproderma physaroides* Rost. var. *sessile* Lister. In November 1911, Miss K. Higgins discovered a fine growth of the same form in woods at Woburn Sands, Beds, in which all the characteristic features were displayed—namely the sessile habit, the granular deposits in the sporangium-wall, and the dark grey spinulose spores. It was then published as the type of a new genus. Subsequently it has been obtained at Porlock, Somerset, in Inverness-shire, in N. Germany, and several parts of Switzerland.

COLLODERMA OCULATUM (Lippert) G. Lister. The first British gathering was made by Mr. Cran in Aberdeenshire, October 1910. It now appears to be fairly abundant in many parts. In Epping Forest, Essex, it has appeared every autumn since 1911; it has also been, recorded from Yorkshire, Shropshire, Worcestershire, Somerset, Devon, and from the south of Scotland; also from the Tyrol, Switzerland, Portugal, New South Wales, Japan, and New Hampshire.

Stemonitis hyperopta Meylan in Bull. Soc. Vaud. Sc. Nat. lii. p. 97, 1918, syn. *Comatricha typhoides* Rost. var. *heterospora* Rex. It has been found from many years' experience that this form is remarkably constant. It differs from *C. typhoides* in the rosy-lilac colour of the sporangia, in their more clustered habit, in the smoother and more complete surface-net of the capillitium, and in the spores showing small patches of reticulation on their surface when highly magnified. It may seem a great change not only to make this form a distinct species, but to place it in another genus, but in reality it is not so, for *Comatricha* is only distinguished from *Stemonitis* by the more scattered habit of the sporangia and by the absence of a smooth surface-net to the capillitium, and it is for convenience, rather than as a natural arrangement, that the genus is retained at all.

Comatricha cornea G. Lister & Cran in Journ. Bot. 1917, p. 121, pl. 548. fig. 1. First discovered by the Rev. W. Cran near Skene in June 1913, and again in 1914 and 1916. M. Meylan writes that he has found this minute species in the Jura Mountains.

C. fimbriata G. Lister & Cran in Journ. Bot. 1917, p. 122, pl. 548. fig. 2. First found by Mr. Raymond Finlayson in Wanstead Park, Essex, in November 1913; since obtained by Mr. Cran near Skene, on Hind Head, Surrey, by myself, and twice by Mr. H. J. Howard in Norfolk.

C. microspora G. Lister: syn. *C. typhoides* var. *microspora* Lister. Repeated gatherings prove that this is a constant form worthy of specific rank; the closely flexuose character of the surface-net of the capillitium and the very small spores distinguish it from *C. typhoides*. It has been found in Devon, Surrey, Essex, and Norfolk, and beyond Britain in Holstein, near Berlin, and in Ohio.

C. tenerrima (Curtis) G. Lister: syn. *C. pulchella* Rost. var. *tenerrima* Lister. It is with some hesitation that the specific rank given to this form by Curtis is once more adopted. When typically developed *C. tenerrima* differs strikingly from *C. pulchella* in having pale red narrowly ovoid sporangia on long slender stalks, instead of reddish-brown broadly ovoid sporangia on short stalks, but it must be acknowledged that forms intermediate in character sometimes occur.

Lamproderma violaceum (Fr.) Rost. var. *debile* G. Lister & Howard in Journ. Bot. 1919, p. 25, pl. 552. fig. 1. Found by Mr. H. J. Howard in April and May 1918.

L. atrosporum Meylan var. *anglicum* G. Lister & Howard in Journ. Bot. 1919, p. 27, pl. 552. fig. 2. Found with the preceding on the same leaf-heaps.

L. insessum G. Lister in Trans. Brit. Mycol. Soc. 1912–13, p. 41, pl. 1. fig. 2. Found only once on lichen at Forres, Elginshire, Sept. 1912.

Clastoderma Debaryanum Blytt. This minute species was discovered for the first time in Britain by Mr. N. G. Hadden at Porlock, Somerset, December 1918, on old gorse stems; when found the sporangia were immature and watery white, but soon changed to the inconspicuous brown mature stage.

Amaurochæte cribrosa (Fries) Sturgis in *Mycologia*, ix. p. 328 (1917). This species has long been included under *A. fuliginosa* (Sow.) Macbr., from which it differs in the æthalia being smaller, rounder, and more compact, and, when perfectly formed, being clothed with a fragile membranous cortex, which either breaks into fragments adhering to the tips of the capillitium or entirely disappears; the capillitium closely resembles that of *Stemonites confluens* Cooke & Ellis, to which *A. cribrosa* appears to be closely allied. There seems to be every probability that this is the species described by Fries as *Lachnobolus cribrosus* (Syst. Orb. Veg. p. 148) as long ago as 1825, the type of which is lost. In Britain it was found near Smethwick, Staffordshire, by Mr. A. Camm, August 1895, and by Mr. T. Petch in Hull dockyard in Sept. 1903. Elsewhere it has been recorded from Sweden and Norway, and in North America from the States of Massachusetts, Pennsylvania, and Washington.

Cribraria vulgaris Schrad. In the British Museum Catalogue this is named *C. aurantiaca* Schrad., and two varieties are distinguished:—*form α*, a short-stalked form with broad nodes to the sporangial net, and *form β*, a long-stalked form with narrow nodes. The species is very variable, but a more natural arrangement is that proposed by Meylan (in Ann. du Conservatoire de Genève, 1913, p. 317); he regards *C. vulgaris* as the typical form, having slate-grey plasmodium, usually short-stalked sporangia with ochraceous spores, and either broad or narrow "nodes"; and var. *aurantiaca* Pers., having green plasmodium, usually longer stalked sporangia with golden-yellow spores, and polygonal nodes approaching in character those of *C. tenella* Schrad. or of *C. intricata* Schrad.

Licea castanea G. Lister. Discovered by Mr. Cran at Lesmoir, W. Aberdeenshire, November 1910, and found again repeatedly by him both there and near Skene. It has also been obtained by M. Meylan in the Jura Mountains.

L. minima Fries. Recorded first in Britain by the late George Massee, from Bulmer, Yorks; found since in Bedfordshire, East and West Aberdeenshire, and Inverness-shire; recently Miss M. Rea has obtained it in County Down.

Hymenobolus parasiticus Zukal. First found in Britain by Mr. Cran at Rhynie, West Aberdeenshire, June 1894, and since obtained repeatedly by him both there and near Skene; also found in the Cawdor Woods, Nairnshire.

Orcadella operculata Wingate. Recorded first from Britain by Mr. W. H. Burrell from Stratton Strawless, Norfolk, January 1909, on liverworts on a living beech-tree. Mr. Cran finds this inconspicuous little species in abundance, also on living trees, near Skene. It has been recorded elsewhere from Holstein, Japan, and in North America from the States of Maine and Pennsylvania.

Enteridium liceoides G. Lister. This has hitherto been retained as a variety of *E. olivaceum*, but, though nearly allied, it always exhibits the flat plasmodiocarp habit, and the pseudo-capillitium is represented by columnar props instead of a network of broad strands. It has been obtained in Devon, Somerset, Wiltshire, Hampshire, Surrey, Bedfordshire, Norfolk, and Argyllshire; also from France, Brandenburg, and New Hampshire.

Trichia floriforme (Schweinitz) G. Lister, syn. *T. Botrytis* Pers. var. *lateritia* Lister. The constancy of this handsome form fully entitles it to specific rank. It differs from all varieties of *T. Botrytis* in having dark red translucent stalks entirely free from refuse-matter, as well as in the orange-coloured spores. It seems unfortunate that the familiar name *lateritia*, published by Leveillé in 1846, cannot be retained; but Dr. Sturgis found, when examining the Schweinitzian herbarium, that the specimen described as *Craterium floriforme* Schweinitz in 1832 is plainly the species in question, and, by the rule of priority, the older name must be adopted. Although widely distributed, *T. floriforme* is not common in Britain; it has been recorded from Somerset, Wilts, Middlesex, Leicestershire, and Shropshire.

T. Botrytis Pers. var. *cerifera* G. Lister in Journ. Bot. 1915, p. 211. Recorded in Britain from Derbyshire, Bedfordshire, Essex, Somerset, and Dorset; also from New South Wales.

Hemitrichia leiotricha Lister. Recorded in Britain from Dorset, Devon, Surrey, Essex, Hertfordshire, Bedfordshire, Shropshire, Northumberland, and Aberdeenshire; also from Norway, Sweden, North Germany, Switzerland, and Ceylon.

H. abietina (Wigand) Lister. Found for the first time in Britain in the Woodhouse Pinetum, Uplyme, Devon, in February 1905; also obtained near Swarraton, Hants, and Hind Head, Surrey.

H. minor G. Lister. The typical form was first found in Britain by the Rev. W. Cran, near Skene, February 1912; and he has met with it again repeatedly there and also at Lesmoir, West Aberdeenshire. Mr. N. G. Hadden obtained it on the mossy bark of living trees at West Porlock, Somerset, November 1916. Here he also found the handsome little dark-spotted var. *pardina* Minakata, growing on hedge-clippings, in January 1919. In this gathering the spirals on the capillitium are unusually well developed and are dextral in arrangement, whereas in all specimens of typical *H. minor* hitherto obtained the direction of the spirals is sinistral, as is usual in the *Trichiaceæ*. In the type of var. *pardina* from Japan, the capillitium has faint and variable spirals, some being dextral, others sinistral. Guided by this character of the spirals, I examined a number of our old mountings, with the result that I came across the record of two gatherings of what I doubt not should be called *H. minor* var. *pardina*, made at Lyme Regis in the years 1891, 1899. They came from the same leaf-heap, and each consisted of a single sporangium. In appearance they are shortly stalked and glossy yellow spotted with prominent dark brown warts; the capillitium shows dextral spirals; one had been called "*H. Karstenii*?," the other "*T. erecta* Rex," and afforded the only evidence for the occurrence of that species in Britain. *T. erecta* is a much more sturdy species and has rich orange-yellow capillitium with spinulose sinistral spirals; it is widely distributed, having been recorded from the Eastern United States, from Victoria and New South Wales, and from New Zealand; it is to be hoped that eventually it may be reinstated as a British species.

H. LEIOCARPA Cooke. The single British record is a specimen found on Sphagnum in an orchid house in the Royal Botanic Gardens, Edinburgh, in 1878. In this gathering, as well as in the type from Harpswell, Maine, and in a specimen found by Mr. Hugo Bilgram near Philadelphia in 1914, the spirals of the capillitium are all dextral; on the other hand, the type of *H. Varneyi* Rex from Kansas, which is included under *H. leiocarpa* in the British Museum Catalogue, had sinistral spirals. How far the direction of the spirals is a reliable diagnostic character is uncertain in the present state of our knowledge. *H. leiocarpa* is closely allied to *H. clavata* Rost.

CORNUVIA SERPULA (Wigand) Rost. Found in abundance on heaps of spent tan, at Grampound, near St. Austell, Cornwall, in April and May 1906, by Mr. J. M. Coon. This is the only British record.

ARCYRIA INSIGNIS Kalchbr. & Cooke. The only British gathering known was made by Miss K. Higgins in woods near Luton, Beds, in August 1916.

PERICHÆNA CORTICALIS (Batch) Rost. var. *liceoides* Lister. Found on hedge-clippings, January 1919, by Mr. N. G. Hadden, near Porlock, Somerset. The minute shining yellow sporangia are both clustered and scattered about the dead herbage, and closely resemble those of an *Oligonema*, but the translucent walls are in some sporangia mottled with deposits of dark refuse-matter; the capillitium consists of a close network of nearly smooth irregular threads; the spores are minutely warted and measure 12 μ in diameter. This specimen is similar in all respects to one kindly sent by Dr. Jahn from Denmark; it had developed on the dung of fallow-deer. Other gatherings of this variety have been obtained on the dung of hares and rabbits in Germany, on old willow-bark in Carinthia, and on old cow-dung in Florida.

P. VERMICULARIS Rost. var. *pedata* Lister (see *Mycetozoa*, ed. 2, p. 253). It has been found that the specimens with stalked sporangia and smooth capillitium, published under this name from Lyme Regis and from Philadelphia, have far less affinity with *P. vermicularis* than with *P. chrysosperma* (Currey) Lister. An extensive series of gatherings of the latter species from Japan shows that the usual characteristic spines on the capillitium are sometimes absent in weak developments; the very faintly papillose sporangium-wall and the dark stalks are not unusual features in *P. chrysosperma*. The variety *pedata* of *P. vermicularis* should therefore be suppressed.

In conclusion, I wish to express my sincere thanks to the friendly correspondents who have given me permission to make free use of their observations.

ALABASTRA DIVERSA.—Part XXX.*

By Spencer Le M. Moore, B.Sc., F.L.S.

(Concluded from p. 91.)

2. Thymeleaceæ africanæ novæ vel notari dignæ.

In writing the following descriptions, the view held by recent authors that the organs found, when they do occur, usually at the throat of the calyx of *Thymeleaceæ* are petals, has not been followed. That view was not without support among older writers; thus Lindley calls the organs in question "scale-like petals," and Eichler alludes to them as "Kronblatter (Schlundschüppchen)," which may be regarded as a sort of "sitting upon the fence"; but Meisner, whose work upon the group is of great importance, always speaks of "squamulæ," while Endlicher boldly names them sterile stamens. Baillon, while adopting the "scale" view, says of *Dicranolepis* that the scales resemble a corolla. In spite of this extreme case and of a certain analogy with *Dichapetalum*, it seems not improbable that these organs are really not petals at all, but either transformed parts of the andrœcium or new structures arising independently and functioning in the pollination of the respective species bearing them. In any event, it would seem better at the present stage to use a non-committal term rather than the definite one now coming into fashion.

Struthiola epacridioides C. H. Wright, District of George, Trake de tow; *Bowie*, 22.

Struthiola Pentheri, sp. nov. Fruticulosa, *ramis* erectis rigidis omnimodo crebro foliosis pubescentibus; *foliis* subarcte imbricatis ovatis vel oblongo-ovatis obtusis nisi obtuse acutis paucistriatis coriaceis nitidulis glabris; *floribus* ex axillis pluribus oriundis; *bracteolis* cymbiformibus ciliatis apice villosulis; *calycis* tubo superne leviter amplificato ipso sub limbo subito paulloque dilatato parum incurvo glabro lobis brevibus late ovatis obtuse acutis; *squamis* 8 oblongis obtusis incrassatis pilos cingentes superantibus; *antheris* inclusis oblongis obtusis; *ovario* glabro.

South Africa, Zitzikamma; *Penther*, 429.

Folia 5–7 × 2–3 mm., in sicco viridi-grisea. Bracteolæ 2·5–3 mm. long. Calycis tubus infra articulum 1 mm., supra idem 8–9 mm. long., hic inferne ·5 mm. superne 1 mm. lat.; lobi 1·5 mm. long. Squamæ 1·2 mm. long. Antheræ squamis æquilongæ. Ovarium ·7 mm long.

Distributed as *S. Thomsoni* Oliv., a native of Tropical East Africa. It is close to *S. Macowani* C. H. Wright, differing from it mainly in the broader and obtuse leaves and the shorter calyx with but a slight enlargement immediately under the limb.

Struthiola flavescens Gilg. Road to Constantia; *Wallich*, 406. Vicinity of Cape Town; *Mrs. Balston*. Basutoland; *Nelson*.

Struthiola concava, sp. nov. Fruticulus ramosus; *ramulis* quadrangularibus foliosis primo ascendentibus postea patentibus

* Types of the species here described are in the National Herbarium.

pilosis deinde glabrescentibus inconspicueque cicatriciferis; *foliis* per paria decussata ordinatis lineari-subulatis apice subpungentibus pag. sup. concavis dorso convexis necnon trinervibus coriaceis margine prominenter sericeo-ciliatis tandem glabris; *floribus* parvis ex axillis superioribus oriundis; *bracteolis* oblongis obtusis dorso carinatis margine ciliatis; *calycis* tubo inferne glabro superne subcylindrico sub limbo dilatato subsparsim appresse sericeo lobis ovatis obtusis; *squamis* 8 (casu 9) oblongis obtusis crassiusculis quam pili stipantes paullo longioribus; *antheris* oblongis obtusis apice exsertis; *ovario* glabro.

Cape, Tulbagh; *Schlechter*, 7513.

Folia 4–6 mm. long., prope basin 1 mm. lat. Bracteolæ apice villosulæ, 3 mm. long. Calycis tubus modo 4 mm. long., pars infra articulamentum ·5 mm. long., juxta medium fere 1 mm., sub limbo 1·25 mm. lat.; lobi extus sub apice solummodo glabri, ægre 2 mm. long. Squamæ 1·2 mm. long.; antheræ totidem. Ovarium ·75 mm., stylus 2·5 mm. long.

Near *S. flavescens* Gilg., the narrower, not imbricated leaves and the very small flowers with bracteoles but little shorter than the calyx are points of easy recognition.

LACHNÆA MACRANTHA Meisn. Swellendam; *Niven*. The Bowie specimens unlocalised in Fl. Cap. are from Mts. of Tradu and Groote vader bosch (*Bowie*, no. 2).

GNIDIA PINIFOLIA L. Natal, Inchanga; *Molyneux*.
Apparently unrecorded from Natal.

Gnidia kasaiensis, sp. nov. *Caule* erecto simplici omnimodo (parte brevi inferiore exempta) folioso; *foliis* laxe imbricatis alternis sessilibus lanceolato-oblongis apice pungenti-acutis subparallele pauci-nervosis subpergamaceis glabris; *capitulis* terminalibus sessilibus globulosis multifloris; *involucri* bracteis paucis anguste ovato-oblongis acuminatis ciliatis papyraceis; *calycis* tubo anguste cylindrico infra articulamentum (basi villosa exclusa) glabro ceterum subtiliter pubescente lobis 4 abbreviatis oblongis vel oblongo-obovatis obtusis vel obtusissimis; *squamis* parvulis filiformibus; *antheris* inclusis oblongis obtusis; *ovario* glabro.

Belgian Congo, Sankuru river, Kasai district: *Kassner*, 3322.

Planta bispithamea. Folia pleraque 2–3 cm. long., 5–8 mm. lat., in sicco viridi-griseola. Capitula usque ad. 3 cm. diam. Involucri bracteæ 6–7 mm. long., saltem in sicco brunneæ. Calycis tubi pars inf. 2 mm. long.; pars sup. 11 mm.; lobi 1·5–2 mm. long. Squamæ circa ·5 mm., antheræ ·5 mm. long. Ovarium oblongum, glabrum, ægre 1 mm. long. Fructus compressus, anguste oblongo-ovoideus, glaber, 1·5 mm. long.

Affinity with *G. mollis* C. H. Wright, from which it is known by several differences in the leaves and flowers. The number of involucral bracts was not exactly ascertained, owing to the specimens having been glued down before description, but they seem to fall far short of the 15–20 possessed by *G. mollis*.

Gnidia kundelungensis, sp. nov. Suffrutex circa trispithamea; *caule* erecto parum ramoso basi nudo ceterum folioso glabro; *foliis* alternis nonnunquam oppositis vel suboppositis oblongo-lanceolatis apice breviter debiliterque pungenti-acuminatis trinervibus microscopice sericeis inferioribus laxe imbricatis superioribus gradatim distantioribus; *floribus* in capitula parva sessilia circa 15-flora ex axillis superioribus oriunda digestis; *involucri* bracteis (anne semper?) 7 anguste ovato-oblongis acuminatis papyraceis saltem in sicco brunneis; *calycis* tubo anguste infundibulari ima basi villoso infra articulamentum glabro alibi microscopice puberulo lobis 4 oblongis obtusis; *squamis* abbreviatis clavellatis; *antheris* inclusis oblongis obtusis; *ovario* glabro.

Belgian Congo, West Kundelungu, under trees; *Kassner*, 2793.

Folia inferiora 1·5–2·5 cm. long., 4–5 mm. lat., superiora gradatim imminuta, ultima equidem angustissime linearia modo 5 mm. long. Capitula circa 7 mm. diam.; horum bracteæ 5–7 mm. long. Ovarium compressum, oblongo-ovoideum, 1·5 mm. long. Stylus ægre 3 mm. long., glaber.

Differs from *G. apiculata* Gilg, which it resembles in many respects, in the broad leaves, the calyx without the long silky clothing, &c.

Gnidia fastigiata Rendle. Transvaal, Johannesburg, open veld to southward near Kliprivierberg; *Rand*, 898.

Gnidia fastigiata Rendle var. *hirsuta* H. H. W. Pears. Transvaal, Johannesburg, in shallow valleys to southward, dry vlei ground; *Rand*, 899.

This variety would seem to be new to South Africa.

Gnidia microcephala Meisn. Rhodesia, Salisbury; *Sawer*, 15, *Rand*, 1373: Victoria; *Monro*, 559.

A South African species extending as far northward as Lydenburg, which, though found also in British Central and Portuguese East Africa, has apparently not been reported hitherto from Rhodesia.

Gnidia dumicola, sp. nov. Fruticulus erectus semispithameus; *caulibus* e rhizomate valido cæspitosis a basi vel fere a basi foliosis simplicibus vel breviramosis pubescentibus; *foliis* alternis sessilibus laxe imbricatis lanceolato-oblongis superioribus lineari-lanceolatis lanceolatisve apice pungentibus longitrorsum nervosis coriaceis margine ciliatis; *capitulis* terminalibus sessilibus brevissimeve pedunculatis 12–20-floris; *involucri* bracteis circa 7 ovato-lanceolatis acuminatis coloratis (in sicco brunneis) pubescentibus; *calycis* tubo angustissime infundibulari inferne et superne dense pubescente lobis 4 obovatis obtusissimis extus pubescentibus intus glabris; *squamis* lineari-clavellatis lobos fere semiæquantibus; *staminibus* inf. medium tubum versus affixis; *ovario* glabro.

Angola, sporadic in thickets between Forte Princeza Amelia and Limbala Monelilo; *Gossweiler*, 2023.

Folia pleraque 1·5–2 cm. long., 3–4 mm. lat., basi 5–7-apice 3-nervia, nervis prominentibus. Capitula circa 1–1·5 cm. diam.

Involucri bracteæ 6–7 mm. long., dorso 5-nervosæ. Pedicelli villosi, 1 mm. long. Calyx sulphureus, pars infra articulamentum 3 mm. long., pars sup. 7 mm.; lobi 1·5 mm. long. Squamæ ·65 mm. long. Antheræ oblongæ, superiores ·75 mm., inferiores 1 mm. long. Ovarium oblongo-ovoideum, stipiti ·25 mm. long. impositum, 1 mm. long. Stylus 2 mm. long.

According to Pearson's clavis this should come next *G. stenophylla* Gilg from Somaliland: the acicular leaves of that species need alone be mentioned.

Lasiosiphon linifolius Meisn. Rhodesia, near Chirinda, 3500 ft.; *Swynnerton*, sine no. Buluwayo; *Rand*, 204.

Well distributed through various parts of South Africa and reaching as far north as Lydenburg and Pilgrim's Rest (*Greenstock*), this species, it is believed, has not hitherto been reported from a tropical habitat.

Arthrosolen chrysantha Solms-Laub. var. ignea H. H. Pearson. Rhodesia, Salisbury; *Eyles*, 862 in part.

The collector's note says " Common herb in clusters, 9–12 in. tall. Flower colour ranges from yellow through orange to red, but colour of a cluster not mixed; yellow flowers commonest and usually tallest." We have the same var. collected by Rand (No. 205) also at Salisbury. This is the first record (of the variety) from Rhodesia.

Arthrosolen Poggei H. H. W. Pearson (ex descript.). Angola, road from Caconda to Cunene; *Gossweiler*, 1794; open thickets by Domba river; *Id.*, 3063.

A very rare plant hitherto unrepresented in the London herbaria.

Arthrosolen Newtonii H. H. W. Pearson. Belgian Congo, Lukifwa river; *Kassner*, 2858.

Referred by de Wildeman (Ann. Mus. Congo Belg. Sér. iv. ii. 113) to *Gnidia katangensis* Gilg & Dew.

Arthosolen paludosa, sp. nov. Fruticosa, ascendens, pauciramulosa, *ramulis* debilibus patentibus vel ascendentibus distanter foliosis glabris; *foliis* subsessilibus linearibus (inferioribus anguste lineari-oblanceolatis) obtusis apice subpungentibus plurinervosis microscopice sericeis; *capitulis* ramulos terminantibus paucis parvis paucifloris; *involucri* bracteis 5 oblongo-ovatis breviter acuminatis membranaceis microscopice sericeis; *calycis* parvi tubo abbreviato angustissime infundibulari parte infra articulamentum glabra parte sup. sericea lobis late oblongis obtusissimis; *antheris* inclusis oblongis obtusis; *ovario* compresso-pyriformi glabro.

Belgian Congo, Luente in swamps; *Kassner*, 2485.

Planta paullo ultra trispithamea. Folia inferiora circa 2 cm. long., 2–3 mm. lat.; superiora ± 1 cm. $\times$ 1 mm., firme membranacea, in sicco viridia. Capitula pansa 6×6 mm.; horum bracteæ 6 mm. long., 2·5–3 mm. lat. Pedicelli ægre 1 mm. long. Calycis tubi pars infra articulamentum 1 mm., pars sup. 2 mm. long., hic deorsum ·2 mm. sursum ·8 mm. lat.; lobi ·6 mm. long. Antheræ ·5 mm. long. Ovarium ·75 mm. long.; stylus a latere impositus, 1·5 mm. long.

De Wildeman (*l. c.*) publishes this as "*Gnidia Buchananii* Gilg," a plant which it resembles superficially. The smaller heads and tiny flowers enable one to distinguish the new plant at first sight, irrespective of the absence of scales from the mouth of the calyx. The affinity is with *A. polycephala* C. A. Mey.

Arthrosolen microcephala, sp. nov. Frutex orgyalis, laxe ramosus, *ramis* sat robustis cortice fusco longitrorsum rimoso obductis ramulos graciles superne foliosos glabros emittentibus; *foliis* sessilibus aciculari-linearibus breviter acuminatis dorso convexiusculis glabris; *capitulis* minimis axillaribus 1–3-floris; *involucri* cylindrici bracteis 5 oblongo-lanceolatis acutis membranaceis margine anguste scariosis dorso sericeo-pilosis margine sericeo-ciliatis; *calycis* parvuli parte infra articulamentum glabra parte sup. anguste infundibulari itaque glabra lobis ovatis obtusis; *antheris* inclusis oblongis obtusis; *ovario* subquadrato glabro.

Angola, in marshy situations beside the Luassingua river; *Gossweiler*, 3009.

Folia ±5 mm. × ·5–·75 mm., in sicco brunnescentia. Capitula circa 3·5 × 2·5 mm. Involucri bracteæ 2–2·5 mm. long. Flores coccinei. Calycis pars infra articulamentum 2·25 mm. long., pars sup. totidem, hæc inferne vix ·5 mm. sub limbo fere 1 mm. lat.; lobi fere 1 mm. long. Antheræ ·5 mm. long. Ovarium ·5 mm., stylus a latere insertus circa 1 mm. long. Fructus oblongo-ovoidea, acuta, brunnea, 3 mm. long.

To be inserted in the genus next to *A. pleurocephala* H. H. W. Pearson, a species not represented in this country, but described as having ovate-lanceolate involucral bracts and heads with 5–6 brown flowers.

Arthrosolen Gossweileri, sp. nov. Caulibus ascendentibus cæspitosis gracilibus e rhizomate sat valido ortis fere a basi crebro foliosis glabris; *foliis* sessilibus aciculari-linearibus acutis vel acuminatis dorso striatis glabris; *capitulis* exiguis cylindricis usque 11-floris in axillis superiorbus positis horum bracteis paucis exterioribus lanceolatis vel lineari-lanceolatis acuminatis membranaceis interioribus 4 ovatis acuminatis scariosis coloratis dorso summum pilosis margine sericeo-ciliatis; *floribus* breviter pedicellatis pedicellis villosis; *calycis* tubi parte infra articulamentum cylindrica glabra parte sup. anguste infundibulari sericea lobis oblongis obtusissimis; *antheris* oblongis inclusis; *ovario* oblongo-ovoideo glabro.

Angola, Munonque in thickets; *Gossweiler*, 3090.

Planta trispithamea habitu scopario. Folia ±10 × ·5 mm., in sicco viridi-brunnea. Capitula pansa modo 5 × 3 mm.; horum bractæ ext. 4 mm. long., int. læte brunneæ 4–5 mm. long., juxta basin 2 mm. lat. Flores ex echedis cl. delectoris dilute flavescentes. Calycis pars inf. 2 mm. long., ·5 mm. lat.; pars sup. 3 mm. long., inferne ·5 mm. ipso sub limbo 1 mm. lat.; lobi 1 mm. long. Antheræ ·4 mm. long. Ovarium vix 1 mm., stylus glaber 1·5 mm. long.

Like the last, this is allied to *A. pleurocephala*: it differs from *A. microcephala* mainly in the involucres and the flowers.

Dicranolepis Talbotiorum, sp. nov. *Ramulis* foliosis teretibus subtiliter sericeo-pubescentibus dein glabrls; *foliis* subsessilibus oblique ovatis vel ovato-oblongis caudato-acuminatis apice obtusis basi cuneatis membranaceis glabris; *floribus* 5-meris in axillis verisimiliter solitariis; *calycis* tubo satis elongato cylindrico basi paullulum dilatato cinereo-tomentoso lobis tubo brevioribus oblongo-lanceolatis obtusis mox reflexis extus tomentosis intus subtiliter etsi dense pubescentibus; *squamis* calycis lobos adæquantibus vel iis paullo brevioribus usque basin partitis spathulato-oblongis obtusissimis integris vel apicem versus leviter undulatis glabris; *staminibus* exsertis; *ovario* glabro, stigmate capitato-truncato subincluso.

Hab. South Nigeria, Degema Division; *Talbot*, 3693.

Folia 5–7·5 cm. long., 2·5–3 cm. lat., in sicco brunneo-viridia. Calycis tubus circa 3 cm. long., humectatus basi 3 mm. lat. alibi 2 mm.; lobi 1·2–1·5 mm. long. Squamæ 1–1·3 cm. long., segmentis juxta apicem 3·5–4 mm. lat. Stamina usque 7 mm. exserta; antheræ subhippocrepiformes, vix 2·5 mm. long. Stigma superne compressum, 1·75 mm. diam. Fructus ovoidea, brunnea, subtiliter pubescens, 1·3 × 1·1 cm., calycis persistentis parte sup. 5–6 mm. long.

Affinity with *D. grandiflora* Engl., differing chiefly in the smaller flowers with relatively broader squamæ, shorter than, or at most equal to, the sepals and stigma only just emerging from the mouth of the calyx-tube.

Dicranolepis angolensis, sp. nov. Suffrutex ramosus ramulis subteretibus novellis pilis fere omnino destitutis; *foliis* subsessilibus oblique ovatis caudato-attenuatis apice obtusis basi obtusis membranaceis subnitidis glabris; *floribus* 5-meris in axillis solitariis sessilibus; *calycis* tubo gracili basi leviter solum dilatato cinereo-tomentoso intus glabro lobis oblanceolato-oblongis obtusis utrinque pubescentibus; *squamis* sepala circiter æquantibus alte partitis segmentis oblongo-oblanceolatis apice leviter incisis glabris; *staminibus* exsertis; *ovario* glabro; *stigmate* incluso compresso-claviformi apice truncato.

Hab. Angola, Cazengo; *Gossweiler*, 4422, 4422 *a*.

Planta ⅔-metralis radice erecto crassissimo quam se ipsa duplo longiore fulta. Folia pleraque 6–8·5 cm. long., usque ad 2·5–3·5 cm. lat., in sicco supra saturate subtus pallide viridia. Flores albi. Calycis tubus 2·5–2·7 cm. long., ima basi 1·5 mm. alibi 1 mm. lat.; lobi 10–11 mm. long., 3 mm. lat. Squamæ 9–10 × 2 mm. Filamentorum pars exserta fere 1 mm. long.; anthera 2·5 mm. long. Stigma 2 × 1 mm.

To be inserted next *D. pubescens* H. H. W. Pearson, a native of French Guinea, from which its glabrous young shoots, its calyx-tube glabrous within, and narrower calyx-lobes are the chief points of difference.

Apparently no. 4422 *b* is the same thing in fruit. The ovoid fruits are covered with a sparse sericeous indumentum easily rubbed off; they measure 9–10 × 7–7·5 mm.: the persistent tubular part of the calyx is 4 mm. in length.

Dicranolepis Batesii, sp. nov. Frutex ultrametralis ramulis crebro foliosis pubescentibus deinde glabris; *foliis* breviter petiolatis oblique ovatis caudato-acuminatis apice acutis basi cuneatis firme membranaceis supra glabris subtus præsertim in nervis appresse piloso-puberulis; *floribus* pro rata parvis 5-meris plerumque 2–3-nis sessilibus; *calycis* tubo abbreviato cylindrico basi vix dilatato extus puberulo intus glabro lobis oblongo-lanceolatis tubo brevioribus extus pubescentibus intus glabris; *squamis* calycis lobos circiter semiæquantibus alte bipartitis segmentis oblongis vel lineari-oblongis integris vel sursum denticulatis glabris; *staminibus* exsertis; *ovario* glabro; *stylo* compresso-claviformi tubo plane incluso.

Hab. Cameroons, Bitye; *Bates*, 692.

Folia pleraque 6–7 × 2·5–3 cm., supra in sicco viridia subtus brunnescentia. Flores albi. Calycis tubus 9–10 mm. long., ima basi 1–1·25 mm. lat., alibi ·75–1 mm.; lobi circiter 3 mm. long., ·5–1 mm. lat. Filamentorum pars exserta 1·5 mm. long.; antheræ 1·25 mm. long. Stigma eroso-marginatum, truncatum, 1·25 mm. long., hujus culmen 1–1·5 mm. infra calycis os.

The squamæ and included style are the chief differences between this and *D. parviflora* H. H. W. Pearson.

The squamæ here and there may be greatly reduced in size, the segments in some cases measuring less than 1 mm. in length.

Peddiea Batesii, sp. nov. Frutex glaber, trimetralis vel paullo ultra; *foliis* pro rata magnis ellipticis apice acuminatis basi in petiolum brevissimum gradatim angustatis membranaceis nitidulis; *floribus* 4-meris in umbellam 10-floram pedunculo brevi insidentem digestis; *bracteis* perpaucis ovatis acutis scariosis margine sericeo-ciliatis; *pedicellis* pedunculo tenuioribus necnon paullo brevioribus; *calycis* tubo juxta medium levissime contracto glabro lobis ovatis obtusissimis apice pubescentibus; *staminibus* 8 antheris oblongis obtusis; *ovario* ovoideo superne dense villoso; *stylo* ovario æquilongo basi apiceque aliquantulum dilatato glabro; *stigmate* compresso-capitato.

Cameroons without precise locality; *Bates*, 1035.

Folia usque 17 vel etiam 19 cm. long. (exstant vero minora) et 5 cm. lat., supra in sicco griseo-viridia, subtus pallidiora; costa media subtus optime eminens, costæ laterales parum perspicue. Bracteæ 4–10 mm. long. Pedunculus 7 mm., pedicelli 4–5 mm. long. Flores sec. cl. detectorem viridi-flavi. Calycis tubus ægre 1 cm. long., inferne 2·25 mm., superne 3–3·5 mm. lat.; lobi mox patentes, 1·5 mm. long. Antheræ 1 mm. long. Ovarium 1·5 mm. long. Stigma ·5 × ·8 mm.

Differs from *P. Zenkeri* Gilg in the large leaves, the differently-shaped bracts, short peduncles and pedicels, and slender style as long as the ovary.

3. **Pseudactis**, *Compositarum* e tribu *Senecionidearum* genus novum.

Capitula homogama, subdiscoidea, flosculis omnibus ☿. *Involucrum* ecalyculatum, cylindrico-campanulatum, phyllis 1-seriatis inter se liberis. *Receptaculum* planum, nudum. *Corollæ* tubulosæ, paucæ exteriores zygomorphæ lobis 2 majoribus ita capitulum radiatum mentientibus. *Antheræ* basi obtusæ, integræ. *Styli* rami complanati, apice truncati penicillatique necnon appendice filiformi sibi ipsis fere æquilonga onusti. *Achænia* subcylindrica, 10-costata, ægre omnino glabra. *Pappi* setæ paucæ, tenuissimæ caducissimæque. Herba annua habitu gracili. *Folia* alterna. *Capitula* exigua, ea *Emiliæ* simulantia, ad apicem ramorum solitaria. Corollæ 5-meræ, verisimiliter flavæ vel aurantiacæ.

Pseudactis emilioides, sp. unica. Planta sparsim ramosa, spithamea vel sesquispithamea, *ramulis* (uti caulis) filiformibus debilibus ascendentibus sparsim foliosis puberulis; *foliis* parvis distantibus inferioribus manifeste petiolatis orbicularibus vel suborbicularibus superioribus contra sessilibus lanceolatis obtusis omnibus tenuiter membranaceis puberulisque; *capitulis* circa 25-flosculosis longipedunculatis; *flosculis* ext. zygomorphis circa 8 exsertis; *involucri* phyllis 6 oblongis acutis vel obtusiusculis apice ipso sphacelatis dorso eleganter striatis puberulis; *styli* ramorum appendicibus ex andrœcio eminentibus; *achæniis* utrinque paullulum angustatis eleganter costatis; *pappi* setis glabis albis.

Belgian Congo, Western slopes of Magila Mts.; *Kassner*, 2994.

Folia inf. 7–10 mm. diam., horum petioli filiformes, summum 5 mm. long.; folia pleraque sup. 7–10 mm. long., 2–3 mm. lat., omnia integra et in sicco viridia. Pedunculi circa 12 cm. long. Capitula pansa 7 × 5 mm. Involucri phylla 5 mm. long. Flosculorum ext. lobi majores oblongi, obtusi, usque ad 3 mm. long., lobi minores lineari-lanceolati, acuti, 1·5 mm. long.; flosculorum int. tubus anguste infundibularis, 3 mm. long., lobi lanceolati, circa 2 mm. long. Styli rami ·6 mm. long., horum appendix ·4 mm. Achænia fusca, 2 mm. long. Pappi setæ 2 mm. long. vel paullo ultra.

A curious plant, which at first sight would be sorted without hesitation into *Emilia*. From this the zygomorphic exterior corollas—recalling those of some *Dipsaceæ* and *Mutisiaceæ*, for instance,—the filiform appendages to the style-arms, and the scanty caducous pappus afford good grounds for separation.

ILFRACOMBE MOSSES AND HEPATICS.

By Cecil P. Hurst.

(Concluded from p. 97.)

Barbula cordata Dixon. First noticed on a wall-top at Saunton by Mr. Holmes in April 1903, and was only known until quite recently from Central Europe (Austria, Germany and Switzerland); in 1902 it was gathered in Pyrenees by Messrs. Dixon and Nicholson the latter of whom writes:—"I found *B. cordata* on the Saunton cliffs in North Devon in October, 1916. It grew in a scattered way practically all along the cliffs, but I think that it was most plentiful at the end nearest to Baggy Point."—*B. tophacea* Mitt. Fruiting freely on the cliffs to the east of Ilfracombe; I think I have also seen the capsules on Braunton Burrows. Mr. Knight writes:—"I fancy that some mosses which seem to be confined to a calcareous element inland are not so particular when growing near the sea.—*B. tophacea* seems to be always common near the sea whatever is the nature of the soil."—*B. rigidula* Mitt. c.fr. on the coast at Lee and near the Watermouth Caves on a wall, apparently not uncommon on rock in the Ilfracombe neighbourhood.—*B. Hornschuchiana* Schultz. Small roadside quarry near Iron Letters Cross, Ilfracombe, in small quantity; very fine on a golfing green on the Lee Golf Links; in extremely small quantity on Braunton Burrows.

Weisia viridula Hedw. c.fr. in sandy places near Ilfracombe, I did not see much of this but it is no doubt not uncommon on sandy banks in the district.—*W. verticillata.* Wet rocky bank near Berrynarbor; rock-crevice on Capstone Parade, Ilfracombe; cliffs near Haggington Beach, where I found capsules in fair quantity; the fruit is very rare.

Trichostomum crispulum Bruch. Rather common on banks, rock-faces, etc. especially on the calcareous eastern side of Ilfracombe, fruiting on stony banks on the south side of the road from Watermouth Castle to Combemartin; the fruit is particularly fine and plentiful in a small limestone quarry in a field a little to the south of this road. Capsules are rare in this plant, but Mr. Dixon tells me he finds that, when produced, they generally occur in some quantity.—*T. mutabile* Bruch. Rather common and often very fine around Ilfracombe on rocks and banks; the fruit, which is rare, occurs sparingly on a rocky bank on the south side of the road from Watermouth Castle to Combemartin.—*T. mutabile* var. *littorale* Dixon. Common and very variable all round Ilfracombe, growing plentifully on the rock-faces on Capstone Parade and also on Lantern Hill; a very small-leaved form occurs which Mr. Knight says he has seen elsewhere.—*T. flavovirens* Bruch. Fairly plentiful on sand at Braunton Burrows; a curious form occurred on rock in some quantity in a small cove near Bull Point Lighthouse, about it Mr. Dixon wrote:—"It is an unusual form with leaves acute and nerve longly excurrent; not, I think, at all common, but I have gathered it in Hants, and one or two other localities." The only record for the fruit of this moss appears to be near Falmouth in 1898 by the Rev. W. H. Painter.—*T. nitidum* Schp. Rather common in and around Ilfracombe; I noticed it on the churchyard wall of the parish church and on a wall close to Wildersmouth beach, near Marine Place.

**Pleurochæte squarrosa* Lindb. On sand at Braunton Burrows in two localities near where *Ammophila arundinacea* has been planted; also very sparingly near the lighthouse on Braunton Burrows. Mr. Dixon wrote:—"The leaves of the *Pleurochæte* you send from Braunton Burrows are unusually entire or subentire at times, but scarcely constantly enough to form a var. or form."

Zygodon viridissimus R. Brown. A form occurred rather plentifully and fruited freely at the roots of trees by the small stream near Watermouth Castle. Mr. Dixon wrote:—"The *Zygodon* must be referred to *Z. viridissimus.* The leaves are sometimes longly apiculate, but even then it is not the nerve that is excurrent or very rarely; and it is not the stout mucro of *Z. Stirtoni*."—*Z. Stirtoni* Schp. Rather common on rock-faces in and around Ilfracombe, growing on Lantern Hill (where I found capsules) and on Capstone Parade; it also fruits on a rocky roadside near Hele, close to Ilfracombe, the capsules are rarely produced. I noticed a form with markedly recurved leaves near Score; of a plant that occurred on a rock-face near Torrs Park Road Mr. Dixon wrote:—"I should refer your *Zygodon* to *Z. Stirtoni*; the better developed leaves have distinctly that apex; but there are a great many with quite the normal apex of *viridissimus*. It is a good illustration of the poor title *Z. Stirtoni* has to specific rank."

Ulota crispa Brid. Not uncommon on trees around Ilfracombe, producing capsules freely. Mr. Knight writes:—"I have always had considerable difficulty in distinguishing between *U. crispa* and *U. Bruchii*, unless one finds them in good conditions, with capsules just ripe and immediately after the fall of the lid. In Gloucestershire, where they are scarce, it is difficult to find *Ulota* in good condition, and you never know when to get ripe fruit in a dry climate like we have here. I have found plants with full-grown but unripe capsules as late as January. In *U. Bruchii* the capsule is contracted at the mouth and in *U. crispa* it is contracted below the mouth.—*U. phyllantha* Brid. Not uncommon on trees around Ilfracombe; in Torr's Park Road and in the Lee Valley and very fine on trees near the Watermouth Caves.

Orthotrichum Lyellii Hook. & Tayl. Scarce on trees near Ilfracombe, where the genus is very poorly represented.

Schistostega osmundacea Mohr.* In rabbit-holes near North Moulton; Mr. Hiern writes:—"*S. osmundacea* grows in the S.W. bank of the road, in the parish of Arlington, about a furlong (say, 200 mètres) from the guide-post at White Cawsey, towards Arlington, at altitude about 260 mètres. Another station is just in the parish of Morte-hoe on the confines of Georgeham parish, in the old disused Spreacombe iron mine, about 120 mètres altitude, about 4 miles from Braunton and rather more than 2 miles from Morte-hoe railway station." The moss was accidentally discovered in this locality by Mr. E. Vidal in 1906 while geologizing; it grows plentifully with the hepatics *Calypogeia arguta* and *Diplophyllum albicans* on the sides and floor of a cave in Devonian Sandstone, which the highly refractive protonema illumines with an exquisitely lovely soft golden green light. In the summer the fruit is produced freely in this station. Mr. Hiern mentions that it occurs in five (1 Barnstaple, 5 Honiton, 6 Torquay, 7 Plymouth, 8 Tavistock) out of the eight botanical districts into which Devonshire is divided.

Bartramia pomiformis Hedw. Wall-crevices on the east side of the road north and south of Mullacott Cross near Ilfracombe.

Ptilonotis fontana Brid. Plentifully in and by the rivulet on the coast halfway between Ilfracombe and Lee, near where the coast-road between these places crosses the streamlet, producing male flowers freely in the summer, but I did not see capsules.

Webera carnea Schp. Damp clay banks in several localities near

Ilfracombe, but not at all common.—*W. albicans* Schp. Magnificent pale glaucous green tufts of this moss grew on the ground in a small quarry near Ilfracombe Water Reservoirs.—*W. Tozeri* Schp. Very sparingly and sterile in a hedgebank in several localities by the lower road leading from Ilfracombe to Score Woods, near a cemetery.

Bryum pendulum Schp. Very plentiful on sand near the Lighthouse on Braunton Burrows; Mr. Knight writes:—"This is common on sands by the sea, and seems to be a smaller form than the plant growing on walls, etc. inland."—*B. Warneum* Bland.* In various places and not uncommon on damp sand in the large wide depressions on Braunton Burrows near the Lighthouse, associated sometimes with *Centunculus minimus* and the hepatic *Moerckia Flotowiana.* In September and October the pinkish wide leaves, tall seta sometimes two inches long, and widely ovate-pyriform, abruptly pendulous capsules were very noticeable. Mr. W. Watson records it from the Burnham-on-Sea sandhills in N. Somerset (v.c. 6).—*B. intermedium* Brid.* On sandy ground near the Lighthouse on Braunton Burrows associated with the hepatic, *Lophozia badensis*, producing capsules all through the autumn.—*B. roseum* Schreb. This fine species was sent me from the vicinity of Barnstaple.

Cryphæa heteromalla Mohr. Local near Ilfracombe, where I saw it in four or five places, including a locality in the Chambercombe Valley; growing and fruiting upon a gate leading on to Braunton Burrows.

Neckera pumila var. *Philippeana* Milde.* Very fine on trees in a damp wooded hollow near Iron Letters Cross, Ilfracombe.—*N. complanata* Hübn. c.fr. in a wall in the Sterridge Valley and also c.fr. on a tree in the Chambercombe Valley.

Pterogonium gracile Swartz. Not uncommon on rock along the coast.

Porotrichum alopecurum Mitt. c.fr. in two places near Ilfracombe.

Anomodon viticulosus Hook. & Tayl. Not common in the immediate vicinity of Ilfracombe; by the roadside near Score Woods; roadsides near Combemartin.

Leptodon Smithii Mohr. Plentiful on felled timber by the roadside near Ilfracombe; I was informed the trees had grown in the neighbourhood. Very sparingly on a tree in the Chambercombe Valley.

Heterocladium heteropterum B. & S. The two forms described in the *Student's Handbook* (p. 419) grew close together in a rocky wood in the Sterridge Valley.

Thuidium tamariscinum B. & S. About a dozen capsules occurred in a damp wooded hollow at the foot of a tree near Iron Letters Cross; also fruiting very sparingly in a wood in the Chambercombe Valley.

Camptothecium lutescens B. & S. Abundant on Braunton Burrows, where I did not see fruit; the capsules occur on the Burnham sandhills in N. Somerset.

Brachythecium glareosum B. & S.* Large tufts occur sparingly on the south side of the road between Ilfracombe and Watermouth

Castle.—*B. albicans* B. & S. Sandy places on the coast near Watermouth Harbour.—*B. rutabulum* B. & S. A large form with erect stout branches and densely crowded markedly plicate leaves grew in a very wet place on the coast halfway between Ilfracombe and Lee and was placed under var. *robustum* B. & S. by Mr. Dixon.—*B. populeum* B. & S. c.fr. in several places by rocky and stony roadsides near Ilfracombe.—*B. illecebrum* De Not.* By the roadside very sparingly at Upper Warcombe Farm near Lee, Ilfracombe; also by the roadside sparingly near Mortehoe Station.

Eurynchium Swartzii Hopk. Fruiting rather freely in a wet dripping hollow on the coast halfway between Ilfracombe and Lee; the fruit was arcuate and considerably larger than the small short turgid capsules which occur in Savernake Forest, Wilts.—*E. pumilum* Schp. In a wall-cleft in the Sterridge Valley, also in a wet hollow by the roadside at Lee.—*E. tenellum* Milde. c.fr. not uncommon on rocks and walls near Ilfracombe, especially in the calcareous regions.—*E. striatum* B. & S. c. fr. in a hedgebank near Spreacombe, the fruit seems uncommon near Ilfracombe.—*E. murale* Milde. c.fr. on a slate roof near Score Woods.

Plagiothecium undulatum B. & S. Fruiting finely for a long distance in a hedgebank near Bratton Fleming.

Amblystegium irriguum B. & S. c.fr. on siliceous boulders in two streams on the coast between Lee and Bull Point Lighthouse.

Hypnum stellatum var. *protensum* Röhl. On a calcareous bank on the south side of the main road between Ilfracombe and Hele.—Harpidioid Hypna are apparently very scarce around Ilfracombe, and even the common *H. aduncum* (unrecorded for N. Devon in the *Census Catalogue*) eluded my search.—*H. commutatum* Hedw. Rather fine in a waterfall and also in a wet clayey place at Haggington Beach, Ilfracombe.—*H. molluscum* Hedw. This species, so significant of calcareous soil appears where there is lime in the Ilfracombe rocks as on Hillsborough and at Haggington Beach, and occurs upon rock in Chambercombe Valley; it grows finely on limestone banks by the roadside between Watermouth and Combemartin.

Hylocomium loreum B. & S. Fruiting finely for a long distance in a hedgebank near Bratton Fleming.—*H. squarrosum* B. & S., and *H. triquetrum* B. & S. I saw the capsules of these on wreaths and crosses in a shop in Ilfracombe High Street.

Hepatics.

Riccia commutata Jack.* Growing sparingly with *R. sorocarpa* on wet clayey rushy ground on the top of Windcutter Hill near Lee.—*R. sorocarpa* Bisch. With the above species on Windcutter Hill near Lee.—*R. crystallina* L. Fruiting upon damp sandy ground near the Lighthouse on Braunton Burrows. It grows on damp sandy ground by the sea in S. Wales (H. H. Knight).

Conocephalum conicum (L.) Dum. Very fine by a rocky roadside near Hele producing ♀ receptacles freely; this common plant grows by a roadside well at Lee, and is not unfrequent around Ilfracombe.

Preissia quadrata (Scop.) Nees.* Sparingly on sandy ground near the lighthouse on Braunton Burrows.

Aneura pinguis (L.) Dum. With *Moerckia Flotowiana* on Braunton Burrows.

Metzgeria furcata (L.) Dum. Very common on trees around Ilfracombe; a small gemmiparous form occurred on trees near Twitchen, a hamlet near West Down.

Moerckia Flotowiana (Nees) Schiffn.* Plentiful and conspicuous on damp sandy ground in the wide flat depressions near the lighthouse on Braunton Burrows.

Pellia Fabbroniana Raddi. Forma *furcigera*, the autumnal state of this species, occurred near Ilfracombe.

Blasia pusilla L.* Plentiful and with numerous flask-shaped gemmiferous receptacles on the ground in a small quarry near the Ilfracombe reservoirs.

Petalophyllum Ralfsii (Wils.) Gottsche. Sparingly with yellow antheridia on damp sandy ground in the wide flat depressions near the lighthouse on Braunton Burrows, growing with *Bryum Warneum* and *Moerckia Flotowiana*. Mr. Knight writes:—"I am familiar with this hepatic on the S. Wales sandhills. It used to be conspicuous in autumn, later on it would be covered with sand and difficult to find. In April or May, when in fruit, the capsule rises above the sand and this makes it more conspicuous." I have also seen it in various places in the hollows of the sandhills near Burnham, N. Somerset.

Fossombronia Wondraczeki (Corda) Dum.* Sparingly on wet clayey ground on Windcutter Hill, near Lee.

Marsupella emarginata (Ehrh.) Dum. On the rocky coast between Ilfracombe and Lee.

Alicularia scalaris (Schrad.) Corda. On rock in Freshwater Bay, west of Ilfracombe.

Haplozia crenulata (Sm.) Dum. On wet ground on the top of Windcutter Hill, near Lee; a generally very common plant.

Lophozia turbinata (Raddi) Steph. In some quantity on the south side of the road from Hele to Watermouth.—*L. badensis* (Gottsche) Schiff.* On sand with *Bryum intermedium* on Braunton Burrows, near the lighthouse.

Saccogyna viticulosa (Sm.) Dum. Damp rock by pathside at Haggington Beach and also in Chambercombe Valley.

Cephaloziella byssacea (Roth.) Warnst. Creeping among stems of *Campylopus brevipilus* on the coast near Mortehoe.

Calypogeia arguta Nees et Mont. This somewhat rare plant grows very plentifully with *Schistostega* in a cave in Devonian Sandstone near Spreacombe.

Scapania compacta (Roth.) Dum. On a bank on the coast upon Lee Golf Links; not uncommon on banks near Ilfracombe.—*S. nemorosa* (L.) Dum. Shady hedgebank near Bratton Fleming.

Frullania Tamarisci (L.) Dum. Rock in Freshwater Bay, near Ilfracombe.

NOTES ON LYCHNOTHAMNUS.

By James Groves, F.L.S.

Through the kindness of Dr. Rendle I have had the opportunity of examining from time to time a charophyte which has for some years past been in cultivation in a glass jar in the Botanical Department of the British Museum. The circumstances in which the plant was obtained are somewhat unusual. Mr. T. V. Hodgson, of the Plymouth Museum, being interested in the Entomostraca, and hearing of Professor Sars's experiments in raising those creatures from dried mud, asked his brother, Mr. E. Roscoe Hodgson, who was residing at Port Elizabeth, Cape Colony, to send him some mud from any local dried-up pond. The latter accordingly in about the year 1896, forwarded some nine or ten pounds of nearly dry mud from a dried-up "vlei" near the town. Mr. T. V. Hodgson sent some of this mud to Professor Sars, and both of these gentlemen raised from it a number of Entomostraca; the result of Prof. Sars's investigation was published in 1898. The mud also contained vegetable matter, and from some of this, which had been sent to Dr. Calman and placed in water, the charophyte grew up together with a species of *Riella*. The charophyte produces oogonia and antheridia in abundance, but I have seen no ripe oospores. I feel, however, very little doubt in referring it to a weak form of *Lychnothamnus macropogon* Braun, a characteristic Australasian species, which had not I think hitherto been known from Africa. In all the fertile whorls of the South African plant which I have examined, oogonia are produced in the axils of the branchlets, as in *L. macropogon*, but not also at any of the free branchlet-nodes; and this added to the absence of ripe fruit militates against an entirely satisfactory determination. It is to be hoped that further material from Cape Colony will be forthcoming to settle the matter.

The extremely long stipulodes, of which there is often a second whorl above the branchlets and which gave rise to the specific name *macropogon*, are but feebly represented in the South African plant, and, indeed, at some nodes are quite wanting. It is possible that this, as well as the defective development of the fruit, may be due to impaired vitality, owing to the plant growing under unnatural conditions. The pronounced development of the stipulodes is, moreover, by no means constant in *L. macropogon*. A large number of specimens of that species were collected at Hawkes Bay, New Zealand, by the late Augustus Hamilton, for many years Director of the Dominion Museum at Wellington, who, through the kind offices of Mr. Walter Barratt was good enough to present them to my late brother and myself. An examination of these disclosed a great variation in the development of the stipulodes, which range from tiny conical processes about 150 μ in length to the characteristic long slender ones attaining to about 1600 μ, but never reaching to the extraordinary length of those of the typical Australian plant, so well shown in Kützing's beautiful drawing, Tab. Phyc. vii. t. 46. In the Hawkes Bay plant I have not observed any whorls destitute of stipulodes, but in some of them the circle is imperfect. The entire absence of these organs from some whorls of the cultivated South African plant has not therefore the importance which it would have appeared to possess if we had only the typical Australian plant with which to compare it.

I take this opportunity to refer to the generic position of this plant, and of the other species which have been placed under *Lychnothamnus.* That genus was first established as such by Leonhardi, in *Lotos*, xiii. p. 72 (1863), having previously been differentiated in 1845 by Ruprecht (Symb. ad hist. et geogr. pl. Ross. pp. 79, 80, and Distr. Crypt. Vasc. Imp. Ross. p. 11) as a subgenus, to include the species in Braun's section "Charæ pleurogynæ," viz. *C. barbata*, *C. papulosa* (under two of its synonyms *C. Wallrothii* and *C. Pouzolsii*), and *C. macropogon.* In Braun's papers from 1849 onwards the name *Lychnothamnus* was adopted as a subgenus. In the conspectus to *Die Characeen Afrika's*, however, Braun, though still keeping it as a subgenus, preceded the specific names with an "*L.*" instead of a "*C.*" In Braun and Nordstedt's *Fragmente einer Monographie der Characeen* (1882) the genus was recognised as distinct, but important changes were made in its constitution. *Chara papulosa* (under another of its synonyms, *C. alopecuroides*) was removed into a new genus, *Lamprothamnus*, and *Chara stelligera* (=*C. obtusa*, Desvaux) was added to *Lychnothamnus*, so that the latter genus consisted of three curiously unlike plants, *L. stelliger*, *L. macropogon*, and *L. barbatus*.

The distinctive character of *Lychnothamnus* is that the antheridia are produced by the side of the oogonia, and as shown in the diagrammatic figures of *L. barbatus*, nos. 191–4, t. vi. of the *Fragmente*, they proceed from separate peripheral cells of the branchlet node, whereas in *Lamprothamnium* (=*Lamprothamnus* Braun, *non* Hiern) and *Chara* both sexual organs arise from the same peripheral cell, in the former genus the antheridium being situated above (or occasionally beside the oogonium, and in the latter below it. Now it happens that of the three species placed under *Lychnothamnus* in the *Fragmente*, it is only in the one, *L. barbatus*, that the relative position of the sexual organs can be satisfactorily ascertained, since *L. stelliger* is diœcious, and in *L. macropogon*, while the antheridia are normally produced at the free nodes of the branchlets and occasionally somewhat irregularly at their base, the oogonia are usually produced only at the basal-nodes in the axils of the branchlets, and when occasionally also at a free branchlet-node scarcely ever at one where there is an antheridium. I will refer later to instances in which to my knowledge they have been found together.

In 1889 Professor Hy (in Bull. Soc. Bot. France, xxxvi. p. 398 (1889) constituted a separate genus, *Nitellopsis* for *L. stelliger*, and this separation was concurred in by Dr. Migula, who, however, gave it a fresh generic name, *Tolypellopsis*. Though the distinctive characters relied upon by these authors are purely vegetative ones, the genus appears to me to be a natural one. It is, however, perhaps a case where "knowledge falls short of conviction"! The simple structure of the plant as compared with other *Chareæ*, seems to mark it out as belonging to an archiac type, and the fruits more than those of any other living species approximate in shape and size to the big globular fruits so characteristic of the Oligocene beds, the original "gyrogonites" of the early geologists. The generic name *Nitellopsis* Hy, antedating that of *Tolypellopsis* must be retained, and as the oldest specific name for the single species is *Chara obtusa* Desvaux (1810), to comply with the International Rules, the name must stand as *Nitellopsis obtusa*, the synonymy being as follows :—

NITELLOPSIS OBTUSA, comb. nov.

Chara obtusa Desvaux, in Loiseleur, Notice aj. Fl. France, p. 136 (1810).

C. vulgaris var. *elongata* Wallroth, Annus Botanicus, p. 182 (1815).

C. ulvoides Bertoloni, in Bruni, Nuov. collez. d'opusc. Scient. 1825, p. 113.

C. translucens Reichenbach, Iconographia, tt. 804–5 (1830) *non* Persoon.

C. stelligera Bauer, in Mössler, Handb. Gewächs. ed. 2, iii. p. 1595 (1829) (*fide* Wallroth & Ruprecht).

Nitella ulvoides & *N. stelligera* Kützing, Phyc. Gen. p. 318 (1843).

N. Bertolonii Kützing, Tab. Phyc. vii. p. 11, t. 26. f. 2 (1857).

Lychnothamnus stelliger Braun, in Braun & Nordstedt, Fragm. Monogr. Charac. p. 102, t. 6. f. 189 (1882).

Nitellopsis stelligera Hy, in Revue de Botanique, viii. p. 46 (1890).

Tolypellopsis stelligera Migula, Die Characeen, vol. v. of Rabenhorst, Krypt. Flor. Germ. ed. 2, p. 255, ff. 70–73 (1890–1).

T. obtusa Beguinot & Formiggini, Bull. Soc. Bot. Ital. 1907, p. 102.

This species has, I believe, so far been recorded from European localities only. There is, however, a specimen in the herbarium of the Calcutta Botanic Gardens, collected in 1892 by Abdul Huk, at Fort Stedman, Upper Burma, which, in my late brother's opinion and my own, can only belong to *N. obtusa*, or some very nearly allied species. The specimen is unfortunately an extremely poor one and is sterile, so that conclusive determination was not possible. It would be satisfactory if perfect specimens of the plant could be collected, as if it should prove to be *N. obtusa* it would represent an important extension of its known distribution and, if a new allied species, of immense interest.

In examining *L. macropogon* the next species of *Lychnothamnus* in the *Fragmente*, one is struck by the great similarity in its vegetative parts to our European *Lamprothamnium papulosum* (=*Lamprothamnus alopecuroides* Braun). In the *Fragmente* (p. 100) is the following remark:—"*Lychnothamnus macropogon* macht Schweirigkeit, ist nach Habitus ein *Lamprothamnus*, nach der Stellung der Sporangien eher ein *Lychnothamnus*." Braun does not however mention having found an antheridium and an oogonium at the same free node of a branchlet, and his remarks rather infer the contrary. In a specimen collected in 1898 by Mr. F. M. Reader at Polkemmet, in the Wimmera River Valley, Victoria, my late brother found an instance of an antheridium and an oogonium at the same free node, and although produced side-by-side proceeding from the same peripheral cell, corresponding therefore with *Lamprothamnium* rather than with *Lychnothamnus*. The coronula of *L. macropogon* moreover closely resembles that of *L. papulosum*, and is quite unlike the diminutive coronulas of *L. barbatus* and *Nitellopsis obtusa*, which in size approach more nearly to those of the *Nitelleæ*. If the evidence ended here I should feel little hesitation in proposing the transfer of *L. macropogon* to *Lamprothamnium*. but in a specimen collected by Mr. S. T. Dunn in a freshwater lagoon, at Shebo, Hong Kong in 1905 (No. 1734), which in other respects closely resembled *L. macropogon*, and which we came to the conclusion must be referred to that species, we found two instances where an oogonium and an antheridium were produced at the same free branchlet-node, both organs in each case proceeding from the same peripheral cell, but the antheridium being *below* the oogonium. This position would, according to the recognized characters, necessitate the plant being placed under *Chara*.

In view of these facts it is difficult to decide where the species is best located. Four alternatives present themselves, to all of which there are objections. To take first that of allowing it to remain in *Lychnothamnus*, this must, I think, be rejected, considering the point of origin of the antheridium when produced in company with an oogonium at a free node in Reader's and Dunn's specimens. This character, as well as the size of the connula, appears to me conclusively to separate it from *L. barbatus*, which must be regarded as the type of the genus. The second alternative, that of placing it under *Lamprothamnium* on account of its great resemblance to *L. papulosum*, would, if our determination of Dunn's plant is correct, mean setting aside the one distinguishing character of that genus.

A third alternative is that proposed by Dr. Migula, who placed *L. macropogon* in a separate genus and named it *Macropogon australicum* (*Die Characeen*, l. c. p. 273, 1891). He did not, however, diagnose his genus, and I am at a loss to discover any character or set of characters upon which such a genus could be based. The production of oogonia in the axils of the branchlets, evidently their normal position in *L. macropogon*, is not peculiar to that species, several of the *Charæ*, sect. *haplostephanæ* producing them in the same position, and the presence of a single stipulode opposite the base of each branchlet is also common to more than one *Chara* of the same section, while the great length of the stipulodes, apart from its not being a satisfactory generic character, is as already stated, by no means constant.

For the present—at any rate until more evidence is forthcoming—the most satisfactory course seems to be to adopt the fourth alternative of reinstating the species in the genus *Chara*, placing it next to *C. succincta*, with which it has much in common, the main differences being that in the latter species oogonia are produced on the outer side of the branchlets as well as in their axils, and that the stipulodes are of a different shape.

The separation of *Nitellopsis* and the removal from the genus of *L. macropogon* would leave the one well-marked species, *L. barbatus*, in *Lychnothamnus*.

The plants from which Miss McNicol obtained the facts for her admirable paper "The Bulbils and Pro-embryo of *Lamprothamnus alopecuroides* A. Braun" (*Annals of Botany*, xxi. p. 61, 1907), were also raised from mud derived from the neighbourhood of Port Elizabeth, but I do not know whether or not from Mr. Hodgson's gathering. The possibility of cultivating charophytes in this way from dried mud opens up opportunities of becoming acquainted with the life-history of little-known species, and the success which has attended these experiments points to the desirability of samples of mud being obtained where possible from districts the aquatic vegetation of which has not been worked up. The preservation of specimens in formalin has been of great assistance and is an immense advance on the dried specimens which formerly represented one's only material, but living plants would, of course, be far better.

In examining one specimen of the South African *L. macropogon* I came across a rather remarkable abnormality, there being no fewer than three oogonia in which the number of spiral enveloping-cells numbered four instead of five. Abnormalities in charophytes are by no means uncommon, but a deviation in the number of spiral cells is of special interest on account of the extraordinary constancy of the number (five), dating back as it does to the earliest undoubtedly characeous fruits which we possess, those from the Oolite. Braun, in referring to the constancy of this character in his paper "Uber die Richtungsverhältnisse der Saftströme in den Zellen der Characeen" pt. 2 (1853), mentions that he had himself met with only one exception, that of a four-celled coronula in *Chara galioides*, which implies also four spiral cells. The only others I have noticed, among the many thousand fruits which have passed under my observation, were a single oogonium of *Nitella opaca*, and a fossil "fruit" from the Lower Headon beds, each of which had six spiral cells.

SHORT NOTE.

Cheshire Plants (p. 91). The only new records for the county in Mr. Adamson's list are *Ceterach officinarum* and *Potamogeton prælongus* Wulf.: the latter is an interesting addition; it occurs rarely in the adjoining counties of Mid-west York! Stafford! and Salop! and is recorded for Denbigh (Journ. Bot. 1913, Supp. 39) and Derby. *P. coloratus* Horn. was found by Major Wolley-Dod on Willey Moor in 1912; the specimens from West Kirby labelled *polygonifolius* in De Tabley's herbarium belong to this species: "*P. lucens* L." from Rostherne Mere, in his herbarium, is *P. angustifolius* Bercht. & Presl. Major Wolley-Dod collected *P. zos-*

terifolius Schum. in (5) the river Dee near Shocklack in Aug. 1899, and *P. densus* L. is recorded in this Journal for 1886, p. 140, making five species additional to the *Flora of Cheshire*. With regard to the note under *P. compressus* (*Flora*, 287) the specimens so named from "Hale Moss, G. Caley, 1818," in Mr. Bickham's herbarium are *P. obtusifolius* M. & K. *Myosotis cespitosa* Schultz was recorded from Hoylake by Mr. Whitwell in this Journal for 1899 (p. 360).

A few additional records may be added. *Elatine hexandra* DC.: 3. Delamere, H. Searle sp. 1883.—*Callitriche vernalis* 'Syme'; to the one station given in the *Flora* may be added (7) "The race-course, Knutsford, 1869," herb. De Tabley. The omission of *C. Lachii* Warren has already been noted (Journ. Bot. 1899, 277); there are sheets in De Tabley's herbarium from (2) "Tabley Moat" and (5) "The Lach Eye meadows."—*Saxifraga Hirculus* L. is noted in the *Flora* as "extinct since 1830 or 1840," but J. B. Wood in Phyt. i, 282, 700 (1842–3) writes that it then still existed on Knutsford Moor.—The occurrence of *Arctostaphylos Uva-ursi* Wimm. is doubted in the *Flora*, but Mr. Cash (*Naturalist*, 1887, 183) cites from W. Wilson's notes in the Warrington Museum: "at the head of the valley near to Staleybridge called the Bushes, June 15, 1832": this is clearly a Cheshire station.—*Euphorbia portlandica* L. "Sand-hills on the banks of the Dee, West Kirby, Wirral," June 1900, H. Bell sp.; see also Journ. Bot. 1900, 319.—*Carex limosa* L. 6. Wyburnbury, A. H. Evans sp. 1906.—*Lycopodium clavatum* L. 5. Bickerton and Peckforton Hills, Wolley-Dod.—For other additional records see *Naturalist*, 1899, 353, 1904, 23, and Mr. Spencer Moore's notes in Journ. Bot. 1900, 74.—ARTHUR BENNETT.

REVIEW.

The Life and Letters of Sir Joseph Dalton Hooker, O.M., G.C.S.I., based on materials collected and arranged by Lady Hooker. By LEONARD HUXLEY. Portraits and Illustrations. Two vols., pp. xii, 546, viii, 569. London: John Murray, 1918. Price 36*s*. net.

THESE volumes, by the son and biographer of Hooker's great friend and contemporary, Thomas Huxley, are in every way worthy of their subject. A brilliant if iconoclastic writer, Mr. Lytton Strachey, in the Preface to his *Eminent Victorians*, has lately condemned with characteristic exaggeration the "two fat volumes with which it is our custom to commemorate our dead—with their ill-digested masses of material, their slipshod style, their tone of tedious panegyric, their lamentable lack of selection, of detachment, and design": Mr. Huxley's volumes, although "fat," present the exact antithesis of Mr. Strachey's censure, and are in every respect admirably done: the only possible improvement in arrangement would be the placing at the head of each page the date of the events recorded below, in accordance with the helpful practice adopted in many biographies. It must however be admitted that Mr. Huxley was exceptionally favourably placed as to material: Hooker himself was "an indefatigable letter writer . . . . add to this his journals of travel, his various books, his scientific essays—the first written at nineteen, the last at ninety-four—the material to draw upon has been superabundant," especially when added to these are the Life and Letters of Darwin and of the author's father.

It would be impossible in the space at our disposal to give anything like an adequate sketch of the contents of the volumes: so far as a general sketch of Hooker's life is concerned, this indeed is scarcely necessary, in view of the full notice by Mr. Boulger which appeared in this Journal for 1912 (pp. 1–9, 31–43). The chapters which tell of Hooker's relations with his family, especially that devoted to his "early days," which contains an "autobiographical fragment set down late in his life," are of much interest. His father and his maternal grandfather (Dawson Turner) both began their botanical studies with the mosses, and "at the age of five or six" Joseph showed a love of these plants: "my mother used to tell an anecdote of me that, while I was still in petticoats, I was found grubbing in a wall in the dirty suburbs of the dirty city of Glasgow, and that when she asked me what I was about, I cried out that I had found *Bryum argenteum* (which it was not), a very pretty little moss I had seen in my father's collection, and to which I had taken a great fancy." The paternal Hooker was not slow to encourage the incipient taste; at the age of seven Joseph was attending his lectures on botany and he had from an early period expressed a hope that his son would succeed him in the Glasgow professorship. As a result of this poor Joseph's nose was always kept very close to the botanical grindstone; even when he was twenty-three his father's letters "urge to stick to botanical work exclusively—to avoid wasting his time in unnecessary entertainments; counsel indeed scarcely needed for one who cared so little for the ordinary attractions of Society." Nor did the father hesitate to express his dissatisfaction with the plants sent—this at one time made the son fear that he "was physically incapacitated for the high trust reposed in" him. "If ever, on my return," he wrote from St. Helena in 1840, "I am enabled to follow up botany on shore, I shall live the life of a hermit, as far as society is concerned; like Brown, perhaps, without his genius." The reply throws a somewhat new light on the generally accepted character of Brown: "If you are no more than a hermit than Brown, I shall not complain; whether you know it or not, he is really fond of society and calculated to shine in it; and to my certain knowledge, never so happy as when he is in it."

Joseph Hooker was not only a voluminous but an excellent letter-writer, and it is not too much to say that the value of the volumes rests largely on the very extensive use that has been made of his letters, which abound in interest chiefly though by no means exclusively botanical. His descriptive powers were considerable—the *Himalayan Journals*, first published in 1854 and twice reissued in cheap form, illustrates this, and the letters written home during the

Antarctic Expedition are only some among the many which might be selected for special mention. His communications to Darwin, Huxley, Bentham, Asa Gray, Harvey, Henslow and others, especially those relating to the growth and development of the theory of evolution, are particularly noteworthy; that to Darwin with reference to his (Hooker's) attack on Wilberforce at the memorable meeting of the British Association at Oxford in 1860 is very lively reading. Throughout his career he was in constant contact with leading botanists at home and abroad, in connection with whom items of interest are incidentally mentioned. In almost all such cases Mr. Huxley has added a footnote containing a brief biography; this could hardly be better done. The *Biographical Index of British Botanists* has, quite rightly, been laid under contribution: in some instances—*e. g.* Edward Madden (i. 468) the notice is little more than an expansion of that in the *Index*. The value of the information given is perhaps best appreciated when it is withheld, as in the case of one "Gerard," whose views on the validity of species are combated (i. 440); the context suggests that Godron is intended, but Hooker could hardly have spoken of him as "evidently no botanist." Moreover, the work criticized—*L'Espèce*—can hardly have been Godron's book so-called, as Mr. Huxley says, inasmuch as Hooker's letter in which it is referred to is dated 1845 and Godron's volume was not published until 1859. In some cases—*e. g.* that of William Anderson, of whom a full account was given in Journ. Bot. 1916, 345–51—the biographies in this Journal might have been consulted with advantage.

The early wish of Sir William Hooker that his son should succeed him was fulfilled not at Glasgow but at Kew; Joseph was appointed assistant to the Director in 1856, after various disappointments which threatened his botanical career, and on his father's death in 1865 became Director. Here he set to work to reorganize the establishment, which he at once raised to a higher state of scientific and horticultural efficiency, carrying out, often in the face of much official discouragement, developments which he had long seen to be necessary. Five years later Hooker's work was interrupted by a long and bitter personal conflict with A. S. Ayrton, First Commissioner of Works, under whose administration Kew then came. A chapter is occupied with a recital of the main facts of the controversy, which occupied the attention of both Houses of Parliament and was embittered by the publication of an official report written by Owen, "who," says Mr. Huxley, "was notoriously hostile to Kew and to its Director for his evidence before the Science Commissioners, and Owen had employed all his great dexterity to belittle Kew and its applications of systematic botany, to urge the transfer of its collections to the British Museum, where they would come under his own government, and to insinuate a bitter personal attack on both the Hookers." This sentence, which is not written with Mr. Huxley's usual care and lucidity, hardly explains Owen's grounds for "hostility": the Science Commission alluded to is apparently that of 1871, at which the "transfer" of the Museum collections to Kew had been advocated by Bentham and Hooker; thus Owen's proposition was rather of the nature of a defence. A similar transference to Kew had been advised by Joseph Hooker in 1858 (see *Life*, i. 381) in "the interests of botanical science" and a like proposal had been made through the Board of Works, apparently at the instigation of Kew, in 1868 (see Journ. Bot. 1876, 103). Those (of whom the writer is one) who can recall the period will remember that although sympathy was generally extended to Hooker for the treatment he had received at the hands of an official who, as *The Times* put it, had an "unfortunate tendency to carry out what he thinks right in as unpleasant a manner as possible," it was felt by some that Hooker's attitude had not always been marked by discretion. Mr. Huxley says that Ayrton's "apparent aim was to drive Hooker to resign, and then convert Kew into an ordinary park, and send science to the right about." That Ayrton had little understanding of the requirements of science I am able to testify: it once fell to my lot to receive him when he visited the Department of Botany, when I failed to convince him that a single specimen of each plant was not sufficient for all scientific purposes. The controversy which elicited so much warmth, and appropriately originated over a heating apparatus, came to an end in July 1872; the Treasury Minute on the basis of which it was settled will be found in this Journal for that year, p. 349.

From this time until his resignation of the Directorate in 1885, Hooker's life was occupied by botanical activities, official, literary, and other, of which some account will be found in Mr. Boulger's sketch already mentioned, although for anything like a complete summary of them the volumes before us must be consulted. "Full of vigour, and indeed continuing an ordinary man's share of labour for another quarter of a century," Hooker in his retirement from office in no way abandoned the interests to which he had devoted his life. A picture of him in his study at Sunningdale shows him surrounded by the Wedgwood plaques in which he delighted—the only form of art to which he seems to have had a special attraction. In 1901 he writes: "Kew still claims about one day of the week, devoted to the *Botanical Magazine*, and I occupy my days here chiefly in dissecting plants for the good of Kew Herbarium, and drawing the analyses on the sheets for the use of those coming after me. This work, dissecting flowers, fruits and seeds, has been a lifelong passion with me; I often think of my dear father working on his Ferns with unabated energy up to the very week of his death." He writes a graphic account of the coronation of Edward VII in 1902, at which he was present in "gorgeous sky-blue satin mantle of a G.C.S.I. with a gold star on it as big as a soup plate, and a heavy gold collar no my shoulders." He took part in the Cambridge celebrations of the Darwin Centenary in 1909, when an interesting photograph (here reproduced) was taken of himself and Lady Hooker, with Mrs. T. H. Huxley, the last holding in her arms Ursula Darwin, Darwin's great-grandchild. Up to the last his letters were full of interest and reminiscence; thus in July 1911, writing of Banks, he says: "I well remember first seeing him, when as a boy I was at

Kinnordy [probably in 1836], and looking out of the window saw him wheeling a barrow of marl up to the house from the pit [to search for shells]."

The volumes contain several portraits, including the weak study by Richmond, who "has turned me out a very lackadaisical young gentleman," and the excellent one by Herkomer (1889) at the Linnean Society. The appendixes contain a full bibliography, extending from 1837 to 1911, thus including the posthumous papers on *Impatiens*, and a long "list of Degrees, Appointments, Societies, and Honours," which was hardly worth printing—it contains such entries as "Two Jasper Cups from the Russian Emperor: Gift" and "Congratulations from the Linnean Society (on completion of *Genera Plantarum*)": a sketch is also given of the extraordinary career of Jorgen Jorgensen, "the Convict King" (1770–1844), whom Hooker met in Tasmania in 1840. An admirable index is provided, in which the summary of the principal events of Hooker's life is particularly well done. Only one detail affords ground for unfavourable criticism: it is to be regretted that the proofs were not submitted to a botanist for revision, as there are far too many misprints; in vol. ii. p. 447, we have in one line, consecutively "*Alpina*, *Lygodon Mongeoltii*" and, five lines later, "*Minum*"; "the genus *Maddenia Rosaceæ*" (i. 468); "*Gymnostonum*" (i. 38); "*Sabularia*" (i. 76) are instances which might easily be multiplied. But this imperfect appreciation of Mr. Huxley's work must not end upon a note of even slight censure upon a biography which will take permanent rank among the best of the class to which it belongs.

James Britten.

BOOK-NOTES, NEWS, etc.

At the meeting of the Linnean Society on 20th March, a paper by Mr. Frederick Lewis, F.L.S., "Notes on a Visit to Kunadiyaparawitta Mountain, with a List of the Plants obtained, and their Altitudinal Distribution," was read by the Botanical Secretary. This curious mountain is nearly due west of the sacred "Adam's Peak," and rises abruptly to an altitude of 5186 feet above the sea, and is surrounded by forest. The summit is small in extent, surrounded by precipices, in the path of the S.W. monsoon, which strikes on this isolated peak and by its force dwarfs the vegetation on it. The rainfall on the eastern base is about 230 inches per annum, on the western side about 330 inches yearly. The flora appears to be largely endemic, animal life is practically absent, and wind transport of seeds of those plants which are on the summit seems unlikely. Forty-nine plants were collected on the mountain top in one day's visit, and were determined at Peradeniya; of the 49, ten only are found outside Ceylon, the remainder being endemic. The President, Sir David Prain, gave an account of his visits to two islands off the Indian coast. On one of these, Barren Island in the Andaman group, he found that *Terminalia Catappa*, which usually grows close to the sea, extending to the top of the outer cone, apparently due to the rats feeding on the fruit (the "Country Almonds" of Anglo-Indian speech), which, when disturbed, they carried in their mouths up the slopes.

At the same meeting Miss M. Rathbone exhibited a series of specimens preserved by submitting them to the action of formalin vapour, as shown in the following statement:—Some years ago it occurred to me to try to find some method of preserving plants which would not destroy either their form or colour. I began by trying liquid paraffin, and this at first gave very promising results; but after a time the specimens became mouldy, and, if antiseptics such as salicylic acid were added, the colour disappeared. It then occurred to me to try formalin vapour, hoping that in this way the tissues of the plants might be hardened, and at the same time that the colour might be preserved. Unfortunately, as these specimens show, the results have fallen far short of my ideal! The colour fades after a time, and the stalks and petals often become limp. However, in spite of these drawbacks, I think the method may have its uses, as, in plants preserved in this way, the microscopic characters of the tissues and the form of the flower and relationship of its parts are less altered than in dried specimens, whilst for travellers specimens preserved in this way are lighter and more convenient to carry than plants preserved in spirit. I found that it was best to dilute the formalin with water, and the strength I used was one part formalin to one or two parts of water, and possibly an even weaker solution might answer. Cotton-wool soaked in this solution is put at the bottom of the bottle, or it may be tied round the stalks of the plants, enough being used to ensure a damp atmosphere. Of course the bottles or boxes in which the plants are kept ought to be air-tight, and I found that candle-grease dropped over the cork answered very well. These plants were bottled in 1917, as last summer I was moving about and was not able to make any further experiments. I have also brought a bottle of African Marigold in salicylic acid and liquid paraffin, bottled in 1912. It was quite the best of my paraffin specimens, most of which are deplorable objects, and I do not think there is much to be said for this method, as it has all the drawbacks of alcohol and none of its advantages. As regards formalin, I might add I have found that a 1/10 solution in water is quite good for freshwater Algæ. I have some bottled in 1911, in which the chlorophyll body in *Spirogyra*, which shrivels up so easily with most reagents, still shows quite distinctly.

At the meeting of the same Society on April 3, a paper, on "An Albino Mutant of *Botrytis cinerea*, Pers.," illustrated with preparations and lantern-slides, was read by Mr. William Brierley. He stated that the fungus possesses characteristic black sclerotia, the colouring matter being deposited in the walls of the outer two or three layers of cells. Among the black sclerotia in a pedigree culture a single colourless sclerotium was formed, and on isolation this gave rise to a strain characterized by colourless sclerotia. Morphologically and physiologically the parent and mutant strains are identical, and the only difference is the lack of colouring matter in the latter. A generation of the fungus may be obtained in three days, and the two strains tested over very many generations under the most diverse conditions have proved absolutely constant. As the colourless form arose in a "single-spore" culture, it cannot represent a strain selected out from an original population; and as *Botrytis cinerea* is asexual, the possibility of the new form being a segregant from a heterozygous parent is eliminated. Furthermore, the occurrence of colourless sclerotia in this fungus is unknown heretofore either in Nature or when the fungus is grown on culture media. There would, therefore, seem no reason to doubt that the colourless form described is an instance of true mutation in *Botrytis cinerea.*

At the same meeting, a paper on "Variation in Flowers of *Jasminum malabaricum* Wight," by Dr. H. H. Mann, F.L.S., was explained by Dr. Rendle. He pointed out that in the forests of the Western Ghats of Bombay, during the month of April, the jungle is covered with flowers of this fragrant and attractive climber. Between April 13th and 20th, 1916, the author had examined 2789 flowers for the corolla, and found from 5 lobes in 0·33 per cent. to a maximum of 8 lobes in 40 per cent., declining to a percentage of 0·04 for those with 12 lobes. Similarly, the teeth of the calyx were examined in 3560 flowers at the same time, and showed with 4 teeth, 2·56 per cent., with 5 and 6 lobes the maximum with respective percentages of 46·26 and 47·81, the last being of 8 teeth with 0·22 per cent. He failed to associate any peculiarity with the position of the flowers on the stem or in the inflorescence.

A GOOD example of manufactured "flower lore" is supplied by the following paragraph published by the *Manchester Guardian.* So far as we are aware, its only foundation in popular legend is the name "Calvary Clover," which is bestowed upon the Spotted Medick in common with other plants with spotted leaves from a tradition that they grew beneath the Cross. The botanical information conveyed in the paragraph is as remarkable as the symbolical:—

"Some curious flower lore is associated with the spotted medick (*Medicago maculata*). The seeds of the plant are very well protected, enclosed as they are in a prickly ball, and some perseverance is needed to unroll them from this rough covering. The first shoots should appear on Low Sunday, if the seed has been sown on Good Friday—a day with which the plant is connected, as it is known in some places under the name of Calvary clover. The first two leaves which appear resemble those of a sunflower, and symbolise the Incarnation—The Godhood (*sic*) and manhood of Christ. At sunset the two outer leaves come together, and the centre one droops over them, suggesting a prayerful attitude of bowed head and folded hands. The leaflets are characterised by a heart-shaped purple spot, rather like a drop of freshly spilt blood, which fades as the leaves grow older. The prickly pod encasing the seed may be twisted into a crown of thorns if care be taken. When the fibre is uncovered the form of a scourge is said to be found beneath it. Eleven, the number of the faithful Apostles, is the number of seeds which a perfect pod should contain."

THE PROBLEM OF THE BRITISH MARSH ORCHIDS.

By Colonel M. J. Godfery, F.L.S.

As the season is with us when the marsh orchids are in flower, it may be of interest to point out the problems requiring solution.

Orchis prætermissa is used in this paper to indicate the marsh orchid with unspotted leaves, other than *O. incarnata*, and *O. latifolia* the one with ringed spots on the leaves. This is not to be taken as an acknowledgement of *prætermissa* as a valid name for the plant in question, or as implying dissent from Mr. Rolfe's suggestion that the ring-spotted plant is a hybrid. The names are solely used as convenient terms of reference. *O. maculata* is employed in the aggregate sense, and includes *O. ericetorum* Linton.

Orchis prætermissa Druce (Rep. Bot. Soc. & E. C. 340 (1913) 1914, also J. Bot. 1915, 176). On returning to England in August 1914, I was much interested to hear that a new species had been described under this name. I first found it in Surrey in 1916, and was much struck by its beauty, especially by the delicate lavender-mauve of its flowers, which was quite different from anything I had seen on the Continent, except perhaps *O. palustris* at Pisa. I found later it was not always of this beautiful tint. Near Godalming I found it in plenty, but here the flowers were red-purple or pinkish rose. Instead, however, of being the rare and local plant I expected, it was reported to be widely spread and plentiful where it occurred. (Its new name implied that it had hitherto been overlooked, and it was difficult to understand how so striking and abundant a plant could have eluded the keen eyes of field-botanists.) Finally, I read in Mr. Druce's "Notes on the British Orchids" (Rep. 1917, Bot. Soc. & Exch. Club) that Smith's *latifolia* (Engl. Flora) and the *O. incarnata* of the Engl. Bot. were both "mainly *prætermissa*," and that the *latifolia* of other British authors was either mainly *prætermissa* or included it. It is not therefore a new species in the sense that it had not been many times seen and recorded before, but only in the sense that it had not been previously differentiated from *latifolia*. Mr. Rolfe says (Orch. Rev. xxvi. p. 186) that it is quite clear that the name *latifolia* primarily belongs to the marsh orchid with broad unspotted leaves—in other words, to the one recently described as *O. prætermissa*. He is no doubt right, in so far as it is true that the *O. latifolia* of British authors was in the main *prætermissa*, as Mr. Druce himself admits, though it also included the ring-spotted plants, and of course hybrids of *prætermissa*, for in those days the occurrence of natural hybrids was hardly yet fully recognized, and they were naturally looked upon as mere varieties of the species.

Whether *O. latifolia*, as thus restricted by Mr. Rolfe, is the plant understood on the Continent to be *O. latifolia* L. is another question. Incidentally it may be remarked that *if* such is the case, there is nothing new about *O. prætermissa* except the name, which would then automatically fall to the scrap-heap as invalid.

In 1918, in a field near Broadstone, Dorset, to my surprise, for the field though damp was hardly marshy, I came across *O. latifolia* with ringed spots on the leaves. Presently I found another specimen, but the leaves were unspotted, and I said to myself "And here is *prætermissa* too." On comparison the plants appeared to be identical, except as to the spots on the leaves. I was puzzled at the time, but on maturer reflection I am strongly inclined to think that the plant with unspotted leaves was not *prætermissa* at all, but simply a form of the ring-spotted *latifolia* with unspotted leaves. I have, I believe, seen similar plants in Somerset and Hants, and I think it is a question worth studying whether Mr. Druce has not drawn his net too wide in the matter of *prætermissa*, whether he has not in fact included in it plants identical with the ring-spotted *latifolia* except as to the absence of spots on the leaves.

To clear up this matter it is suggested that the following investigations should be made:—

1. Is there in Britain a form of *O. latifolia* with unspotted leaves distinct from *O. prætermissa*?

2. Is there a form of *prætermissa* only distinguishable from the type by having spotted leaves?

To the best of my belief I have seen the former, but never the latter.

Orchis latifolia. Mr. Rolfe, as we have seen, considers *O. prætermissa* to be the true *O. latifolia* L., and even goes so far as to suggest that the figures of *O. latifolia* L. in Schulze's Orch. Deutschl. (t. 21) and Barla's Icon. des Orchidées represent the hybrid × *O. Braunii* (*latifolia* × *maculata*). These figures, however, are intended to depict the plant understood on the Continent to be *O. latifolia* L. Schulze knew *O. Braunii*, and gives a sketch of the lip of this hybrid on the same plate, and also a description, pointing out the characters in which it differs from *latifolia*. I think we must guard against taking an insular view of our flora; after all it is only a branch of the larger and much more extensive flora of the Continent. All our orchids are found there with the exception of *Spiranthes Romanzoffiana*. It is much safer to interpret our flora in the light of the continental one, than to argue from the smaller to the greater. It should be noted that according to Schulze *both* the parents of *O. Braunii* have spotted leaves.

Mr. St. Quintin tells me in a letter that on July 15th, 1914, he and Canon Travis visited a marsh of some twenty acres not far from Champéry, which was a marvellous garden of marsh plants, thick with *O. latifolia*, which grew in thousands, *Primula farinosa*, *Trollius*, *Bartsia alpina*, a few *Gymnadenia albida*, an *Allium*, etc., but *O. latifolia* predominated. Canon Travis, to whom he has recently spoken on the subject, agrees with him that all the *O. latifolia* they saw there were alike, with purple flowers and spotted leaves. They did not see *O. maculata* that day, though Mr. St. Quintin noted in his journal every species of orchid they found. These alpine *latifolia* seemed to him wonderfully similar, with little or no variation, and with no suggestion of hybridism. He also says that on June 8th in the Western Pyrenees he found many specimens of *O. latifolia* with spotted leaves, and further that, with the exception of *O. incarnata*, he has never found any marsh orchid on the Continent with hollow stem and unspotted leaves (except *O. palustris*, which is otherwise unmistakable). He is confident that he has never seen, amongst the common spotted forms of *O. latifolia*, plants with similar flowers and unspotted leaves. These spotted *latifolia*, then, could not possibly be hybrids—there was no plain-leaved parent and no *maculata* to be found in the neighbourhood.

He also says that "on the Continent you may find undoubted *latifolia* growing in quantity with no other marsh orchis." Personally I have always found *latifolia* on the Continent with spotted leaves, but I have never seen anything approaching *prætermissa*. My experience, however, only extends to a few scattered localities in Southern France, Switzerland, and Italy—I know nothing of Northern France or Central Europe. Ascherson and Graebner (Syn. Mitt. eur. Fl. iii. p. 732) say of the Central European plant that the leaves are usually all marked with black-brown spots, often confluent, oftener faint, more rarely absent. I do not think any serious doubt can be entertained that the plant known on the Continent as *O. latifolia* L. usually has spotted leaves. The spots, however, are not always ringed. Mr. St. Quintin says that from recollection he would say that the alpine plants referred to above did not always have ringed spots; in some, if not in many cases, the spots were solid. Mr. Raine tells me that at Hyères *latifolia* grows with unspotted leaves, and Brébisson in his *Flore de Normandie* says the leaves are "rarement tachées de brun." These *may* be *prætermissa*, but the fact remains that ring-leaved and spotted-leaved *latifolia* grow abundantly where *prætermissa* does not exist.

The Rev. E. S. Marshall tells me (*in lit.*) that he found at Wexford a plant with short blotched leaves which seemed to agree exactly with one in Herb. Brit. Mus. gathered by Messrs. Britten and Nicholson in June 1882 in Co. Waterford, and named by H. G. Reichenbach as *O. latifolia* var. *brevifolia*, and that he obtained other plants in W. Mayo and Caithness, which he referred to this same variety, and noted at the time as having the leaves faintly ring-spotted. He adds "I do not think that these three gatherings come under *O. prætermissa*; nor are they likely to be hybrids, for which I have kept a good look out." He also mentions that a plant with spotted leaves sent to him from Winchester agrees very well indeed with Schulze's figure of *O. latifolia* L. (plate 21). I was present at the gathering of this specimen, which was our ordinary ring-spotted plant.

I sent a water-colour drawing of *O. prætermissa* to Dr. Keller, of Aarau, who has a very wide experience of European Orchids. He did not say, as one might have expected, "This is *O. latifolia* L.," which he assuredly would have done had he considered it to be that species, but suggested that it might be *O. Traunsteineri* A. II. *Russowii* Asch. & Graebn. Syn. iii. 730 (1907); their description, howover, does not seem to fit *prætermissa* very well. For the above reasons it would seem that while *O. prætermissa* is no doubt the *O. latifolia* of most English authors, it is open to question whether it is *O. latifolia* L. as understood on the Continent.

The Argument as to Spots on the Leaves.

Most, if not all, European orchids with spotted leaves are sometimes found without spots. Even *O. maculata*, which is perhaps more persistently spotted than any other European orchid, occurs occasionally with unspotted leaves. Spots on the leaves are not therefore of specific value, and nothing seems to be known of their cause or object. Our native *mascula* is sometimes spotted, sometimes not. In 1918, I saw specimens with spotted leaves growing in the midst of a colony of unspotted plants. As both kinds flourished within the same square yard of ground, it was evident that soil and surroundings had nothing to do with the spotting. Mr. H. McKechnie suggested in the Report of the Winchester College Nat. Hist. Soc. (reprinted in Rep. B. E. C. (1917, p. 187) that ring-spotted *latifolia* was originally a hybrid between *maculata* and *prætermissa*, and Mr. Druce (*l. c.* p. 167) regards it as proved that a plant with clear green leaves crossed with one with spots of solid colour will produce ringed spots in the offspring. This theory is so plausible that it is apt to be too readily accepted. Is there any reason why the circumference of the spot should retain its depth of colour, and the centre revert to the original green of the leaf? Fewer or fainter spots of solid colour would appear to be more truly intermediate. Let us see what happens in the case of other orchids. On June 27th, 1916, I found *Gymnadenia conopsea* × *O. maculata* near Winchester, the leaves were not spotted; another specimen found June 28th, 1917, near Guildford, had spotted leaves, but the spots were solid. I also found *Cœloglossum viride* × *C. maculata* near Winchester, the leaves were spotted, the spots not ringed. Plate 15 (*l. c.*), said to be a form of the same hybrid, has unspotted leaves. *O. incarnata* is unspotted, and so closely related to *O. prætermissa* that nearly all British botanists down to Hooker (and Mr. Druce himself in the 14th ed. of Hayward's *Botanist's Pocket-book* (1914)), considered it only a variety of *O. latifolia*. We might therefore expect that in its hybrids it would behave similarly to *prætermissa*. *O. incarnata* × *maculata*, however, does not present ringed spots; according to Asch. & Graebner, and also to Schulze, it is either quite unspotted or weakly spotted with faint spots. A specimen found at Winchester in 1917 had all the leaves unspotted (plate 17, *l. c.*).

All this evidence goes to show that when spotted *maculata* is crossed with an unspotted species, whether the latter be *G. conopsea*, *Cœloglossum viride*, or *O. incarnata*, the offspring is not ring-spotted; in all these cases the spots either disappear altogether or become fewer and smaller, diminishing in intensity as a whole, not in the centre only. Lastly, I have found several hybrids between *O. prætermissa* itself and *O. maculata*. One from Godalming had the leaves rather plentifully spotted; one from Winchester (*l. c.* plate 13) had spotted leaves; one from the Hog's Back had the lowest leaf unspotted, the upper ones very clearly spotted with small irregular spots. None of these had ring-spotted leaves.

On the other hand, a hybrid between *Cœloglossum viride* and *O. latifolia* (ring-spotted), found at Winchester in June 1917, had ringed spots. Dr. Keller, to whom I sent a water-colour drawing of this plant, was extremely interested in it, as it had never been found on the Continent, and at once confirmed the identification of *O. latifolia* as one of the parents. It is quite evident that by *latifolia* he did not mean *prætermissa*—first, because two plain-leaved parents could not endow their offspring with ringed spots, and, secondly, because a drawing of *prætermissa* was also sent to him, but he did not suggest that as one of the parents. The hypothesis that a plain-leaved crossed with a spotted-leaved plant will give rise to a ring-spotted hybrid may possibly eventually prove correct, but at present it appears to rest purely on conjecture. I have been so far unable to trace a single instance in which a known hybrid between parents of these classes has presented ringed spots, and of all hybrids between unspotted *prætermissa* and spotted *maculata* which I have come across not one was ring-spotted.

There are thus two hypotheses to be investigated, *i. e.*,

(1) That there are only two British marsh orchids, *O. incarnata* and *O. prætermissa*; all other forms are hybrids between one or other of these and *O. maculata*. Mr. Druce and Mr. Rolfe both appear to favour this view.

(2) That there are three, *O. incarnata*, *O. prætermissa*, and ring-spotted *O. latifolia*. There are therefore six possible hybrids, viz. (1) *incarnata* × *maculata*, (2) *prætermissa* × *maculata*, (3) *latifolia* × *maculata*, (4) *incarnata* × *latifolia*, (5) *incarnata* × *prætermissa*, (6) *latifolia* × *prætermissa*. If *O. ericetorum* Linton be regarded as a species, the number is increased to nine.

It would seem that the bewildering variety of intermediate forms found growing wild is more likely to result from the combinations of a number of different factors, than from the crossing of only two species (when *incarnata* is absent) or at the most three.

It is suggested that the following points should be investigated, in addition to the two named above:—

(3) Are there any localities in which ring-spotted *latifolia* grows, from which *prætermissa* or *maculata*, or both, are absent?

(4) Do *prætermissa* and *maculata* grow together in any place where the ring-spotted plant is absent?

(5) If so, are hybrids present without ringed spots, and are they numerous?

(6) Is there any locality in which ring-spotted plants and unspotted *prætermissa* grow together, but where there is no *maculata* in the neighbourhood?

(7) If so, are the ring-spotted plants identical in every other way with those without spots on the leaves?

If any or all of these questions can be definitely answered, it would probably throw much needed light on a difficult problem.

The most satisfactory thing would be for some of our younger botanists to grow unspotted *prætermissa* and *maculata*, fertilize the flowers of the former with pollinia from the latter (or *vice versa*), and raise plants from the resultant seeds. It could then be definitely ascertained whether such hybrids ever have ring-spotted leaves. The experiment would take a few years to carry out, but it would solve a problem which has so far baffled all attempts at solution, and also throw a flood of light on the range of variation in the offspring of such crosses. It should be borne in mind that the seeds must be sown in pots containing the soil in which the parents originally grew, as they will not germinate unless the microscopic fungus (*rhizoctonia*) which infects the roots of orchids is present (see Prof. F. E. Weiss's paper on Seeds and Seedlings of Orchids in Proc. Manchester Microsc. Soc. 1917). The simplest way is to grow *prætermissa* and *maculata* in pots, taking up with them the ball of earth in which they grow, and to sow the seeds on the surface of the pots. I should be glad to hear from any readers the results of their investigations, addressed to me c/o Messrs. Cox & Co., 16 Charing Cross, London, S.W. 1. No specimens, however, should be sent till my actual address at the time has been ascertained by a postcard to me at the above address.

NOTES ON BRAITHWAITE'S SPHAGNACEÆ EXSICCATÆ.

By J. A. Wheldon.

Dr. Braithwaite published his great work on *The Sphagnaceæ or Peat Mosses of Europe and America* in 1880: his *Sphagnaceæ Britannicæ Exsiccatæ* appears to have been issued whilst preparing this work. Through the kindness of Mr. H. Beesley of Preston, I have been allowed to examine a copy of the latter which belonged to the late M. B. Slater of Malton. This, on the dedicatory page, is dated in the Doctor's handwriting April 1877, just a month prior to the issue of the circular announcing the publication of his work on the *Sphagnaceæ*. I am unacquainted with the whereabouts of the other copies, nor do I know whether the specimens in them are from identical gatherings; but I suspect this is not always so, as in a few instances I find my determinations do not accord with other published ones. A very small proportion of the specimens appears to have been collected by Braithwaite himself, the principal contributors being Messrs. J. M. Barnes, S. Anderson, W. Curnow, G. Stabler, J. Sim, and J. E. Bagnall. Some of the examples are too scanty, and, being gummed down, could not be examined with the completeness that is so desirable with these difficult subjects. In some cases, however, loose material in envelopes accompanied the mounted plants.

It was interesting to find in the collection a confirmation of Mr. Bellerby's record of *Sphagnum bavaricum* Warnst. His plant was named by Warnstorf, but the specimen was not returned, and therefore no example was existent in our collections. The plant of Anderson, which I refer to this species, was collected in the same locality as Mr. Bellerby's, viz. Goathlands, Yorkshire. Some of the pages of the volume are blank, having been reserved for varieties which were apparently unobtainable. These, and a few foreign species, or others which do not call for comment, account for the missing numbers in the following list, in which the specimens have been named in accordance with my *Synopsis of the European Sphagna* published by the Moss Exchange Club.

1. *Sphagnum Austini* Sull. forma cristulis parietalibus cellularum chlorophyllif. imperfecte evolutis. Lythe Moss, Westmorland, *J. M. Barnes*. On many leaves no fibrils can be traced on the cell walls; others have traces of them in the basal cells only. This is *S. imbricatum* Russ. var. *sublæve* Warnst. f. *densissimum* Warnst., not hitherto recorded as British.

2. *S. Austini* Sull. var. *imbricatum*. (*a*) Lewis, *J. Smith*; (*b*) Westmorland, *Barnes*; are both *S. imbricatum* Russ. var. *cristatum* Warnst. f. *congestum* Warnst.

3. *S. papillosum* Lindb. (*a*) Witherslack Moss, Westmorland, *J. M. Barnes*, is the var. *normale* Warnst. f. *squarrosulum* Ingh. & Wheld. subf. *neglectum* Ingh. & Wheld. (*b*) Finland, *S. O. Lindberg*, is var. *normale* Warnst. f. *majus* Grav. subf. *subfuscum* Wheld.

4. *S. papillosum* Lindb. (*a*) Westmorland, *Barnes*, is var. *sublæve* Limpr. f. *breviramosum* Warnst. subf. *heterocladum* Warnst.; (*b*) Penzance, *W. Curnow*; and (*c*) Ross, Scotland, *Braithwaite*, are both var. *normale* Warnst. f. *brachycladum* Warnst. subf. *flavofuscum* Wheld.

5. *S. papillosum* Lindb. var. *confertum*. (*a*) Penzance, Cornwall, *Curnow*, is var. *normale* Warnst. f. *confertum* Warnst. subf. *fuscoluteum* Wheld. (*b*) forma *virens* Braithw., Sutton Park, Warwickshire, *J. Bagnall*, is var. *normale* Warnst. f. *squarrosulum* Ingh. & Wheld. subf. *neglectum* Ingh. & Wheld.

6. There is no specimen on this page, which was apparently reserved for *S. papillosum* var. *stenophyllum* Lindb.

7. *S. cymbifolium* Ehrh., Saltersgate Beck, Yorks, *S. Anderson*, is var. *pallescens* Warnst.

8. *S. cymbifolium* Ehrh. (*a*) Goathland, Yorks, *Anderson*, is var. *pallescens* Warnst. f. *laxum* Warnst. (*b*) Staveley, Westmorland, *G. Stabler*, is *S. papillosum* var. *normale* Warnst. f. *brachycladum* Warnst. subf. *pallescens* Wheld. (*c*) Penzance, *Curnow*, is *S. cymbifolium* Ehrh. var. *pallescens* Warnst. f. *confertum* Wheld.

9. *S. cymbifolium* Ehrh. var. *squarrosulum*, Sutton Park, Warwickshire, *Bagnall*, is var. *glaucescens* Warnst. f. *squarrosulum* Pers. subf. *immersum* Warnst.

10. *S. cymbifolium* Ehrh. var. *congestum*, (*a*) Staveley, Westmorland, *Stabler*, is *S. papillosum* Lindb. var. *normale* W. f. *brachycladum* Warnst. subf. *pallescens* Wheld. (*b*) var. *purpurascens*, Witherslack, Westmorland, *Barnes*, is *S. medium* Limpr. var. *violascens* Warnst.

13. *S. laricinum* Spruce. (*a*) Vale Royal, Cheshire, *J. Whitehead*, is *S. contortum* Schultz var. *gracile* Warnst. subf. *virescens* Warnst. (*b*) Barbon Fell, Westmorland, *Barnes*, belongs to the same variety, subf. *sordidum* Warnst.

14. *S. lacinium* Spruce var. *platyphyllum*, Aber, Carnarvonshire, *Holmes & George*, is *S. platyphyllum* var. *teretiusculum* f. *contortum* Warnst.

15. *S. subsecundum* Nees. (*a*) Stockton Forest, Yorkshire, *Stabler*; (*b*) Nr. Penzance, Cornwall, *Curnow*; are both *S. inundatum* Warnst. var. *ovalifolium* Warnst f. *subfalcatum* Warnst.

16. *S. subsecundum*. (*a*) Staveley, Westmorland, *Stabler*, is

referred by Mr. Horrell (*European Sphagnaceæ*, p. 67) to *S. rufescens*. If this be so it would come under var. *parvulum* Warnst., but the specimen is gummed down and cannot be examined. (*b*) Chyandal Moor, Cornwall, *Curnow*, is *S. rufescens* Warnst. var. *magnifolium* Warnst. f. *rufidulum* Warnst. subf. *densiramosum* Warnst.

17. *S. subsecundum* var. *contortum*. (*a*) Goathland, Yorks, *Anderson*; I think after a very partial examination that this is a form of *S. bavaricum* Warnst. var. *mesophyllum* Warnst. (*b*) forma *rufescens*. Sleights Moor, Yorks, *Anderson*. Only two stems, both gummed down, of this interesting looking specimen.

18. *S. subsecundum* var. *obesum*. (*a*) Cornwall, *Curnow*, is *S. turgidulum* Warnst. var. *insignitum* Warnst. (*b*) Sleights Moor, Yorks, *Anderson*, is *S. rufescens* Nees var. *magnifolium* Warnst. f. *rufidulum* Warnst.

19. *S. subsecundum* var. *auriculatum*. (*a*) Sutton Park, Warwickshire, *Bagnall*, is *S. rufescens* Nees f. *virescens* Warnst. (*b*) Delamere, Cheshire, *Whitehead*, is *S. rufescens* Nees var. *parvulum* Warnst. f. *gracile* Warnst. (*c*) Staveley, Westmorland, *Barnes*, is *S. auriculatum* Schimp var. *laxifolium* Warnst.

20. *S. subsecundum* var. *auriculatum* f. *immersum*. (*a*) Witherslack Moss, Westmorland, *Barnes*, appears to be an undescribed form of *S. auriculatum* Schimp. Var. *laxifolium* Warnst. f. *immersum* (Braithw.) Wheld. Very lax, elongate, green, and floating, about 20 cm. long, with small, indistinct capitulum. Br. distant, upper shorter (5–6 mm.), their leaves spreading, lower up to 10 mm. long, with more imbricate leaves. St. l. large ($1{\cdot}5 \times {\cdot}7$–${\cdot}8$), fibrose above, rarely to base, externally with many ringed pores, internally with few pores, chiefly in cell angles, cells often septate. (*b*) Lindon Common, Cheshire, *Whitehead*, is *S. crassicladum* Warnst. var. *intermedium* Warnst. f. *ovalifolium* Warnst.

21. *S. molle* Sull. var. *Mulleri*, Goathlanddale, Yorks, *Anderson*, is the average British *S. molle* Sull. var. *molluscoides* Warnst. f. *heterophyllum* Warnst.; it does not come under any of the subforms which Warnstorf describes and may be distinguished as follows:—subf. *typicum* Wheld. Branches cumulate, less dense than in subf. *tenerum* (Br.) Warnst. in larger and taller tufts, leaves erect, less closely imbricate.

21*. *S. molle* Sull. var. *arctum*. (*a*) Witherslack Moss, Westmorland, *Barnes*. (*b*) Connemara, Galway, *D. Moore*. These are gummed down and the material is too scanty for removal and examination, but neither is *S. molle*: probably forms of *S. rubellum* or *S. acutifolium*. (*c*) Dalfroo Bog, Kincardine, *J. Sim*, is *S. molle* Sull. var. *molluscoides* Warnst. f. *heterophyllum* Warnst. subf. *tenerum* Warnst. It is distinguished from subf. *typicum* Wheld. by its much denser usually anoclade branches, smaller tufts, and its smaller and more closely imbricate leaves.

23. *S. rigidum* (Nees), Petworth, Sussex, *G. Davies*, is *S. compactum* DC. var. *subsquarrosum* W. f. *densum* Warnst.

24. *S. rigidum* var. *squarrosum*, Langdale, Westmorland, *Barnes*, is a paler form of the preceding.

25. *S. rigidum* (Nees) var. *compactum*, Strachan, Kincardine, *Sim.*, is *S. compactum* DC. v. *imbricatum* Warnst. f. *obscurum* Warnst.

26. *S. squarrosum* Pers. (*a*) Witherslack Moss, Westmorland, *Barnes*, is var. *subsquarrosum* Russ. f. *gracile* Russ. (*b*) Loch Garve, Ross, *Braithwaite*, is var. *spectabils* Russ. f. *patulum* Warnst. (*c*) Nr. Penzance, *Curnow*, is var. *spectabile* Russ. f. *elegans* Warnst.

27. *S. squarrosum* var. *squarrosulum*. Scotstown Moor, Aberdeen, *Sim.* Probably *S. teres* var. *subteres*, but I was unable to examine it, the specimen being scanty and gummed down.

28. *S. squarrosum* var. *subteres*, Skeggles, Westmorland, *Barnes*, is *S. teres* Angstr. var. *subteres* Lindb.

29. *S. squarrosum* var. *teres*, Kincardine, *Sim*, is *S. teres* Angstr. var. *imbricatum* Warnst. f. *elegans* Warnst.

30. *S. squarrosum* var. *teres*. (*a*) Broadgate Bog and (*b*) Skeggles, Westmorland, *Stabler*, are *S. teres* Lindb. var. *imbricatum* Warnst. f. *gracile* Warnst.

31. *S. acutifolium* Ehrh. Goathland, Yorks, *Anderson*, is *S. plumulosum* Roll. var. *ochraceum* Warnst. f. *immersum* Warnst.

32. *S. acutifolium* var. *deflexum*. (*a*) Kincardine, *Sim*, is *S. plumulosum* Roll. var. *ochraceum* Warnst. f. *congestum* Warnst., as also is (*b*) forma *densius*, Dalfroo Bog, *Sim.* (*c*) Lewis, Hebrides, *Braithwaite*, is *S. plumulosum* Roll. var. *lilacinum* Spruce f. *compactum* Warnst.

33. *S. acutifolium* var. *purpureum* and (*b*) forma *laxum* Goathland, Yorks, *Anderson*, are both *S. plumulosum* Roll. var. *cærulescens* Schlieph.

34. *S. acutifolium* var. *rubellum*, form *ambiguum*, Strachan, Kincardine, *Sim*, is *S. acutifolium* Ehrh. var. *flavorubellum* Warnst.

36. *S. acutifolium* var. *rubellum*. (*a*) Nr. Penzance, Cornwall, *Curnow*; and (*b*) Foulshaw Moss, Westmorland, *Stabler*; are both *S. rubellum* var. *violascens* Warnst.

35. *S. acutifolium* var. *elegans*, Nr. Garve, Ross, 1876, *Braithwaite*, is *S. acutifolium* Ehrh. var. *rubrum* Brid.

37. *S. acutifolium* var. *tenue*. (*a*) Skeggles, Westmorland, *Barnes*, is *S. rubellum* Wils. var. *viride* Warnst. (*b*) Glenfarne Leitrim, *D. Moore*, is *S. quinquefarium* Warnst. var. *roseum* Warnst.

39. *S. acutifolium* var. *fuscum*. Witherslack Moss, Westmorland, *Barnes*, is *S. fuscum* v. Klinggr. var. *medium* Russ. f. *drepanocladum* Warnst.

40. *S. acutifolium* var. *luridum* is not represented.

41. *S. acutifolium* var. *patulum*. (*a*) Barton Fell, Westmorland, *Barnes*, is *S. plumulosum* Roll. var. *viride* Warnst. f. *laxum* Warnst. (*b*) Tremethick Moor, Cornwall, *Curnow*, is *S. plumulosum* Roll. var. *pallens* Warnst. f. *substrictum* Warnst.

42. *S. strictum* Lindb. (*a*) Skeggles, Westmorland, *Barnes*, is *S. Girgensohnii* Russ., probably var. *microcephalum* Warnst. (*b*) Saltersgate Beck, Yorks, *Anderson*, is *S. Russowii* Warnst. var. *flavescens* Russ.

44. *S. fimbriatum* var. *robustum* Braithw. Prior to the publication of Warnstorf's *Sphagnologia Universalis*, we had referred many

specimens of var. *validius* Cardot to Braithwaite's variety. The records for vice-counties 60 and 61 (and probably that for 48) refer to var. *validius* Card. and should be so amended. Mr. Horrell in *The European Sphagnaceæ* quotes No. 44 of the Exsiccata under both *S. fimbriatum* and *S. squarrosum.* There are two specimens from the same locality (Eskdale, Yorkshire, *Anderson*) in Mr. Slater's copy; I refer both to *S. fimbriatum.* In this copy there are also several loose packets collected by Anderson in the same vicinity at different times. Some of these belong to *S. fimbriatum* var. *laxifolium* Warnst., others—labelled by Anderson *S. fimbriatum* var. *squarrosulum* Anderson, Eskdaleside Moor, 2 Oct., 1875, and *S. fimbriatum* var. *robustior* Anderson ?, 18 June, 1875—belong to *S. fimbriatum* var. *robustum* Br. On the latter packet Anderson has written "To say the least of this, it is a good variety; I have never collected *fimbriatum* like it in any other locality." With it is a letter from Anderson to Slater, written from Whitby, June 1875, from which I extract the following: "I send herewith the plant alluded to in my list—I have sent it to Braithwaite and he says, 'I shall send this to Lindberg when I write again.' You will see that it is coming into fruit, so that in the course of a month I shall be able to send you plenty of it in that state. I collected it last year in the same locality, nay from the same identical 9 feet tuft, but not then in fruit. Notice the ascending branches at the apex of the plant, and the narrow border on the stem leaves—altogether different to the ordinary form of *S. fimbriatum.* I sent it to Braithwaite as under 'No. 1. *S. fimbriatum* var. *robustior* ? Anderson (a sad piece of presumption this).' Look at it well tomorrow and write me fully on it by that day's post." There is no doubt Anderson first detected and even named this variety, but did not describe or publish it. Warnstorf's description is excellent, but does not cover all the forms, which are as follows:—

(*a*) forma *laxum* Wheldon. Pale yellowish-green deep tufts 15–25 cm. high. Fascicles distant. Branches elongate, spreading, longly and gradually acuminate, 2–3 cm. long. St. l. broadly spatulate, 1·14–1·3 long, and usually nearly and sometimes quite as wide. L. lax, broadly ovate-lanceolate $2 \times 1{\cdot}14$, erect arcuate with spreading points, sometimes distinctly squarrose. Braithw. Exsicc. No. 44. Right-hand specimen. Eskdale, Yorks, *S. Anderson.* This plant rivals *S. squarrosum* in stature; someone, probably Slater, has crossed out the title *S. fimbriatum*, and written in *S. squarrosum* var. *laxum* Braithw. I have, however, examined the chlorophyll cells in section and they are situated on the inner surface of the leaf.

(*b*) forma *pycnocladum* Wheldon. Shorter (10–15 cm.). Fascicles denser. Branches much stouter, more densely leaved, shorter ($1\frac{1}{2}$–2 cm.), suddenly acute, the upper ones erect-patent. The lowest branches are more laxly leaved. Leaves of upper branches imbricate, of the lower erect patent to subsquarrose. Braithw. Exsicc. No. 44. Left-hand specimen. Eskdale, Yorks, Oct. 1875, *Anderson.*

(*c*) forma *compactum* Wheldon. Grey-green, short (5–8 cm.). Branches cumulate, arcuate-spreading to deflexed ($1\frac{1}{2}$–2 cm., occasionally longer). Leaves densely imbricate or with the points only spreading, squarrose in the large capitulum (2–2·3 × 0·8–1 mm.). Stem leaves very variable in shape, sometimes nearly as broad as long, but with longer and less spathulate ones intermixed (1·3–1·4 × 0·6–1·3). Howle Green Wood, Herefordshire, May 1918, *Miss E. Armitage.* Very different in habit from the other two forms, but agreeing better with it than with var. *validius* Card. in details. Some of the stem leaves recall those of *S. teres*, but the chlor. cells are emergent on the inner side of the leaf. In some respects, also, it connects *S. fimbriatum* very closely with *S. Girgensohnii.* I have not seen the Cornish specimens of this variety collected by Curnow.

47. *S. intermedium* Hoffm. (*a*) Staveley, Westmorland, *Barnes*, is *S. amblyphyllum* Russ. var. *mesophyllum* Warnst. f. *molle* Russ. (*b*) Ben Wyvis, Ross, *Braithwaite*, is *S. fimbriatum* Wils. var. *intermedium* Russ. f. *densum* Wheld. (*c*) forma *fol. caulinibus apicibus fimbriatis*, Keggles, Westmorland, *Barnes*, is *S. amblyphyllum* Russ. var. *mesophyllum* Warnst. f. *sylvaticum* Russ.

48. *S. intermedium* var. *pulchrum.* (*a*) Staveley, Westmorland, *Stabler*; and (*b*) Carrington Moss, Cheshire, July 1863, *G. E. Hunt*; are both *S. pulchrum* Warnst.

49. *S. intermedium* var. *riparium.* Oakmere, Cheshire, *W. Wilson* and *G. E. Hunt.* This has no connection with *S. riparium* Angstr., to which it was at one time referred, but is *S. riparioides* Warnst.

50. *S. cuspidatum* Ehrh. (*a*) Witherslack Moss, Westmorland, *Barnes*; (*b*) Lindon Common, Cheshire, *Whitehead.*

51. *S. cuspidatum* var. *falcatum.* Fowlshan Moss, Westmorland, *Stabler.* This, and also both specimens under No. 50, are *S. cuspidatum* Ehrh. v. *falcatum* Russ. subf. *aquaticum* Warnst.

52. *S. cuspidatum* var. *plumosum.* Scotstown Moor, Aberdeen, *Sim.*, is *S. serratum* Aust. var. *serrulatum* Warnst.

NOTES ON SOMERSET PLANTS FOR 1918.

By the Rev. E. S. Marshall, M.A., F.L.S.

In spite of travelling restrictions and other drawbacks, a fair amount of work was done last year. Dr. W. Watson (*W.*) furnished a very long list; Dr. H. Downes (*D.*), Mrs. C. Sandwith, Miss Ida M. Roper (*R.*), Mr. H. S. Thompson (*T.*), Rev. H. L. Graham (*G.*), and others have also given valuable help. I spent a month on Exmoor, finding a few things of interest; brambles are numerous, some reaching an elevation of 1300 feet or more.

Districts 1 to 4 and 6 are in v.c. 5 S. Somerset: the rest belong to v.c. 6 N. Somerset.

Clematis Vitalba L. 2. Kilve, *W.*

Ranunculus trichophyllus Chaix. 3. Orchard Portman, *W.*—*R. Lenormandi* F. Schultz. 1. Simonsbath.—*R. auricomus* L. 2. West Luccombe; 3. West Hatch; 4. Clayhanger, near Combe St. Nicholas; 6. Whitestaunton, *W.*—*R. acris* L. var. *vulgatus* (Jord.). 3. Ruishton; Taunton, *W.*—*R. parviflorus* L. 3. Thurlbear, *W.*

9. Clevedon Court Wood; Tickenham, *T.*—*R. arvensis* L. 5. Kingsdon, *G.*

Helleborus viridis L. var. *occidentalis* (Reuter). 8. Batcombe, *Miss F. Chiddell.*

Aconitum Napellus L. 3. Buncombe, near Kingston; 6. Whitestaunton, *W.*

Berberis vulgaris L. 3. Norton Fitzwarren; probably planted, *W.*

Papaver Rhœas L. var. **strigosum* (Bœnn.). Two specimens, with the type, in a field on Leycroft Farm, Bathpool, *W.*—*P. Lecoqii* Lamotte and *P. Argemone* L. 5. Kingsdon, *G.*, sp.

Corydalis claviculata DC. 1. One large patch, at 900 feet, above Withypool.

Fumaria capreolata L. (*pallidiflora* Jord.). 2. East Quantoxhead, *W.*

F. Boræi Jord. 2. Roadwater; Quantoxhead, *W.*

Nasturtium palustre DC. 3. Near Staplegrove; Bathpool; West Sedgemoor, *W.*—*N. amphibium* Br. 4. By the River Ile, below Ilminster, *D.*

Arabis hirsuta Scop. 6. Combe St. Nicholas, *W.*

Cardamine impatiens L. 10. Stony slope, Asham Woods, *T.*

Draba muralis L. 6. Frequent on walls, Whitestaunton and Wambrook, *W.*, sp.

Hesperis matronalis L. 3. Stoke St. Mary; a garden escape, *W.* 4. Orchards, &c., about Ilminster, *D.*

Sisymbrium Thalianum Gay. 6. Whitestaunton, *W.*—[*S. altissimum* L. (*pannonicum* Jacq.). 4. Waste ground near Ilminster, *D.*; named at Kew.]

Brassica nigra Koch. 1. At 1250 feet, in a root-field on Blackland Farm, Withypool.—*B. alba* Boiss. 3. Fosgrove, near Taunton, *W.*

Coronopus didymus Pers. 4. Cultivated ground near Ilminster Station, *D.*—*C. procumbens* Gilib. 2. Quantoxhead, *W.* 4. Common in the Ilminster district, *D.*

Lepidium campestre Br. 3. Frequent within a 5-mile radius of Taunton; 8. Bruton, *W.*—*L. Smithii* Hook. 1. Ascends to 1200 feet near Simonsbath.

Hutchinsia petræa Br. 10. Sparingly on limestone rocks above the Avon, close to Bristol, *T.*

Raphanus Raphanistrum L. 1. One fine plant, at 1250 feet, on Horsen Farm, near Simonsbath.

Viola palustris L. 2. Elworthy; 6. Wambrook, *W.*—*V. hirta* L. 3. Adcombe, near Pitminster, *W.*—**V. hirta* × *odorata*. 3. Stoke St. Mary, *W.*—*V. agrestis* Jord. 3. Wiveliscombe, *W.*; West Monkton.—**V. segetalis* Jord. 4. Castle Neroche, *W.*— *V. obtusifolia* Jord. 6. Buckland St. Mary, *W.*—**V. ruralis* Jord. 2. Quantoxhead and Crowcombe; 3. Staplegrove, *W.*

Polygala serpyllacea Weihe. 1. Common on Exmoor!; 2. Kilve and Lilstock; 6. Bewley Down, *W.*

Saponaria officinalis L. 3. Kingston; 4. Wadeford, near Chard; 6. Combe St. Nicholas, *W.*

Silene maritima With. 2. Quantoxhead, *W.*

Lychnis Githago Scop. 6. Otterford, *W.*

Cerastium semidecandrum L. 2. Kilve, *W.* 4. Hinton St. George, *D.*

Stellaria aquatica Scop. 3. Common on West Sedgemoor; 4. Chard district, frequent, *W.*

Arenaria leptoclados Guss. 1. Walls at Simonsbath, above 1000 feet.

Sagina subulata. 1. Withypool, *W.* Near Simonsbath. 2. Halsway Combe; 6. Wambrook, *W.*

Spergula arvensis L. 1. Plentiful in turnip-fields, up to 1250 feet, about Exford, Withypool, and Simonsbath. Ashway, near Tarr Steps, *W.* 3. West Monkton. 4. Castle Neroche; 6. Culmhead and Buckland St. Mary, *W.*—*S. sativa* Bœnn. 1. Simonsbath; Exford.

Spergularia marginata Kittel. 2. Lilstock, *W.*

[*Tamarix anglica* Webb. 2. Planted and flourishing, on the coast near Lilstock, *W.*]

Hypericum Androsæmum L. 2. Kilve and Quantoxhead; 3. Kingston; 4. Combe St. Nicholas; 6. Wambrook, *W.*—*H. perforatum* L. var. **angustifolium* DC. 2. East Quantoxhead; 3. Kingston; Chilworthy, *W.*—*H. humifusum* L. 1. Near Cutcombe, *W.* Simonsbath. 2. Kilve, *W.* Var. **magnum* Bast. 1. Exford; Withypool, *W.*—*H. elodes* L. 1. Common in bogs on Exmoor, up 1400 feet. 6. Bewley Down, *W.*

Malva moschata L. 3. Cothelstone, Cotford, and Thurlbear; 4. Staple Fitzpaine and Knowle St. Giles, *W.* The white-flowered form occurs at 3. Thurlbear and Orchard Portman, *W.*; and 4. Ilminster, *D.*—*M. rotundifolia* L. 2. East Quantoxhead and Kilve; 3. Orchard Portman, Ruishton, Bathpool, and Stoke St. Gregory; 6. Combe St. Nicholas and Whitestaunton, *W.*—[*M. pusilla* Sm. 4. Waste ground at Horton, near Ilminster, *D.*, sp.; so named by me, and confirmed by Mr. A. J. Wilmott.]

Linum bienne Miller (*angustifolium* Huds.). 2. Cliffs between Lilstock and Kilve, *W.*

[*Geranium pratense* L. 2. Two roots, near houses, probably planted, at St. Audries, *W.* 3. Broomfield Churchyard, *Miss A. G. Miller.*]—*G. pyrenaicum* Burm. fil. 3. Kingston, *W.*—*G. pusillum* L. 3. Thurlbear, *W.*—*G. rotundifolium* L. 10. Babington, *T.*—*G. columbinum* L. 2. Frequent about Kilve; 3. Thurlbear and Bishop's Lydeard; 8. Bruton, rare, *W.*—*G. lucidum* L. 5. Kingsdon, *G.* Still unrecorded for dist. 1.—*G. Robertianum* L., *fl. albo.* 1. Exford.

Erodium moschatum L'Hérit. 9. Berrow, *W.* Farmyard, Tickenham, *T.*—*E. maritimum* L'Hérit. 9. Tyntesfield Woods, *T.*

[*Oxalis corniculata* L. A garden escape at 3. Taunton, *W.*, and 4. Ilminster, *D.*]

Rhamnus Frangula L. Woods near Curland, *D.*

Genista tinctoria L. 6. Buckland St. Mary, *W.*

Ulex Gallii Planch. 1. Common on Exmoor. 2, 3. Common on the Quantocks, *W.* Var. **humilis* Planch. 1. Plentiful on Winsford Hill and some other Exmoor heights, up to 1400 feet!, *W.* I can, however, see no good varietal characters, and believe this to be only a state due to situation and exposure, which passes gradually into the normal form.—*U. minor* Roth. Accidentally omitted from my Supplement to Fl. Som. 1. Withypool; Exford, *W.* 2. Crowcombe Heathfield. 4. Abundant on Staple Common. 6. Near Chard.

Ononis repens L. var. *horrida* Lange. 2. Kilve and Quantoxhead, *W.*—*O. spinosa* L. 2. East Quantoxhead; 3. Thurlbear, *W.*

Trigonella ornithopodioides DC. 2. North Hill, Minehead, and on the coast towards Greenaleigh, *W.*

Melilotus altissima Thuill. 2. Kilve and Lilstock; 3. Thurlbear and Orchard Portman; 4. Fivehead, *W.*

[*Trifolium pratense* L. var. *americanum* Harz. 2. Kilve; 3. Not uncommon in cultivation in the Taunton district, *W.*]—*T. medium* L. 2. Kilve; 3. Corfe and Blagdon; 6. Culmhead; 8. Bruton, *W.*—*T. squamosum* L. 2. Portlock Weir, *W.*—*T. arvense* L. var. **perpusillum* DC. 2. Minehead Warren, *W.*—*T. hybridum* L. 1. Withypool; 2. Crowcombe and East Quantoxhead; 3. Taunton; 4. Curry Mallet; 8. Bruton; 9. Yatton, *W.*—*T. fragiferum* L. 2. Cliffs, Kilve to Lilstock; 3. Athelney, Orchard Portman, and common on the White Lias (3 and 4) from Hatch to Langport; 4. Combe St. Nicholas, *W.*—*T. dubium* Sibth. var. **pygmæum* Soyer-Willemet. 2. Smith's Combe, above East Quantoxhead, *W.*—*T. filiforme* L. 2. Halsway Combe, *W.*

Anthyllis Vulneraria L. 2. St. Audries, *W.*

Lotus corniculatus L. var. *crassifolius* Pers. 2. About Kilve, *W.*—*L. tenuis* Waldst. & Kit. 3 and 4. Rock Hill, near Wrantage, *W.*

Astragalus glycyphyllos L. 10. Babington, *T.*

Ornithopus perpusillus L. 1. Roadside, Withypool Hill, at 1000 feet.

Vicia hirsuta Gray and *V. tetrasperma* Moench. 2. Kilve; 8. Bruton, *W.*—*V. angustifolia* L. 2. Oare; 3. Norton Fitzwarren, *W.*

Lathyrus Nissolia L. 3. Badger Street, *W.* 4. Herne Hill, Ilminster, *D.*—*L. montanus* Bernh. 1. Withypool and Exton; 4. Bickenhall and Combe St. Nicholas; 6. Whitestaunton and Wambrook; 8. Bruton, *W.*

Prunus insititia L. 3. Taunton; 8. Bruton, *W.*—*P. domestica* L. 6. Combe St. Nicholas; 8. Bruton, *W.*—*P. avium* L. 2. Washford; 3. Pickeridge, near Corfe; 6. Whitestaunton and Wambrook, *W.*—*P. Cerasus* L. 2. Washford, *W.*

Rubus fissus Lindley. 1. Exe Valley, above Exford; lane at Honeymead Corner, near Simonsbath, in good quantity. The dull-red fruit is excellent.—*R. plicatus* Wh. & N. 1. Withypool; locally plentiful by the Sherdon Water, near Simonsbath.—*R. cariensis* Genev. 1. Simonsbath; Exford. Confirmed by *W. M. Rogers.*—*R. Lindleianus* Lees. 1. Exford; Simonsbath, &c.—*R. argenteus* Wh. & N. 1. Exford, Withypool, and Simonsbath.—*R. rhamnifolius* Wh. & N. 1. About Exford and Simonsbath.—*R. pulcherrimus* Neuman. 1. Exford, Withypool, and Simonsbath; frequent. 2. Abundant near Elworthy, and 3. Clatsworthy.—*R. rusticanus*

Merc. 1. Apparently scarce on the upper parts of Exmoor, though so abundant in the county, as a whole; one bush was seen as high up as 1250 feet, but this is exceptional.—*R. Questierii* Lefv. & Muell. 1. Sherdon Water.—*R. hypoleucus* Lefv. & Muell. 1. Wood-border, Simonsbath. 3. Orchard Portman, *W.*—*R. pyramidalis* Kalt. 1. Rather common about Exford, Simonsbath, and Withypool.—*R. leucostachys* Sm. 1. Simonsbath. 2. Halsway Combe, *W.*—*R. Borreri* Bell Salter. 1. Plentiful about Simonsbath; Exford, Withypool. The fruit is unpalatable, and often defective—*R. dasyphyllus* Rogers. 1. The most abundant species, I believe, about Exford, Withypool, and Simonsbath.

Geum rivale × *urbanum*. 10. Melcombe Wood, Mells, *T.*

Potentilla erecta × *procumbens*. 6. Buckland St. Mary, *W.*—*P. erecta* × *reptans*. 1. Exford.—*P. procumbens* Sibth. 1. Exford, frequent; Simonsbath. Withypool, *W.* 3. Adcombe; Will's Neck, *W.*

Alchemilla minor Huds. 1. Exford; Simonsbath. Dulverton, *W.* 3. Cothelstone; Kingston, *W.*

Agrimonia odorata Miller. 9. Miss Roper tells me that the Walton-by-Clevedon plant, formerly thought to be *A. Eupatoria* var. *sepium* Bréb., is this. 10. Frequent on the borders of Asham Woods, *R.* and *T.* Mells, *T.*

Poterium officinale A. Gray. 1. Withypool!; Barle Valley, 3 miles above Dulverton, *W.*

Rosa omissa Déségl. var. *submollis* (Ley.). 1. Exford, Withypool, and Simonsbath; a form with globose fruit.—*R. micrantha* Sm. 3. Corfe, *W.*—*R. obtusifolia* Desv. var. *tomentella* (Léman). 3. Corfe, *W.*, sp.—*R. canina* L. var. *verticillacantha* (Mérat). 3. Langford Heathfield, and in several places, south of Taunton, *W.* Var. *aspernata* (Déségl.). 4. Ilminster, *W.*—*R. dumetorum* Thuill. var. *Déséglisei* (Bor.). 6. Combe St. Nicholas, *W.*—*R. systyla* Bast. 3. Trull, *W.*—*R. arvensis* Huds. var. *scabra* Baker. 3. Bathpool; 4. Crook Street, near Ilminster; 6. Wambrook, *W.* Var. *ovata* Desv. 2. East Quantoxhead, *W.* Var. *biserrata* Crépin. 6. Combe St. Nicholas, *W.*

Pyrus torminalis Ehrh. 3. Cotlake Hill, near Trull, *W.*—*P. Aucuparia* Ehrh. 8. Cogley Wood, Bruton, *W.*—*P. Malus* L. (a. *sylvestris* L.). 2. East Quantoxhead; 3. Wrantage and Orchard Portman; 4. Fivehead, *W.* Var. *mitis* Wallr. 2. Kilve; 3. Feltham; 4. Chard, *W.*

Ribes rubrum L. 10. Melcombe Wood, Mells, in quantity, *T.*—*R. nigrum* L. 6. Whitestaunton, *W.*

Sedum purpureum Tausch. 3. Pitminster; but probably an escape, *W.*—*S. dasyphyllum* L. 2. Wall at Kilton, *W.*

Drosera rotundifolia L. 1. Ascends to 1600 feet on Dunkery; 6. Bewley Down, with *D. longifolia*, *W.*

Myriophyllum spicatum L. 4. River Ile, Ilminster, *D.*

Peplis Portula L. 10. Melcombe Wood, Mells, *T.*

Epilobium angustifolium L. 1. Withypool!; Winsford, *W.*; Sherdon Water. 2. Combe Sydenham; 6. Bishop's Wood and Buckland St. Mary, *W.*—*E. tetragonum* Curt. 2. Kilve, *W.*—

E. Lamyi F. Schultz. 3. Holway, Taunton, *W.*—*E. palustre* L. 1. Frequent on Exmoor. Var. **lavandulæfolium* Lecoq & Lamotte. 1. Wet bogs, Knighton Combe, Withypool, very characteristic; I also saw it near Simonsbath. Hitherto only known in Britain from Shetland and the Highlands.—Dr. Watson has found the following hybrids, but kept no specimens:—**E. hirsutum* × *montanum*. 3. Blagdon Hill. **E. hirsutum* × *parviflorum*. 2. Stogumber, St. Audries, and East Quantoxhead. 3. Norton Fitzwarren.—*E. montanum* × *obscurum*. 2. Trull.—*E. montanum* × *parviflorum*. 2. Kilve. 3. Langford Budville and Kingston.—*E. obscurum* × *parviflorum*. 2. Kilve and Stogumber. 3. Bathpool. 6. Wambrook.—*E. obscurum* × *tetragonum*. 2. East Quantoxhead. 3. Corfe.

Bryonia dioica L. 2. Kilve; 3. West Hatch, *W.*

Sium erectum Huds. 3. Creech St. Michael; 9. Berrow, *W.*

Fœniculum vulgare Miller. 2. Lilstock; St. Audries, *W.*

Œnanthe pimpinelloides L. 1. Barle Valley, above Dulverton; 4. and 6. Combe St. Nicholas; 9. Berrow, *W.*

Caucalis nodosa Scop. 2. East Quantoxhead, *W.* 5. Kingsdon, *G.* Var. **pedunculata* Rouy (under *Torilis*). 3. Bridgwater, 1886, *T.*

Adoxa Moschatellina L. 2. Stogumber; Crowcombe.

Viburnum Opulus L. 1. Hawkridge and Quarme Valley!; 2. Kilton; 4. Bickenhall, *W.*

Rubia peregrina L. 2. Frequent about Kilve!, *W.* 4. Abundant at Broadway, *D.*

Gallium Mollugo L. var. **insubricum* (Gaud.). 2. Kilve, *W.*—*G. palustre* L. var. *lanceolatum* Uechtr. 3. Canal, Bathpool!, *W.*—*G. uliginosum* L. 1. Not uncommon about Simonsbath, Exford, and Withypool, reaching 1300 feet.—*G. tricorne* Stokes. 4. Fields, Ilminster, *D.*

Asperula odorata L. 4. Hatch and Bickenhall; 6. Whitestaunton, *W.*—*A. cynanchica* L. 3. Galmington, near Taunton, *W.*

Sherardia arvensis L. var. **maritima* Griseb. 2. Downs, East Quantoxhead, *W.*

Valeriana dioica L. 4. Bickenhall, *W.*

Valerianella dentata Poll. 2. Frequent in ploughed fields about Kilve, *W.*

Solidago Virgaurea L. 1. Exe Valley!; 4. Barley Hill; 6. Wambrook, Whitestaunton, and Yarty Valley; 9. Brockley Combe, *W.*

Erigeron acre L. 2. Minehead; 3. Stoke St. Mary, *W.*

Gnaphalium uliginosum L. 1. Abundant about Exford; Simonsbath, etc. 2. Elworthy and East Quantoxhead; 3. Bishop's Lydeard; 6. Buckland St. Mary, *W.*—*G. sylvaticum* L. 2. Sparingly near Bellinger Farm, Porlock, *N. G. Hadden.*

Inula Helenium L. 8. One root, Westcombe, near Batcombe, *R. V. Sherring.*

Bidens cernua L. 3. Bathpool, *W.*—*B. tripartita* L. 3. West Sedgemoor, Barthpool, and Staplegrove; 4. Chaffcombe, *W.*

Achillea Ptarmica L. 1. Exton; 3. Langford Heathfield; 4. Britty Common and Street Ash, *W.*

Anthemis Cotula L. 3. Taunton; 8. Shapwick, *W.*—*A. arvensis* L. 2. East Quantoxhead; 4. Combe St. Nicholas, *W.*—*A. nobilis* L. 2. St. Audries; 3. Triscombe, *W.*

Matricaria inodora L. var. *salina* Bab. 2. Minehead, *W.*—*M. Chamomilla* L. 2. Frequent about Kilve; 4. Langport, *W.*—[*M. suaveolens* Buchenau. 3. Taunton; 4 and 6. Chard, *W.*]

Tanacetum vulgare L. 2. Minehead, *W.*

Artemisia maritima L. 8. Burnham, *W.*

Petasites ovatus Hill. 2. Cutcombe, *W.*

Senecio sylvaticus L. 2. Withypool. Minehead, *W.* Var. **auriculatus* Meyer. Withypool, *W.*

S. erucifolius L. 2. Frequent about Kilve, *W.*—*S. aquaticus* L. var. *pennatifidus* Gren. & Godr. 1. Barle Valley, below Tarr Steps, *W.*

Carlina vulgaris L. 1. Hill-top (1100 feet) near Staddens, between Exford and Winsford. 2. Elworthy and Lilstock; 3. Broomfield; 9. Yatton, *W.*

Arctium Lappa L. (*majus* Bernh.). 3. Holway; Hatch Beauchamp; Burton Pynsent, *W.*

Carduus crispus L. 2. Elworthy. 3. Creech St. Michael.—*C. crispus* × *nutans*. 2. East Quantoxhead; 9. Berrow sandhills, *W.*

Cnicus pratensis L. 4. Combe St. Nicholas; 6. Bewley Down, *W.*—*C. acaulis* L. 3. Thurlbear, *W.* Var. **caulescens* Pers. Cliffs, east of Kilve, *W.*

Picris hieracioides L. 2. Frequent near Kilve; 3. below Burton Pynsent; 4 and 6. Combe St. Nicholas, *W.* Var. **umbellata* Schultz (*P. arvalis* Jord.). 3. Between Thurlbear and Stoke St. Mary, *W.*—*P. echioides* L. 3. Thurlbear; 4. Staple Fitzpaine, *W.*

Crepis taraxacifolia Thuill. 2. Stogumber; 3. Langford Budville, Pitminster, and Thorn Falcon; 4. Combe St. Nicholas; 6. Wambrook, *W.* 5. Kingsdon, *G.*—*C. capillaris* Wallr. var. *diffusa* (DC.). 9. Berrow, *W.*

Hieracium Pilosella L. var. *concinnatum* F. J. Hanb. 9. Purn Hill, Bleadon, *W.*—*H. mutabile* Ley. 1. Exford, and Quarme Valley; Withypool; near Simonsbath (1200 feet). Scarce and local.—*H. sciaphilum* Uechtr. 3. Buncombe Wood, Kingston, *W.*, sp.—*H. umbellatum* L. 1. Frequent about Withypool and Exford. 4. Britty Common; Buckland St. Mary, *W.*

Leontodon nudicaule Banks & Sol. var. **lasiolænum*. 9. With type, on sand-hills near Berrow, *W.*

Taraxacum erythrospermum Andrz. 3. Stoke Hill; Adcombe, *W.* Var. *lævigatum* (DC.). 3. Stoke Hill; Thurlbear; Corfe, *W.*

Lactuca muralis Gaertn. 1. Lane, west of Codsend, near Exford. 3. Buncombe Wood; Cothelstone; Pitminster, *W.*

Sonchus arvensis L. var. **angustifolius* Meyer. 2. East Quantoxhead, *W.*

Tragopogon pratense L. 3. Pitminster; Thurlbear, *W.*—*T. minus* Miller. 2. Kilve, *W.*

Jasione montana L. 1. Exford, &c.; common. 2. Stogumber, *W.*

[*Lobelia Dortmanna* L. 6. Ponds at Culmhead; planted, *W.*]

Wahlenbergia hederacea Reichb. 1. In many places about Exford and Withypool.

Campanula rotundifolia L. 8. Wrington Warren, *W.*

**Statice Limonium* L. 2. Lilstock, *W.*

Primula veris × *vulgaris*. 3. Thurlbear; Corfe, *W.*

Lysimachia Nummularia L. 9. Common on the Bleadon levels; 10. Longleat Wood, *W.*

Anagallis arvensis L. var. *carnea* (Schrank). 3. Taunton School garden, *W.*—*A. fœmina* Miller. 5. Kingsdon, *G.*—*A. tenella* Murray. 6. Bewley Down, *W.*

Erythræa Centaurium Pers. 2. Kilve; 3. Thurlbear, Merridge, and Broomfield; 6. Whitestaunton, *W.* Var. *capitatum* Koch. 2. Cliffs, St. Audries to Lilstoch, *W.*

Menyanthes trifoliata L. 1. Frequent on Exmoor; *e. g.* Withypool, Quarme Valley, and about Simonsbath, to 1300 feet.

[*Polemonium cæruleum* L. 3. By a stream at Trull, *W.* 4. Sea Mills, Ilminster, *D.* 8. A few white-flowered plants, by the River Alham, Westcombe, *R. V. Sherring.* Garden escapes.]

Cynoglossum officinale L. 9. Yatton; Wrington Warren, *W.*

Symphytum peregrinum L. 2. Kilton; 3. Holway, *W.*—**S. tuberosum* L. 10. In two woods at Mells and Whatley; "looking very wild," *T.*

Anchusa sempervirens L. 2. Selworthy, *W.*

Myosotis cespitosa Schultz. 2. Kilve; 3. Frequent around Taunton; 6. Combe St. Nicholas, W.—*M. repens* G. & D. Don. 1. Simonsbath. 2, 3. Combes on Quantock; 4. Castle Neroche; 6. Wambrook, *W.*—*M. arvensis* Hill var. *umbrosa* Bab. 3. Triscombe; well marked. *W.*—*M. collina* Hoffm. 3. Adcombe and Cothelstone; 6. Whitestaunton, *W.*

Lithospermum purpureo-cæruleum L. 9. Lane, north-east of Tickenham, *T.*—*L. officinale* L. 10. Little Elm and Chantry, *T.*—*L. arvense*, L. 8. Castle Cary, *C. E. Moss* (*teste W.*).

Cuscuta Epithymum Murray. 2. Frequent above Kilve and Quantoxhead, *W.*

(To be concluded)

THE AFRICAN SPECIES OF ALLOPHYLUS.

By Edmund G. Baker, F.L.S.

The genus *Allophylus* was founded by Linnæus in 1747 in the *Flora Zeylanica* (p. 58) on the species now known as *A. zeylanicus* and of which the types are in Hermann's herbarium in the National Herbarium. This is the only species mentioned in the *Species Plantarum* in 1753. The genus *Schmidelia* was also described by Linnæus, in 1767, in the *Mantissa*, and as the two are now almost universally considered synonymous, the former must take precedence. In 1859–60 Sonder (in Harvey and Sonder's Fl. Capensis, 238) gave under *Schmidelia* descriptions of five species, and in 1868 my father, in the *Flora of Tropical Africa* (i. 420), described twelve species. In 1895 Dr. Radlkofer, in Engler & Prantl. Naturl. Pflanzenfamilien, v. 3. 311, mentions eighteen species from Africa and Madagascar. He relies for purposes of classification and arrangement primarily on whether the leaves are unifoliolate or trifoliolate, and on the character of the thyrse. Students of the genus are much indebted to Dr. Radlkofer for his most careful work, and especially for his paper in Sitz. Bayer. Akad. Wiss. xxxviii. 221–237 (1909) "Uber die Gattung *Allophylus* und die Ordnung ihrer Arten."

The division into unifoliolate leaves and trifoliolate leaves is not entirely satisfactory: in certain special instances such as *A. congolanus* Gilg., in which, although usually trifoliolate, the lateral leaflets are occasionally entirely absent. The division also of trifoliolate-leaved species into those with a simple thyrse, and those with a branched thyrse, is also occasionally difficult of application, as in some species—such as, for instance, *A. repandus* Engl.—a simple and branched thyrse is often found on the same specimen. I note that Dr. Radlkofer doubts whether this latter species is really specifically distinct from *A. alnifolius* Radlk., the former being founded on *Schmidelia repanda* Baker, the latter on *S. alnifolia* Baker. I have carefully examined the types; in the latter the leaves are cuneate-obovate and blunt, whilst in *S. repanda* they are broadest about half way down and acute, and as far as one can judge the species are quite distinct.

Dr. Gilg has also made important contributions to our knowledge of the African species; his papers are in Engler's *Jahrbuch*, xxiv. 286 (1897), where he published 17 novelties, xxx. 348, where are three, and in 1914 in the *Botany of the Deutschen Zentral-Africa Expedition*, 474 (1911) he published three species. In Journ. Linn. Soc. xxxvii. 136 (1905) I described *A. pseudopaniculatus*, *A. subcoriaceus*, and *A. latefoliolatus* from material collected by Dr. Bagshawe in Uganda, and in xl. 48 (1911) *A. chirindensis*, from specimens collected by Mr. C. F. M. Swynnerton in the Chirinda Forest.

For the discrimination of the trifoliolate species special attention must be paid to the character, consistence, absence or presence of indumentum, and toothing of the leaflets, the absence or presence of petiolules, the character of the thyrse, the size of the flowers, and the size and shape of the fruit. The structure of the flower does not seem to be of primary importance for taxonomic purposes.

In the following enumeration of the African species known to me, either from herbarium material or description, I have thought it advisable to retain as far as possible Dr. Radlkofer's sequence, interpolating the more recently described novelties and those here described in their correct positions.

Clavis specierum.

A. Folia unifoliolata rarissime trifoliolata.
  Thyrsi simplices.
    Thyrsi petiolos vix æquantes vel paullo superantes.
      Ramuli hirtelli vel hirsuti. Foliola papyracea.
        Foliola margine dentata apice abrupte acuminata . 1. *hirtellus.*
        Foliola margine crenato-dentata apice longe acuminata .... 2. *nigericus.*
    Thyrsi mediocres petiolos superantes. Ramuli cinerei, glabri. Foliola chartacea, apice acuta vel obtusa .... 3. *Pervillei.*
    Thyrsi foliorum vix ⅓ adæquantes. Calyx ferrugineo-tomentosus .... 4. *hylophilus.*
    Thyrsi longi. Ramuli puberuli vel glabriusculi. Calyx glaber vel subglaber .... 5. *monophyllus.*
  Thyrsi ramosi, rami glabri .... 6. *melliodorus.*

B. Folia trifoliolata.
Thyrsi simplices vel subsimplices.
Folia parviuscula sæpissime 6 cm. non superantia.
Species Africæ Tropicalis. [*scharicus.*
Foliola membranacea, rhombea, siccitate viridia. 7. *kilimand-*
Foliola membranacea, siccitate brunnescentia vel nigrescentia .... 8. *rubifolius.*
Foliola subcoriacea, apice rotundata .... 9. *alnifolius.*
Foliola chartacea, lateralia parva, subtus dense griseo-tomentosa .... 10. *Fischeri.*
Foliola chartacea, siccitate brunnescentia vel nigrescentia, elliptica, acuminata .... 11. *lasiopus.*
Species Capensis .... 12. *decipiens.*
Folia majora 6–15 cm. longa et ultra.
Flores magni vel majusculi.
Thyrsi folia superantes, densi vel subdensi.
Foliola oblonga vel ovato-oblonga, subtus ad nervos puberula .... 13. *macrobotrys.*
Foliola ovato-lanceolata, subtus glandulis microscopicis vestita.......................... 14. *didymadenius.*
Foliola elliptica vel elliptico-obovata, papyracea .... 15. *toroensis.*
Foliola late ovata, lateralia oblique oblongo-ovata .... 16. *latefoliolatus.*
Thyrsi folia superantes vel adæquantes, laxi.
Foliola chartacea omnino glabra.
Foliola terminalia 6–8 cm. longa, petiolulis 3–6 mm. longis .... 17. *chaunostachys.*
Foliola terminalia 8–12 cm. longa, petiolulis 10–15 mm. longis .... 18. *gazensis.*
Foliola papyracea, glabra, ovato-lanceolata, acuminata angustissima .... 19. *macrurus.*
Foliola glabra, nervo medio excepto, ovata vel ovato-oblonga .... 20. *spectabilis.*
Foliola papyracea, glabrata, ovata vel ovato-oblonga .... 21. *oreophilus.*
Foliola subtus in axillis barbata, lanceolata ... 22. *Buchanani.*
Thyrsi foliis breviores, laxiusculi .... 23. *cuneatus.*
Thyrsi folii petiolum adæquantes .... 24. *Volkensii.*
Flores mediocres.
Thyrsi folia perspicue superantes.
Alabastra sericeo-villosa .... 25. *ferrugineus.*
Alabastra glabra vel subglabra .... 26. *cazengœnsis.*
Thyrsi folia æquantes vel subadæquantes.
Foliola chartacea, subtus densissime griseo-tomentosa .... 27. *dasystachys.*
Foliola subchartacea utrinque opaca et glabrata sed ad nervos ferruginea pilosa. Thyrsi laxiflori .... 28. *Antunesii.*
Foliola subchartacea, glaberrima, præter nervorum axillas barbata. Thyrsi fere a basi densiflori.................................... 29. *Goetzeanus.*
Thyrsi petiolos superantes foliis breviores ...... 30. *andongensis.*
Flores parvi.
Foliola lateralia intermediis multo breviora vel rarissime obsoleta.
Folia subsessilia. Thyrsi folia superantes ... 31. *congolanus.*
Folia subsessilia margine serrata. Thyrsi [*serratus.*
folia haud adæquantes .... 32. *appendiculato-*
Folia manifeste petiolata. Thyrsi folia superantes vel æquantes .... 33. *Yeru.*

Foliola lateralia intermediis parum breviora.
Thyrsi folia superantes vel subæquantes.
Foliola ex ovali subrhombea, fuscescentia... 34. *spicatus.*
Foliola ex elongato rhombeo sublanceolata, saturate viridia .... 35. *elongatus.*
Thyrsi petiolos superantes foliis breviores, laxi .... 36. *tenuifolius.*
Thyrsi petiolos superantes foliis breviores, densi .... 37. *Welwitschii.*
Thyrsi petiolos vix superantes vel paullo longiores.
Foliola oblongo-lanceolata, membranacea, grossiuscule dentata .... 38. *Conraui.*
Foliola intermedia subrhombea, inæqualiter inciso-serrata .... 39. *leptaulos.*
Thyrsi simplices et ramosi in eadem planta.
Foliola subcoriacea, ovali-oblonga, integerrima ...... 40. *integrifolius.*
Foliola papyracea, siccitate supra nigrescentia, apice sæpius acuta. Arbuscula .... 41. *repandus.*
Foliola subcoriacea, siccitate brunnescentia............ 42. *subcoriaceus.*
Foliola papyracea, ovata vel ovalia .... 43. *Warneckei.*
Thyrsi ramosi paniculas exhibentes.
Flores magni vel majusculi.
Foliola ampla in typo papyracea. Fructus cocci oblongi, magni .... 44. *grandifolius.*
Foliola obovata, adultiora ± bullata. Fructus cocci obovoideo-pyriformes .... 45. *bullatus.*
Foliola oblongo-lanceolata. Fructus cocci obovoideo-globosi .... 46. *abyssinicus.*
Flores mediocres vel parvi.
Species Africæ Tropicalis.
Foliola omnino glabra vel glabriuscula.
Foliola margine integerrima.
Foliola chartacea, late elliptica acuminata . 47. *camptoneurus.*
Foliola papyracea, apice acuminata, siccitate argenteo-brunnescentia.................... 48. *Talbotii.*
Foliola supra nitida, siccitate cæruleo-cinerea .... 49. *Gossweileri.*
Foliola subcoriacea, oblonga vel ovato-oblonga .... 50. *rutete.*
Foliola crassiuscula, elliptica vel ovalia, siccitate viridia .... 51. *Ussheri.*
Foliola apice paucidentata, siccitate brunnescentia .... 52. *Schweinfurthii.*
Foliola margine serrata.
Foliola rhombeo-elliptica siccitate intense viridia .... 53. *Dummeri.*
Foliola obovata acuminata .... 54. *kiwuensis.*
Foliola oblonga vel ovato-oblonga .... 55. *mawambensis.*
Foliola margine integra vel hinc inde obsolete emarginato-denticulata...................... 56. *schirensis.*
Foliola præter nervos pubescentes vel tomentosos glabra.
Foliola viridia cuneato-ovata vel oblongo-oblanceolata .... 57. *crebriflorus.*
Foliola triste viridia, elliptica, acuminata. Petioli mediocres .... 58. *Zenkeri.*
Foliola obovata vel obovato-oblonga. Petioli longi .... 59. *longipetiolatus.*
Foliola subtus canescenti-puberula, triste viridia, siccitate nigrescentia vel brunnescentia...... 60. *tristis.*

Foliola pilis setaceis albidis utrinque adspersa... 61. *pseudo-paniculatus.*
Foliola supra glabra subtus pubescentia, chartacea, siccitate cinerea .... 62. *Kaessneri.*
Foliola glabra, viridia, subtus costarum axillis exceptis .... 63. *chirindensis.*
Foliola glabra vel subvelutina, siccitate supra nigrescentia .... 64. *africanus.*
Foliola papyracea, supra præter costam glabra subtus pilis adspersa.......... 65. *brachycalyx.*
Foliola præcipue subtus tomentosa.
Foliola parviuscula, obovata .... 66. *Holubii.*
Foliola ovalia vel ovali-oblonga .... 67. *stachyanthus.*
Foliola obovata vel elliptica.......... 68. *griseo-tomentosus.*
Foliola obovata vel ovalia, crenato-dentata vel subintegerrima .... 69. *fulvo-tomentosus.*
Foliola oblongo-ovata vel obovata .... 70. *cataractorum.*
Foliola terminalia elliptica, lateralia oblique ovata, subtus griseo-tomentosa .... 71. *calophyllus.*
Species Austro-Africanæ.
Folia patula .... 72. *melanocarpus.*
Folia ramis subadpressa .... 73. *erosus.*

1. A. HIRTELLUS Radlk. in Engler & Prantl. Naturl. Pflanzenfam. iii. 5, 313 (1895). *Schmidelia hirtella* Hook. fil. in Niger Fl. 248, t. xxv. (1849). *S. monophylla* Hook. fil. in Ic. Pl. t. 775 (1848).

FERNANDO PO: *Vogel* 96! *Mann*! Hb. Kew.

Var. nov. BARTERI.

Frutex 15-pedalis. *Foliola* papyracea, angustiora 15–19 cm. longa, 4·5–7 cm. lata. *Thyrsi* breves.

NIGER EXPD. *Barter* 85! Oban, *P. Talbot* 1392! Hb. Mus. Brit. CAMEROONS: Ambas Bay, *Mann* 727! Hb. Kew.

Differs from type by the narrower leaflets.

2. **A. nigericus**, sp. nov.

Ramuli novelli hirsutissimi. *Folia* unifoliolata, foliolis ovato-lanceolatis vel oblongo-lanceolatis margine crenato-dentatis basi rotundatis vel late cuneatis supra præter costam demum glabris nervis lateralibus utrinque 15–19, 15–20 cm. longis, 5·5–7 cm. latis, petiolo hirsuto 12–15 mm. longo prædita. *Thyrsi* breves 1·5–3·0 cm. petiolos adæquantes vel paullo superantes, multiflori, rhachi pubescente. *Flores* parviusculi in cymulas paucifloras dispositi. *Sepala* 4 per paria opposita, cucullata, membranacea, 2 exteriora minora. *Petala* 4. *Stamina* 8. *Ovarium* hirtum. *Styli* 2. *Fructus* ignotus.

NIGERIA: Oban, *P. Talbot* 442! 447! Hb. Mus. Brit.

Closely allied to *A. hirtellus* Radlk., differing in the margin of the leaflets being crenate-dentate and the apex being gradually not abruptly acuminate. The thyrse is generally slightly longer than the petioles—the pedicels are 1–1·5 mm. long.

3. A. PERVILLEI Bl. Rumphia, iii. 123 (1847). *A. monophyllus* Taub. in Engl. Pflanzenwelt Ost-Afr. c. 250 (1895) non Radlk.

EAST AFRICA: Zanzibar, *Hildebrandt* 1153! *Bojer*! *Kirk* 26! Dar-es-Salaam, *Kirk* 130! Hb. Kew. Amboni, *Holst* 2832! W. Schimba Mts., *Kässner* 380! Hb. Mus. Brit.

4. A. HYLOPHILUS Gilg in Engl. Jahrb. xxiv. 294 (1897).
CAMEROONS: *Buchholz*, Hb. Berol.

5. A. MONOPHYLLUS Radlk. in Engl. & Prantl. l. c. (1895). *Schmidelia monophylla* Presl. Bot. Bemerk. 40 (1844). *S. Dregeana* Sonder in Harvey, Sonder Fl. Cap. i. 239 (1859–60). *Rhus monophylla* E. Meyer in Drège Zwei Pfl. Docum. 216 (1844).
NATAL: Many collectors. PONDOLAND: Port St. John, *E. Galpin* 2863! Hb. Kew.

Var. NATALITIA Szyl. in Enum. Polypet. Rehmann, part 2, 47 (1888).
NATAL: Inanda, *Wood* 481! Hb. Kew.

6. A. MELLIODORUS Gilg ex Radlk. in Sitz. Bayer. Akad. Wien (1908) xxxviii. 217 (1909).
EAST AFRICA: Amani, *Scheffler* 54! Hb. Berol.; *Warnecke* 364! Hbb. Mus. Brit. Kew.

7. A. KILIMANDSCHARICUS Taub. in Engl. Pflanzenwelt Ost-Afr. c. 249 (1895).
KILIMANJARO: *Volkens* 2003! Hbb. Berol. Mus. Brit.

8. A. RUBIFOLIUS Engler, Hochgebirgsflora, 892 (1892). *Schmidelia rubifolia* Hochst. ex Rich. Tent. Fl. Abyss. i. 103 (1847).
ABYSSINIA: *Schimper* 1169! and other collectors. ERITREA: *Pappi* 286! Hbb. Mus. Brit. Kew. SERIBA GHATTAS: *Schweinfurth*, ser. iii. 105! 1964! Hb. Kew.
S. minutiflora Mattei in Fedde Rep. ix. 346, from Italian Somaliland, is unknown to me except from the description. It is allied to the above.

9. A. ALNIFOLIUS Radlk. in Engl. & Prantl. l. c. (1895). *Schmidelia alnifolia* Baker in Fl. Trop. Afr. i. 422 (1868).
EAST AFRICA: Mozambique, *Forbes*! Tanga, *Holst* 2091, *Volkens* 95! Amboni, *Holst* 2567! Hbb. Kew. Mus. Brit. Kitui in Ukamba, *Hildebrandt* 2812! Hb. Kew.

10. A. FISCHERI Gilg in Engl. Jahrb. xxiv. 292 (1897).
EAST AFRICA: *Fischer*, i. 308. Hb. Berol.
I only know this species from the description.

11. A. lasiopus, sp. nov.
Arbuscula 10-pedalis. *Ramuli* novelli ferrugineo vel fusco-tomentosi. *Folia* trifoliolata, supra præter nervos glabra, subtus præcipue ad nervos pubescentia, foliolis ellipticis vel ovalibus margine integris vel rarissime hinc inde serratis terminalibus breviter acuminatis 6–10 cm. longis, 3–4·5 cm. latis, longiuscule petiolulatis (10–14 mm.) lateralibus paullo minoribus et petiolulis brevioribus. *Petiolus* communis 2–3 cm. longus, fusco-tomentosus. *Thyrsi* inferne nudi, graciles, simplices, 4–9 cm. longi, laxiflori, foliis breviores, rhachi pubescente. *Flores* mediocres in cymulas paucifloras dispositi, pedicellati. *Sepala* membranacea. *Ovarium* pilis vestitum. *Styli* 2–3 divaricati. *Fructus* ignotus.
CAMEROONS: Batanga, *G. L. Bates* 209! Hbb. Mus. Brit. Kew.

Distinguished by the small rather thick leaves which when dried turn brown or black, the terminal leaflet is rather longly petiolulate. The lax-flowered simple thyrse is 5–9 cm. long, with the pedicellate flowers in few flowered cymules.

12. A. DECIPIENS Radlk. in Engler & Prantl. iii. 5, 313 (1895). *Schmidelia decipiens* Presl. Bot. Bemerk. 41 (1844). *Rhus decipiens* E. Mey. in Drège Zwei Pfl. Docum. 216 (1844).
CAPE: Many collectors.
Rudatis 590 so named is *A. melanocarpus* Radlk.

13. A. MACROBOTRYS Gilg in Engl. Jahrb. xxiv. 288 (1897).
LAKE REGION: Bukoba, *Stuhlmann* etc. Hb. Berol. CONGO REGION: *Sapin*! Hb. Brux.

14. A. DIDYMADENIUS Radlk. in Sitz. Bayer. Akad. l. c. 219 (1909).
EAST AFRICA: *A. Whyte.*

(To be continued.)

ALABASTRA DIVERSA.—PART XXX.

BY SPENCER LE M. MOORE, B.Sc., F.L.S.

PLANTÆ ROGERSIANÆ.—IV.

[The following description of the new *Phyllanthus* referred to on p. 86 should have appeared in its proper sequence on p. 91, but the specimen had been mislaid.—S. M.]

Phyllanthus Rogersii Hutchinson, sp. nov. Verisimiliter suffrutex dioicus glaber; *ramulis* fasciculatis gracilibus crebro foliosis; *foliis* parvis brevipetiolatis ovato-oblongis apice obtusis necnon mucronulatis basi rotundatis nonnunquam levissime cordatis firme membranaceis; *floribus* ♂ gracile pedicellatis sepalis 5 suborbicularibus glandulis totidem subreniformibus staminibus 5 filamentis ægre omnino solutis antheris longitrorsum dehiscentibus; *floribus* ♀ axillaribus quam ♂ validius pedicellatis sepalis quam ea maris majoribus suborbicularibus glandulis in discum annularem conflatis ovario depresse subgloboso stylis 3 a basi divergentibus ultra medium bicruris; *capsula* depresse globosa glabra.

Transvaal, Pietersburg Div., Haenertsburg; *Rogers*, 19023.

Folia 4–5 × 2·5–3 mm., supra in sicco saturate subtus dilute viridia; costæ laterales utrinque 3–4, teneræ; petioli 1 mm. long. Stipulæ exiguæ, coloratæ, circa 1 mm. long. Pedicelli ♂ 3 mm. long. Flores ♂ diam. 2 mm. leviter excedentes; sepala 1 × 1 mm.; glandulæ ·3 mm. lat.; filamenta fere 1 mm. long; antheræ ·2 mm. long. Pedicelli ♀ 4 mm. long. Flores ♀ 3 mm. diam.; sepala 1·75 × 1·75 mm., rubra vel rubro-lineata; ovarium 1·5 mm. diam.; styli in toto vix 1 mm. long. Capsula trigona, 3 mm. diam.

Near *P. capillaris* Schum. & Thonn., but without any pubescence and with smaller leaves not narrowed at the base and flowers on shorter pedicels among other features.

SOME BRITISH RUST FUNGI.

By Malcolm Wilson, D.Sc., F.L.S.,
Lecturer in Mycology, University of Edinburgh.

In this Journal for 1915 (pp. 43–49) an account was given of the occurrence of several alpine species of the Uredineæ; the following notes supply additional information on some of these and record the occurrence of several others. *The British Rust Fungi* by W. B. Grove has been of great help in the determination.

Melampsora alpina Juel.

The uredo- and teleutospore stages of this species on *Salix herbacea* have already been recorded (Ber. d. schweiz. bot. Ges. ix. 49) from Ben Lui. A further search was made on Ben Lui on July 1st, 1915, and the æcidial stage was discovered on *Saxifraga oppositifolia*, growing at an altitude of about 2500 ft., in close proximity to *Salix herbacea*, which was bearing young uredospore sori. Only a singly æcidium was discovered, and no spermagonia were found on the leaf, although these were probably present at an earlier date.

The æcidial stage, which has been known as *Cæoma Saxifragæ* Wint., has been found in Switzerland by Jacky (Ber. d. schweiz. bot. Ges. ix. 49), who proved the connection between the two stages by carrying out infection experiments with both æcidiospores and teleutospores. The Scottish specimen agrees closely with his description.

The complete description of the species is as follows:—

Spermagonia. Several, epiphyllous. *Æcidia.* Solitary, epiphyllous, orange-red, at first covered by the epidermis; spore layer flat; spores spherical or polygonal, $17–25 \times 16–24\ \mu$, wall colourless up to $3\ \mu$ in thickness; paraphyses colourless, filled with yellow granular contents, ending in a swollen head which is always smaller than the æcidiospores. *Uredospores.* Sori small, scattered, rounded, amphigenous, orange-yellow; spores ellipsoidal or spherical, $19–22 \times 14–17\ \mu$, finely echinulate, contents orange-yellow; paraphyses abundant, capitate, thick-walled, up to $88\ \mu$ long, head about the same size as uredospores, wall up to $5\ \mu$ in thickness. *Teleutospores.* Sori amphigenous, mostly epiphyllous, rounded, up to ·8 mm. in diameter, brownish black, covered by the epidermis; spores flattened or rounded at the apex, rounded and usually diminishing in size towards the base, $26–50 \times 9–14\ \mu$, wall thin, smooth yellowish brown.

Æcidia on *Saxifraga oppositifolia* L., Switzerland and on Ben Lui, Scotland. July and August. Uredo- and teleutospores on *Salix herbacea* L., Norway, Sweden, Switzerland and on Ben Lui, Scotland. July–October.

The discovery of the æcidial stage clears up any doubt as to the distinctness of this fungus from *M. arctica* Rost., a species also growing on *Salix herbacea* and closely resembling *M. alpina* in its uredo- and teleutospore stages, but apparently autœcious.

Puccinia borealis Juel.

The æcidial stage of this fungus was discovered by Greville on Ben Voirlich (Loch Lomond) in 1821, and this appears to be the only record of this species in Britain. It has recently been found in considerable quantity on Ben Lui (Perthshire) occurring on *Thalictrum alpinum* at an altitude of about 2500 ft. The æcidia are found on the petioles, peduncles, and on the under surface of the leaves on unthickened spots which are pale or reddish yellow on the upper surface. About 8–12 æcidia are found in each group. The spores are rather larger than those described by Juel (K. Vet. Akad. Forh. no. 8, 411, 1898), being $20–23 \times 17–20\ \mu$.

Juel showed by infection-experiments that the uredospore and teleutospore stages occurred on *Agrostis borealis*. He considered that *Anthoxanthum odoratum* also acted as a second host, but was unable to infect this species with the æcidiospores from *Thalictrum alpinum*. Athough *A. odoratum* occurs commonly on Ben Lui, no plants were present in close proximity to the diseased *Thalictrum alpinum*. It is proposed to carry out infection-experiments to determine whether this species really acts as a second host in this country.

Puccinia Polygoni-vivipari Karst.

This was found on *Polygonum viviporum* near Ballinling, Perthshire, in August 1915. In this neighbourhood *P. viviparum* is found almost down to the level of the river Tay, and the fungus occurs in abundance on the underside of the leaves, producing pale spots on the upper surface. This rust has been recorded by Greville in 1822 from Mar Lodge and by Trail in 1882 from Braemar, both localities in Aberdeen. The present specimens agree with the description given by Grove, except that the uredospores are slightly larger, being $22–28 \times 20–24\ \mu$.

The uredospore and teleutospore stages of *Puccinia septentrionalis* are also found on *Polygonum viviparum*, but this species appears to be confined to higher altitudes where its alternative host, *Thalictrum alpinum*, is abundant. The sori of the two species closely resemble each other, but *P. septentrionalis* is distinguished by the presence of an apical papilla on the teleutospore, while the teleutospore wall of *P. Polygoni-vivipari* is unthickened.

P. Polygoni-vivipari appears to be autœcious and æcidia are unknown. The infected plants were growing amongst grass, and an examination of the withered leaves of the previous year showed evidence of their infection by the fungus. No æcidia were found on other species of plants in the close vicinity.

Uromyces Onobrychidis Lév.

This was found on Oct. 1914 near Faversham, Kent, growing on cultivated sainfoin. It has not been previously recorded for Britain, and in this case was possibly introduced with seed. The uredospore sori are easily seen on the leaflets, but teleutospore sori were only found on the lower part of the petioles.

The characters of the species are as follows:—

Uredospores. Sori amphigenous and on the petioles, scattered, small, soon naked, pulverulent, rounded on leaf, oblong or linear on petiole, cinnamon-brown; spores subglobose to ellipsoid, echinulate, cinnamon-brown, $22–24 \times 15–22\,\mu$, epispore $2·3\,\mu$ thick with 3 germ pores. *Teleutospores*. Sori similar but darker; spores ellipsoidal to pyriform, hardly constricted, $21–25 \times 14–18\,\mu$, minutely warted with a minute papilla at the tip, pedicels short deciduous.

On cultivated *Onobrychis sativa*, Faversham, Kent.

Puccinia Hypochœridis Oud. Teleutospores have apparently not been discovered in British specimens of this species up to the present. They were found, however, along with uredospores, on a plant of *Hypochœris radicata*, gathered in 1916 near Epsom. They agree closely with the description of the foreign specimens given by Grove, and the minute punctations on the spore wall are clearly visible.

P. Crepidis Schröt. has been found on *Crepis virens* near Ballinling, Perthshire, in July 1915. Only uredospores were present on the specimen. This rare species has been previously recorded from Moray, North Devon, and from Ireland.

P. uliginosa Juel. The æcidial stage was found on *Parnassia palustris* in Glen Sloy, Argyllshire, in June 1915. Up to the present this has only been recorded from Glasgow and Aberdeen. The uredospore and teleutospore stages on *Carex Goodenovii* have not yet been discovered in Britain.

P. major Dietel was found on the lower slopes of Ben Voirlich (Loch Lomond) in June 1915. Only the æcidial stage was present. This autœcious species on *Crepis paludosa* has only been previously recorded in Scotland from Braemar.

Erratum.—In Journ. Bot. 1915, 44, the measurements of the teleutospores of *Puccinia Prostii* should read $56–62 \times 34–38\,\mu$.

REVIEWS.

The Quantitative Method in Biology. By Julius MacLeod, Dr. Nat Sc. Manchester University Press & Longmans, Green & Co. 1919. Price 15*s*.

We must confess that so far we have been in no way impressed with the value of the application of mathematical methods to biological problems, nor has a study of this volume in any way caused us to alter our opinion. The book is the result of labours which can only be described as prodigious, but the results do not seem to be in any way commensurate. No doubt it would be useful to have "constants" instead of "terms" in botany—if we could cite a certain figure instead of talking of a leaf as *broad* or *narrow*. But is it possible? we greatly doubt it. The systematic botanist will find many points of interest scattered through these pages which we should regret to be suspected of undervaluing. Far from it: there are many careful and valuable observations to be discovered by the patient seeker. Let us take as examples the discussion on Plasticity, with numerous instances, notably that of the "crimson rambler" of which "when an inflorescence (corymb) is evolved before the buds have reached their full size, the flowers of this branch, when expanded, are quite healthy but white: the crimson rambler is, as it were, transformed into a white rambler": and again, the discussion on the interesting topic of "convergence." As the writer points out, the facts which we try to explain by the theory of "convergent adaptation" require two sets of assumptions in accordance with our acceptance of the neo-Darwinian or neo-Lamarckian standpoint; that all these hypotheses require verification, and until such is forthcoming, "the term *convergent adaptation* is a delusive screen behind which we *conceal the problems which ought to be solved*" (author's italics). None of the hypotheses yet brought forward explain the similarity between the fore-legs of *Talpa* and *Gryllotalpa*, nor the resemblance between the fruits of certain Myxomycetes and certain Gasteromycetes.

We mention these two discussions with the object of sending philosophically minded botanists to the pages of the book itself.

B. C. A. W.

Botany: a Textbook for Senior Students. By D. Thoday, M.A. Second edition. 8vo. Pp. xix, 524, tt. 230. Cambridge University Press, 1919. Price 7*s.* 6*d.*

It is not surprising that a new edition of Mr. Thoday's textbook has been called for within four years of the publication of the original work. The book was intended primarily for use in connexion with preparation for the Senior Cambridge Local Examinations, and special attention has been given to a clear exposition of certain matters which experience as an examiner had convinced the author were widely misconceived or imperfectly grasped. But the book should appeal to a wider circle than is embraced by the candidates for a particular examination. It forms a well-written and well-arranged introduction to the study of botany, and a student who, under a capable teacher, has worked through the matter of its chapters will have a good ground-work in the science.

After a short introductory chapter on the general conformation of a plant, the student is led through a series of experiments (forming the chapters of Section I.) in which the plant is demonstrated as a living organism, feeding, breathing, and growing; Section II. deals with internal structure in reference to the life-processes which have already been described; Section III., "Reproduction," describes the flower, its pollination, production of fruit and seed, the dispersal of the seed, its germination, and the growth of the seedling. In Section IV., "The Classification of Plants," the species, genus, and family are explained and the principles of classification illustrated by a study of members of the Ranunculaceæ; and the types of flower and fruit are further studied in a selection of common British families. Section V. "Plants in relation to their Environment," begins with a chapter on "fitness," or adaptation, and successive chapters deal with trees, climbing plants, and water-plants, as common biological types. A concluding chapter forms an introduction to the study of plant-associations.

A new feature of this edition is the addition of a supplement on seedless plants, a series of short chapters in which the structure and life-history of Algæ, Fungi, Mosses and Liverworts, and Ferns are illustrated by a few selected types.

The illustrations are clear and adequate, but the book has been somewhat carelessly produced; there is no reference on the title-page to the fact that this is a second edition—on the contrary, the back of this page bears the legend "First edition 1915. Reprinted 1919"; the pages are not uniform in size and the volume is badly bound.

A. B. R.

Our National Forests: a short popular account of the work of the United States Forest Service on the national forests. By R. H. D. Boerker, Ph.D., New York. The Macmillan Co., 1919, pp. lxix, 238. With 80 illustrations. Price 12*s.* 6*d.*

Manual of Tree Diseases. By W. Howard Rankin, A.B., Ph.D., Assistant Professor of Plant Pathology, New York State College of Agriculture, pp. xx, 398. With 70 Figures. Same publishers and price.

Those of us who have watched with admiring eyes the progress of State and National forestry in America since Dr. F. B. Hough's memorable European tour of inspection, rather more than forty years ago, can appreciate Dr. Boerker's fully justified pride in his countrymen's achievement. The forest statistics of half a continent necessarily deal with large figures. When we read that the United States use annually "90,000,000 cords of firewood, nearly 40,000,000,000 feet of lumber, 150,000,000 railroad ties, nearly 1,700,000,000 barrel staves, 445,000,000 board feet of veneer, over 135,000,000 sets of barrel headings .... over 3,300,000 cords of native pulpwood, 170,000,000 cubic feet of round mine timbers, ... and nearly 3,500,000 telephone and telegraph poles," we are not surprised to learn "that out of 5200 billion feet of merchantable timber once present, only 2000 billion feet are left." Whilst in Germany, where scientific management has brought about the largest annual increment of the national forests per acre, the annual consumption of wood for all purposes—before the recent *débâcle*—was only 40 cubic feet per head of the population, in the United States it was nearly 250 cubic feet! Naturally, since the destruction of the Appalachian forests "the surrounding country has suffered from alternate floods and droughts; great manufacturing centres have lost their steady supply of water; harbours are filled with silt from the mountain sides; and fields, once fertile, are covered with sand, gravel, and débris." Thus America, like other lands, has learnt by bitter experience, and has realised "that forest conservation can be assured only through the public ownership of forest resources." The bulk of the mixed hardwood forests of the Eastern States has gone beyond recall, and the reserves of which Dr. Boerker tells the story are coniferous forests at high altitudes in the mountain ranges of the

Western States. They cover, however, 155 million acres—an area one-fifth larger than the whole of France. To place such an area, scattered through eighteen States, under scientific management, to protect it from forest fires and to get from it a revenue of some £700,000—although that by no means yet equals the cost of the administration—is no mean achievement; and this the United States Forest Service have accomplished within the last twenty years. Dr. Boerker's book is a song of triumph; but it is also a most interesting and thoroughly documented exposition of the organization that has reached this result. Although he is no longer himself in the Service, he has had some eight years' experience in it, and has been able to furnish the latest particulars and to make use of many excellent official pictures. His story is pleasant reading: what he has to tell of protection from fire and from tree diseases is full of lessons particularly important to the Government and people of our own North American Dominion, and also to some extent to us here in our relatively wood-less England.

The whole history of forest administration in the United States is one of thoroughness of organization and of liberal far-sighted expenditure—to some extent upon purely scientific investigations—which is evidence of true commercial imagination. Such thoroughness necessarily implies an attention to detail, and Dr. Rankin's *Manual of Tree Diseases*, which we have received at the same time as Dr. Boerker's book, is a fair specimen of the scientific works on economic topics which American workers are now giving us. The author does not deal with injurious insects; but, whilst the bulk of his work deals with fungal disease, he does treat briefly of sun-scorch, frost, drought, smoke, gas, and mistletoe as causes of disease. The book is an eminently practical one, adapted to the needs of the forester. After four preliminary chapters dealing with those diseases which are general on seedlings, leaves, and roots, the author describes the diseases of twenty-eight leading American trees in the alphabetical order of their common names, ending with chapters on tree surgery and spraying. Bibliographical references—mainly American—are added to each chapter, and a useful list of common names of trees, based upon that of Sudworth, with their scientific equivalents, is also given.

The use of text-figures has led to the use of a very heavy paper; but in spite of this, we cannot help suggesting that something is distinctly wanting, which would add somewhat to the size of the work. The author has relied almost entirely on external or naked-eye characters, so that we doubt whether the amateur will be able to identify the diseases, even though those of each species are brought together in one chapter. A very brief glossary is given in which we note what we consider the unnecessary substitution of æciospore, epiphytotic, teliospore and urediniospore for æcidiospore, epidemic, teleutospore and uredospore. There is, however, no general outline of the structure of the main groups of parasitic fungi.

Curative treatment is described wherever possible; and if it is depressing to read (p. 138) of "the passing of the chestnut" as a forest tree, owing to the irresistible ravages of *Endothia parasitica*, the usefulness of the book may be gauged from the fact that a knowledge of what it contains as to the prevalence of "peckiness," due to *Fomes geotropus* Cooke, in from 33 to 100 per cent. of the trees of *Taxodium* in Florida, Louisiana and other States might—not many months ago—have saved our Government many thousands of pounds.

Both volumes are well got up; but publishers should submit the "jackets," in which it is now the fashion to send out books, to the authors for correction, as two misprints in one brief descriptive paragraph is not a good advertisement of the contents of a volume.

G. S. Boulger.

BOOK-NOTES, NEWS, etc.

At the meeting of the Linnean Society on May 1, Mr. James Smith gave a demonstration of the various forms assumed by the pappus in *Compositæ*, of which the following is his abstract:—Stating the case for the trichome nature of the pappus in this family as briefly as possible, we have six points. 1. The development of the members of the pappus is either that of a typical trichome (from one epidermal cell) or that of an emergence, such as the spines of a thistle. 2. The structure of the mature pappus is that of a series of hairs which have become fused throughout all or a part of their length, either side by side to give a scale or in a mass to give an awn. 3. The similarity of the setæ to the achenial hairs is very marked. 4. The primitiveness of the scabrid seta is in conformity with the evolution of the family as deduced from other data. 5. The predominant type of pappus in the fossil forms is the setose type: no fossil paleaceous pappus is known. 6. The presence of a pappus is correlated or linked with the presence of achenial hairs. Reduction of both characters is also linked, *e. g.* reduction of the elater hairs of the achene in the *Anthemideæ* to special epidermal cells is accompanied by reduction of the pappus to the coroniform type. The same applies to some cases in the *Cichorieæ*. As all the facts adduced in support of the phyllome theory can be easily and adequately explained by assuming that the pappus in certain cases is partly a development of the hairs which were inserted on the now aborted but once free calyx-segments, the evidence in favour of the trichome or emergence nature of the organ admits of no other conclusion than that which takes the pappus to be hairs, free or fixed, derived in their evolution from the hairs of the achene, or sometimes also from the hairs of the now aborted calyx-limb.

The subject of tropical plant-diseases is extremely important, seeing that we rely on the warmer regions of the earth for so many raw products. Fungi seems to flourish there with great luxuriance, the warmth and moisture providing most favourable conditions for their development. In his *Philippine Economic-Plant Diseases* (Phil. Journ. Sci. xiii. 1918, nos. 4 & 5) Dr. Otto Reinking says: "There are as many destructive plant diseases in the Philippine Islands as there are in the United States, if there are not more." In this work, the author has followed on the lines of Thurston Cooke's *Tropical Diseases*; he has arranged them in alphabetical order under a list—also alphabetical—of the host-plants. The method evidently has commended itself to the practical grower as a ready means of ascertaining what is already known as to the diseases to which any plant is liable; but it involves a good deal of repetition as the same or nearly related fungi occur on various hosts, and gives little assistance in recognizing the nature of any disease not previously known. Special attention is given to curative methods. Several diseases due to Bacteria are carefully described, such as the bud-rot of Coconut and the Citrus canker, but the large bulk of those tabulated are caused by microfungi. Very little attention has been paid to the larger fungi which do serious damage in the tropical woods as elsewhere; insects too are left out of account. So far as it goes, however, the record is very complete and provides a useful guide for a much wider field than the Philippine Islands.—A. L. S.

The *Kew Bulletin* issued in March (1919, nos. 1, 2) is mainly occupied by a List of "Food and Fodder Plants" by Mr. J. H. Holland, in which are given the chief countries of production with details as to uses and other notes of interest and full references to works quoted. "The natural families first in importance for plants of this nature are placed first in order"—an arrangement the possible advantage of which hardly compensates for its obvious inconvenience to those who are accustomed to follow a certain sequence of orders.

The latest issue (vol. viii. n. 2; 24 April) of the *Journal of Genetics* is entirely devoted to botanical matters. E. S. Salmon continues his account of experiments made at Wye College "On Forms of the Hop (*Humulus Lupulus L.*) resistant to Mildew (*Sphærotheca Humuli* (DC.) Burr."; Bateson gives the first of a series of "Studies in Variegation" in which he deals with "Reversal in Periclinal Chimæras" as exemplified in *Euonymus japonicus latifolius*, *Coprosma Baueri* var. *variegata*, and three Pelargoniums—the paper is accompanied by two of the admirable coloured plates which have always been a feature of the Journal: S. C. Harland treats of the "Inheritance of certain Characters in the Cow-pea (*Vigna sinensis*)"; and Ö. Winge, of the Carlsberg Laboratory, Copenhagen, writes "On the Relation between number of Chromosomes and number of Types in *Lathyrus* especially."

The Essex Field Club has issued a neat volume, the sixth of its "special memoirs" (price not stated) on the *Mycetozoa*, containing "a short history of their study in Britain, an account of their habitats generally, and a list of species recorded from Essex." The matter in the little volume was delivered by the author, Miss Lister, as two presidential addresses, at the annual meetings of the Club in 1917 and 1918; to these she has added a list, with descriptive notes, of the species found in Essex and tables of those for certain other counties. A plate contains three species found first in Essex—*Badhamia foliicola*, *B. populina*, and *Comatricha fimbriata*—for a description of which we are referred to p. 50; it will however be found on the back of the table of contents.

NOTES ON BRITISH EUPHRASIAS.—I.

By H. W. Pugsley, B.A.

About twenty years ago I began to pay attention to the genus *Euphrasia* and collected a number of forms, most of which were sent to the late Mr. F. Townsend for determination. In later years I have continued to augment my collection of these plants, both British and Continental, with the intention of working them out in detail, when opportunity offered, with Wettstein's Monograph and the original descriptions. The fortunate occasion has not yet arrived, but as Mr. W. C. Barton was desirous that I should add my criticisms to the rather numerous contributions sent this year to the Botanical Exchange Club, I have lately made a partial survey of my gatherings in conjunction with the plants sent to the Club, and the succeeding notes embody some of the results that seem of special interest.

In reviewing the European forms of the true *Euphrasiæ*, it must be borne in mind that the points of distinction between the alleged species are relatively trivial, and that one species only, *E. officinalis* L., was commonly recognized by British botanists prior to the advent of Townsend's account in this Journal in 1897. This work accurately applied to the forms then known in Britain the views of Wettstein, and marked a great advance on the treatment hitherto accorded here to the genus. But it is perhaps regrettable that Townsend always followed so closely in Wettstein's steps, for a perusal of the Monograph suggests that more has yet to be done in the grouping of the forms recognized as species and in establishing their natural affinities.

The bases of segregation of Wettstein's three series, *Parvifloræ*, *Grandifloræ*, and *Angustifoliæ*, seem open to serious criticism as primary group-characters, although possibly no better means of distinction can be found among plants whose differences are so slight. The validity of the elongation of the corolla-tube after anthesis, or the reverse, seems especially doubtful, and at best, is rarely an obvious and unmistakeable feature. My observations lead me to doubt its constancy even in the single species, *E. Rostkoviana*, as represented in Britain; and I notice that Mr. Bucknall tacitly ignores it in *British Euphrasiæ*, published as Supplement I. to vol. lv. of this Journal (1917), by referring to *E. campestris*, an undisputed member of the *Grandifloræ*, the plant that he names var. *neglecta*, which he admits has the corolla-characters of the *Parvifloræ*.

A paper that deserves consideration in connection with the British Eyebrights is that by M. Chabert, "Les *Euphrasia* de la France," in the *Bulletin de l'Herbier Boissier* for 1902. This author recognizes about a dozen species as French, with a number of varieties, and reduces the rank of some plants that Wettstein and Townsend treated as species.

Euphrasia minima Jacquin.

This species was first brought to notice as a British plant by Miss Helen Saunders in a short note in this Journal for 1909 (p. 30), in which its discovery on Exmoor is reported and its name published on the authority of Wettstein. A month later a further note was contributed (*l. c.* p. 74) by Mr. C. E. Salmon, who stated that he had found the same plant near Porlock in 1898, and that it had been referred by Townsend to *E. nemorosa.* These notes were followed in the succeeding May (*l. c.* p. 165) by a lengthy paper by Mr. Hiern, wherein an interesting account of *E. minima* is given, with a full synonymy and a detailed description of the plant as seen on Exmoor. A figure, with dissections, is also furnished. *E. minima* has subsequently appeared in the British list in Mr. F. N. Williams's *Prodromus*, where *E. borealis* Towns. is united with it, and in Mr. Bucknall's *British Euphrasiæ.* In the last-named work fresh forms from the Lake District, North Wales, and Monmouth are described as varieties *nana* Rouy and *arbuscula* Bucknall.

It may readily be concluded from the pre-Linnean citations in Mr. Hiern's paper, which show that *E. minima* was one of the earliest forms of the genus to be distinguished, that it is a plant of a relatively distinct facies and one characteristic of the Alps. Its usual form is well depicted by Boccone—"E. lutea, minima, alpina, subrotundo folio nigricante"; and as such it is often common in Switzerland at an altitude of 5–7000 ft. I first met with it in 1896 on the Frohnalp, in Canton Schwyz, where it grew in myriads, completely covering large stretches of mountain slope. Since that date I have collected it in various localities both in the calcareous and the granitic Alps, the last occasion being in the Blumenthal above Mürren in 1911. The Pennine Alps produce forms somewhat different from that prevalent in Central Switzerland, the very compact form described by Townsend as *E. capitulata*, and the form *pallida* of Gremli, with larger, whitish flowers, both occurring in the Saas Valley.

The Swiss forms of this species, however, all show the same essential characters, which they possess in common with the varying forms of the adjacent regions, extending to the Pyrenees and to the Balkans, which have been united under *E. minima* by Wettstein and other authors. *E. minima* seems to be one of the "æstival" species of Wettstein, which are scarcely represented in Britain, except by *E. foulaensis* and *E. scotica.* Its stem is erect and normally simple, and never more than sparingly branched, its leaves, which are rarely numerous, are typically subrotund and very obtuse, or at least always distinctly broad, its spike is relatively dense, its small, yellow corolla has subequal lips, the lower but little deflexed, and its capsule is emarginate and fairly broad. This may be seen from a perusal of the varied exsiccata in Herb. Mus. Brit. and Herb. Kew, but it is worthy of note that the sheet of plants in the National Herbarium at South Kensington from Jacquin's Herbarium, referred to by Mr. Hiern, consists of seven specimens, none of which is *E. minima*: one is *Bartsia Odontites*, one *Euphrasia salisburgensis* var. *cuprea*, and the remainder apparently *E. Rostkoviana*!

The Exmoor plant, as compared with the Continental species, is slenderer and, when well grown, very much branched, with flexuous, ascending rather than erect stems, numerous small, narrow leaves, which are never strongly pubescent, laxer spikes, and the lower lip of the corolla distinctly longer than the upper one. On seeing Mr. Salmon's original specimen several years ago, and those placed by Mr. Hiern in Herb. Mus. Brit., I at once dissented from the identification, quite failing to recognize in them the Swiss plant with which I was familiar, or to understand Wettstein's reasons for such a determination if he was furnished with adequate specimens. A recent examination of the abundant and well-dried material contributed by the Rev. E. S. Marshall to the Exchange Club has confirmed me in this view, and I find that a similar opinion is held by Mr. H. Stuart Thompson, who is familiar with the Alpine *E. minima* and remarked in 1912 in *Subalpine Plants* (p. 233) that Exmoor was an unlikely spot for *E. minima* and that the British Museum specimen was not very typical. I indeed fail to see any real resemblance to *E. minima* in a well-grown individual of our British plant, excepting its small yellow corollas and emarginate capsules; and the opinion of Townsend and that of the unnamed authority referred to by Miss Saunders, who suggested the name "*E. curta* var. *glabrescens*," seem to be more in accord with the plant's affinities than the determination of Wettstein.

If it be admitted that this Exmoor plant cannot be regarded as conspecific with *E. minima* Jacq., as seems impossible if a standard of species approaching that of Wettstein and Townsend is followed, it becomes necessary to reconsider its position in the genus. It is evidently a well-defined form, growing over a considerable area, and is remarkable as the only yellow-flowered *Euphrasia* found in Britain. The features that differentiate it from *E. minima* do so almost equally from *E. scotica* Wettst., which has lately been suggested with some show of reason to be inseparable specifically from *E. minima*. The slender stems and narrow leaves of the Exmoor plant recall *E. gracilis* Fr., but this differs widely in its strict habit, with suberect, central branching, and also in its differently coloured corolla and narrow, subtruncate fruit. *E. nemorosa* Mart. and *E. curta* Wettst., especially the latter, show somewhat similar branching, but both of them are much robuster plants, with stout stems, larger and broader leaves, white or bluish flowers, and narrower and less emarginate fruits. The only remaining British Euphrasias with which a comparison is necessary are *E. borealis* Towns. and *E. occidentalis* Wettst. Both of these are robust forms, the former with large, broad leaves, and white or more rarely blue flowers in a dense spike, and the latter a dwarf plant, much branched, with short stems, broader and partly glandular foliage, and small, white corollas. The Exmoor plant thus seems separable from all other known British forms.

Furthermore, none of the foreign species described in Wettstein's Monograph or elsewhere, so far as is traceable, can be considered identical with our plant. The closest resemblance is seen in *E. variabilis* Freyn (Sched. Fl. Austro-Hungaricæ, iv. p. 55 (1886)), which, when dry, is not readily separable from small individuals, with simple stems, of the Exmoor plant. But *E. variabilis* does not become much branched when well developed, and the lips of its yellow corolla are subequal as in *E. minima*. in which it is merged by Wettstein. *E. exigua* Reuter and *E. pumila* Kerner are also somewhat similar,

o 2

but both of them are at most only sparingly branched. Of the remaining two species of *Euphrasia* bearing yellow flowers, the Andalusian *E. Willkommii* Freyn is easily distinguished by its robust, compact habit and broad, deeply cut leaves, and the alpine *E. Christii* Favrat by its very large, showy flowers.

The Exmoor plant therefore appears to be an unnamed form, and as there seems no evidence that it is especially connected with either of its apparently nearest allies, *E. gracilis*, *E. nemorosa*, and *E. curta*, it can hardly be treated as a variety of one of these, and it becomes necessary to regard it as a new endemic species, intermediate in general features between *E. gracilis* on the one hand, and *E. nemorosa* and *E. curta* on the other, but peculiar for its yellow corollas and broad, emarginate capsules. It is proposed to name the plant *E. confusa*, and it may be diagnosed as follows:—

Euphrasia confusa, sp. nov.

E. minima Hiern in Journ. Bot. 1909, 165, non Jacquin nec aliorum.

Icon. Journ. Bot. *l. c.* tab. 497 A, ut *E. minima*.

Exsicc. E. S. Marshall, nos. 4440 et 4443, ut *E. minima*!

Caulis suberectus vel adscendens, gracilis, 2–20 cm. (vulgo sub-8 cm.) longus, sæpissime infra medium ramosissimus (rarius in plantis depauperatis simplex), ramis (usque ad 20) flexuosis relative longis simplicibus vel iterum ramosis infimis sæpe filiformibus præditus, viridis vel fuscescens, pilis deflexis haud glanduliferis vestitus. Folia caulina oblonga vel oblongo-obovata, basi cuneata, 2–7 mm. longa et dimidio angustiora, inferiora 2–4 dentibus subacutis obtusa, superiora 4–8 dentibus plus minusve acutis obtusiuscula; floralia (bracteæ) latiora, ovata sed basi vix rotundata, 6–10 dentibus acutiusculis acutis vel etiam aristatis acuta vel acuminata; omnia glabriuscula vel setulis minimis (rarissime paucis glanduliferis) parce ciliata; infima florendi tempore nonnunquam caduca. Spica plus minusve elongata, fructifera internodis inferioribus folia sæpius superantibus. Calyx glaber vel in nervis dentibusque tenuiter acuminatis parce setulosus, in fructu paulo accretus. Corolla ad labii superioris apicem 4·5–7 mm. longa, omnino pallide vel saturate lutea striis purpureis picta aut interdum labio superiore purpurascente; labio inferiore deflexo quam superius plane longiore. Capsula oblongo-elliptica, emarginata, pilis erectis ciliata, calycem subæquans.

Euphrasia confusa inter *E. gracilem* Fr. et *E. nemorosam* Mart. (cum *E. curtâ* Wettst.) verisimiliter medium fere tenet, sed per corollam luteam ei *E. minimæ* subsimilem notabilis est.

In collibus regionis Exmoor dicta (alt. circa 400 m.) in comitatu Somerset et forsan in Devon Angliæ invenitur.

In view of the very full description of this plant furnished by Mr. Hiern (*l. c.*) a further diagnosis in English seems superfluous. It may be mentioned, however, that the cauline leaves of well-grown plants are scarcely ovate, though this term may perhaps be used in respect of weak examples such as those originally gathered by Mr. Hiern at Great Cornham. And it is apparently chiefly in luxuriant specimens that the teeth of the floral leaves become distinctly aristate. It may be added that Mr. Hiern's figure is drawn from weak plants and does not portray the intricate branching that is prevalent in well-grown examples of the species.

Of the variety *nana* mentioned by Mr. Bucknall (Brit. Euphr. p. 23) I have seen no material; of var. *arbuscula* (*l. c.* p. 24) authentic specimens in Mr. Barton's herbarium from Patterdale and Moel Siabod seem to me unconnected with the Exmoor plant and referable for the most part to *E. curta* var. *piccola* Towns. Mr. Pearsall's plant from Bigland, similarly named, shows distinctly larger flowers, and I think is probably a stunted form, such as is occasionally seen in hilly districts, either of *E. Kerneri* or eglandular *E. brevipila*.

I may add that I collected a *Euphrasia* near Keswick in 1903, with simple stem, broad, obtuse leaves, and very small, whitish flowers, which I referred at the time to *E. scotica*, but which in the dry state is not readily distinguishable from true *E. minima*.

Euphrasia hirtella Jordan.

It is a curious coincidence that this paper, which has been largely devoted to contesting the identification of the yellow-flowered Eyebright of Exmoor with the Swiss *E. minima*, should be concluded by an introduction to the British Flora of *E. hirtella*, which often grows in the Alps with *E. minima* and occasionally forms hybrids with it. The basis of this new introduction is a set of specimens which I collected on a rocky pasture near Llanberis, in North Wales, in September, 1917. The plants attracted my attention owing to their robust, erect, unbranched habit, and their shaggy grey-green foliage; and at the time of gathering them I omitted to notice the glandular character of the hair-clothing and supposed that, as they bore quite small flowers, they were referable either to *E. curta* or *E. latifolia*. On recently examining the specimens, I immediately saw that the hairs were glandular as in *E. Rostkoviana*, and that the habit and small flowers, in conjunction with this feature, brought them to *E. hirtella* Jordan, a species that I have collected at Arolla and elsewhere in the Pennine Alps.

The National Herbarium contains an authentic French example of *E. hirtella*, received from Jordan himself, as well as other good exsiccata that are clearly conspecific, and a comparison of these and the Kew collection with my Llanberis material reveals no essential differences. The chief divergence is that the British specimens, the tallest of which is but 12·5 cm. high, do not show the distant lower leaves referred to in Jordan's original description (Reuter, *Comptes rendus des travaux de la Société Hallérienne*, iv. p. 120 (1854–6)) —a feature readily seen in most of the foreign exsiccata. But this does not appear to be a constant character, for it is omitted from Wettstein's diagnosis, and in undoubted examples that I collected at Arolla in 1906 the lower internodes are scarcely longer than those of the Llanberis form, as seen in 1917. The nature of the Llanberis habitat—a barren, cool and wind-swept situation—may be conducive to the plant's dwarf growth there, or it may prove that it constantly differs in this respect from the Continental type and is varietally separable. It is also probable that in the British form the lower leaves are relatively narrower.

The occurrence of *E. hirtella* in North Wales might not unreasonably be expected from its Continental distribution. It is found in Central and Northern Spain, in the Pyrenees, in the French, Italian, and South-Western Swiss Alps; and eastwards, it is said to extend from the Tyrol through the Balkan Peninsula, Transcaucasia and Siberia to Chinese Mongolia. In France it reaches the department of Haute-Loire and the mountains of Auvergne.

In connection with *E. hirtella* it seems desirable to allude to *E. fennica* Kihlman, included as British in Mr. Bucknall's *British Euphrasiæ* (p. 27). Of this plant there is an authentic sheet in Herb. Kew from Kihlman himself (Pl. Finlandiæ Exsicc. no. 354, as *E. hirtella* Jord. var. *fennica* Lind. fil. (*E. fennica* Kihl.)), and I possess other good Finnish material. It is a form somewhat intermediate between *E. hirtella*, to a variety of which it is apparently reduced by Kihlman, and *E. Rostkoviana*, to which it has been likened by Wettstein. Of the former it possesses the strict, erect habit, but it is taller and more slender, with long lower internodes and a tendency to branch about the middle of the stem. Its lowest leaves are easily caducous as in *E. hirtella*, but its corolla is much larger, 7–8 mm. long, with the lower lip distinctly longer than the upper one and with broader segments, and hence approaching the flower of *E. Rostkoviana*. On the whole, however, there seems good ground for placing it under *E. hirtella*, to the type of which it seems nearer than some Asiatic examples that have been so named. I have had no opportunity of seeing Mr. Druce's original Exmoor specimen determined by Dr. Lindman, but those collected in that district in 1917 and 1918 by Mr. Barton and the Rev. E. S. Marshall do not appear to me to be identical with the Finnish form but rather modifications of *E. Rostkoviana*.

E. hirtella may be described as follows:—

Euphrasia hirtella Jordan ex Reuter in Comptes Rendus Soc Hallér. iv. 120 (1854–6); Wettstein, Mon. der Gattung Euphrasia, 175 (1896); *E. tatarica* race *E. hirtella* Rouy, Fl. France, xi. 149 (1909).

Icon. Wettstein, *l. c.* taf. iv. fig. 278–290, and taf. viii. fig. 4–7.

Exsicc. Billot, Fl. G. & G. 2332 & bis! 2333 ter! Rostan, Exsicc. Pedemontana, 46! Fiori, &c. Fl. Ital. Exsicc. 338!

Stem strict and erect, of variable size but usually robust, 3–25 cm. high, simple or occasionally with one or few erect branches towards the base, more or less purplish, pilose (especially above) with long, whitish, flexuous and partly glandular hairs. Leaves subopposite, dull green, up to 8 mm. long or larger in vigorous plants, clothed with whitish bristles and abundant long, flexuous, unequal glandular hairs; the lowest leaves obovate, or in the British form narrower and cuneate below, obtuse, with few obtuse teeth; upper cauline leaves ovate or broadly ovate, obtuse or subacute, with 3–6 more or less acute teeth on each side; floral leaves broadly ovate or triangular-orbicular, acute, with 4–8 acute or acuminate but not awned teeth on each side; nerves prominent below when dry; lower leaves often readily caducous. Spike very dense above and never much elongated, with the imbricated floral leaves more or less covering the fruiting calyces. Calyx clothed like the foliage, with lanceolate teeth, scarcely accrescent in fruit. Corolla small, 5–7 mm. long (5 mm. in British form) along the back, white, streaked with violet and with a yellow spot in the throat; lower lip but little exceeding the upper, with narrow, emarginate lobes. Capsule oblong-ovate, truncate or slightly retuse, nearly equalling the calyx or slightly exceeding it, usually shorter than its floral leaf, margin long-ciliate.

E. hirtella is readily distinguishable from all other British Eyebrights, except *E. Rostkoviana* Hayne and *E. Vigursii* F. H. Davey, by the long, flexuous glandular hairs that usually abound on its stem, leaves and calyx. *E. Rostkoviana*, which is furnished with similar but sometimes less abundant hair-clothing, is generally a widely different plant. Considering its usually larger size, it is of slenderer habit. Its stem is ascending rather than erect, flexuous rather than strict, and though not much branched, yet clearly more so than in *E. hirtella*. Its corolla is very much larger, commonly 9–11 mm. in length, with the lower lip conspicuously longer and broader than the upper one and the tube eventually elongating. Its capsule, also, differs in being broader, more elliptical in form, and generally distinctly emarginate.

E. Vigursii is normally still slenderer than most of the forms of *E. Rostkoviana*, with smaller foliage clothed with proportionately shorter and less unequal glandular hairs, and the corolla and capsule as in *E. Rostkoviana*, except that the former is commonly violet in colour instead of white.

E. campestris Jordan can hardly be confounded with *E. hirtella*, being a slender, much branched plant, with small, narrow leaves clothed with shorter glandular hairs, and very large corollas with elongating tube.

I have placed Llanberis examples of *E. hirtella* in the National Herbarium.

NOTES ON SOMERSET PLANTS FOR 1918.

By the Rev. E. S. Marshall, M.A., F.L.S.

(Concluded from p. 154.)

Solanum nigrum L. 3. Burton Pynsent, *W.*

Atropa Belladonna L. 10. About a dozen young plants, among rocks below Leigh Woods, *Dr. Newman Nield*; seen there by *T.*

Verbascum Thapsus L. 6. Combe St. Nicholas, *W.*

Linaria Elatine Miller. 3. Orchard Portman; Staplegrove, *W.* 4. Ilminster, *D.*—*L. spuria* Miller. 2. Frequent in cornfields about Kilve, *W.* 4. Abundant in cultivated ground, Ashill, *D.*

Antirrhinum Orontium L. 3. Staplegrove, sp.; 8. Burnham, *W.*

Mimulus Langsdorffii Donn. 1. Simonsbath. 4. Combe St. Nicholas, *W.* River Ile, below Ilminster, *D.*—*M. moschatus* Douglas. 6. Wambrook, *W.*

Veronica montana L. 4. Bickenhall; 8. Cogley Wood, Bruton, *W.*—*V. scutellata* L. 1. Exford.

Euphrasia Rostkoviana Hayne. 1. Abundant and variable about Simonsbath, up to fully 1400 feet; Exford; Withypool, where a minute form was found by *W.* 3. Broomfield and Traveller's Rest, between Kingston and Merridge (small form); 8. Wambrook, *W.*—*E. fennica* Kihlman. 1. Near Simonsbath (confirmed by Mr. C. Bucknall). I am not sure that this Exmoor plant is sufficiently distinct from *E. Rostkoviana*; the most obvious difference is in its capsules being deeply notched at the apex, but intermediate forms occur.—*E. Kerneri* Wettst. 1. Hill-pastures near Exford; named by *C. B.*—*E. nemorosa* H. Mart. 1. Dulverton, and near Tarr Steps; 2. Elworthy, and Horridge Combe; 3. Adcombe; 6. Whitestaunton, *W.* Var. *ciliata* Drabble. 1. Withypool; 6. Chard Common, *W.*—*E. gracilis* Fr. 1. Very local about Exford and Withypool.—*E. scottica* Wettst. 1. Here and there, in bogs, near Simonsbath and Withypool, up to 1400 feet.—*E. minima* Jacq. 1. This was observed in about a dozen stations near Simonsbath and Withypool, several being on the banks of the Barle. It reaches 1480 feet, and occurs as low as 800 feet. Decidedly polymorphic, but not at all closely approaching *E. scottica*, in this neighbourhood. Dwarf, densely branched, compact specimens are like var. *arbuscula* Bucknall, except that the flowers are not white; usually they are bright golden-yellow; but paler shades are not uncommon, those with a reddish or orange hue being scarce. Dr. Watson gathered what he believes to be a hybrid with the minute Withypool form of *E. Rostkoviana*; and I found two or three specimens of a cross (perhaps with *E. curta* var. *glabrescens*) near Wintershead Farm, Simonsbath.—*E. occidentalis* Wettst. 2. Holford Combe, *W.*, sp.—*E. curta* Wettst. var. *glabrescens* Wettst. 1. This, I suspect, is the commonest segregate on Exmoor; but several gatherings so named by me were referred to *E. nemorosa* by *C. B.* 2. Kilve district and Brendon Hills; 3. Quantocks and Blackdown; 6. Whitestaunton, *W.*

Bartsia Odontites Huds. var. *serotina* Reichb. 3. Aisholt; 4. Combe St. Nicholas, *W.* Var. *divergens* (Jord.). 1. Exford and Winsford; 2. Lilstock, *W.*

Rhinanthus major Ehrh. 9. By a roadside, Kenn Moor, *T.*

Utricularia major Schmidel? 9. Mineries Bog, near Priddy, *B. W. Tucker*, sp.; a small plant, probably this, but flowerless.

Pinguicula lusitanica L. 1. Reaches 1300 feet near Simonsbath. 6. Bewley Down, near Wambrook, *W.*

Verbena officinalis L. 2. East Quantoxhead and Lilstock; 3. Staplegrove, Curry Rivell, and Rock Hill, Wrantage. *W.*

Mentha spicata L. 6. Birchwood and Combe St. Nicholas; well established, and far from houses, *W.*—*M. piperita* L. 1. Islet in the Barle, below Simonsbath. 3. Buncombe Wood, Kingston, near a cottage; 6. Chard Common, *W.*—*M. hircina* Hull (*aquatica* × *longifolia*?). 9. In two places, about half a mile apart, near Weston-in-Gordano, *R.*—*M. rubra* Sm. 9. Roadside, between Tickenham and Failand, *T.*—**M. gentilis* L. 4. Knowle St. Giles, *W.*, sp.—M. *arvensis* L. var. *agrestis* (Sole). 2. East Quantoxhead; 3. Cothelstone; 6. Wambrook, *W.* Var. *præcox* (Sole). 4. Cornfield, Castle Neroche. 6. Chard Common, *W.*

Origanum vulgare L. 3. On the White Lias ridge, from Hatch to Langport, *W.*

Thymnus ovatus Miller. 6. Combe St. Nicholas, *W.*

Calamintha Acinos Clairv. 9. Field on Creech Hill, near Bruton, *C. E. Moss* (*teste W.*). 9. Between Failand and Tickenham, *T.*—*C. montana* Lam. 2. Stogumber!, Kilve, and East Quantoxhead; 3. Aisholt, Kingston!, and Staplegrove; 4. Street Ash; 9. Yatton, *W.*

Melissa officinalis L. 3. Kingston and Bathpool; 4. Barley Hill, *W.*

Salvia Verbenaca L. 3. Curry Rivell, *W.* 5. Kingsdon, *G.*—[*S. verticillata* L. 2. Established on the Lower Marsh, Dunster, *J. A. Fort*, sp. 9. Flax Bourton, *T.*]

Scutellaria galericulata L. 3. West Sedgemoor; 8. Rare at Bruton, *W.*—*S. minor* Huds. 1. Exford; Withypool; ascends to 1300 feet near Simonsbath. 2. Elworthy; 4. Britty Common; 6. Buckland St. Mary and Bewley Down, *W.*

Stachys officinalis Trev. 3. Norton Fitzwarren, Pitminster, Corfe, Thurlbear, &c.; 4. Castle Neroche, &c.; 6. Whitestaunton and Wambrook; 8. Bruton, *W.*—*S. palustris* × *sylvatica* (*ambigua* Sm.). 4. Donyatt, *D.* Knowle St. Giles, *W.*—*S. arvensis* L. 1. Field on Sherdon Farm, Simonsbath (1250 feet).

Galeopsis angustifolia Ehrh. 2. East Quantoxhead; 3. Near Fivehead, *W.*—*G. Tetrahit* L. var. *bifida* (Boenn.). 3. Elworthy; 6. Whitestaunton, *W.* Var. *nigricans* Bréb. 1. Withypool!, Exford!, Simonsbath!, Winsford, and Exton; 6. Buckland St. Mary, *W.*

Lamium Galeobdolon Crantz. 2. Washford; 3. Broomfield, *W.* 4. Hinton St. George; Dinnington; Chilworthy, *D.* 6. Combe St. Nicholas; Whitestaunton, *W.*

Plantago major L. var. *intermedia* Syme. 3. Gravel paths, West Monkton. On the Lias, Thurlbear; 8. Bruton, *W.*—*P. lanceolata* L. var. *sphærostachya* Roehl. 1. Withypool and Simonsbath; 2. Frequent above Kilve and Quantoxhead, and at Minehead; 3. Cothelstone, *W.* This form does not seem to be constant.—*P. Coronopus* L. var. *pygmæa* Lange. 2. Minehead, and from St. Audries to Lilstock; 9. Berrow, *W.* Below Brean Down, on the northern side.

Littorella uniflora Aschers. (*lacustris* L.). 1. Pools in the Barle, about two miles below Simonsbath; a very unusual station. It does not seem to flower here. Leaves up to eight inches long.

Scleranthus annuus L. 3. West Monkton, *W. D. Miller*! 4. Castle Neroche, *W.*

Chenopodium polyspermum L. 2. Minehead, *W.* 3. Cothelstone.—*C. murale* L. 2. East Quantoxhead; Lilstock, *W.*—*C. urbicum* L. 9. Near Brean, *W.*—*C. rubrum* L. 3. West Monkton. Var. *blitoides* Wallr. 3. Staplegrove. *W.*—*C. Bonus-Henricus* L. 2. East Quantoxhead; Trull and Ruishton, *W.*

Atriplex deltoidea Bab. 3. Taunton, *W.* Var. *prostrata* Bab. 2. Kilve, on shingle; Lilstock, on mud, *W.*

Salicornia europæa L. forma *stricta* Moss. 9. Berrow, *W.*

Suæda maritima Dum. 2. Lilstock, *W.*

Polygonum Convolvulus L. var. *subalatum* V. Hall. 3. Staplegrove and Kingston, *W.* 4. Ilminster, *D.* 9. Berrow, *W.*—*P. lapathifolium* L. 3. W. Sedgemoor; 4. Knowle St. Giles and Combe St. Nicholas, *W.* Ilminster, *D.*—**P. lapathifolium* × *Persicaria.* 3. Orchard Portman, Staplegrove, and West Sedgemoor; 4. Combe St. Nicholas and Knowle St. Giles, *W.*—*P. Bistorta* L. 3. Roadside near Kingston, *W.*

Rumex maritimus L. 3. By a pool on the edge of West Sedgemoor, below Burton Pynsent, *W.*—*R. obtusifolius* L. var. **agrestis* Fr. 1. Withypool; 3. Thurlbear, and near Taunton; 6. Wambrook —"a frequent form," *W.*—*R. crispus* × *obtusifolius.* 3. Stoke St. Mary, *W.*

Euphorbia Lathyrus L. A garden weed at 3. Holway, *W.*, and 4. Ilminster, *D.*

Mercurialis annua L. 3. Allotments, Staplegrove, *W.*

Urtica urens L. 2. East Quantoxhead; 3. Taunton; 6. Combe St. Nicholas and Wambrook; 9. Bleadon, *W.*

Parietaria officinalis L. 2. Kilve and Stogumber; 4. Chard and Knowle St. Giles; 6. Winsham, *W.*

Carpinus Betulus L. 2. Stogumber; Crowcombe, *W.*

Quercus Robur × *sessiliflora.* 3. Stoke St. Mary, *W.*

Salix triandra L. 3. Holway, *W.*—*S. aurita* L. 1. Common on Exmoor up to 1400 feet. 2. Horner to Dunkery; 6. Bewley Down, *W.*—**S. aurita* × *caprea*, **S. aurita* × *cinerea*, and **S. caprea* × *cinerea.* 1. Simonsbath (only leaf-specimens).—*S. repens* L., the form *S. ascendens* Sm. 6. Bewley Down, *W.*

Empetrum nigrum L. 2. One patch on Yearnor Moor, near Selworthy; *N. G. Haddon.*

Neottia Nidus-avis Rich. 4. Ely Wood, near Chard, *W.*

Cephalanthera grandiflora Gray. 8. Near Batcombe, scarce, *R. V. S.*

Orchis pyramidalis L. 3. Thurlbear, Pitminster, and Corfe; 6. Combe St. Nicholas, *W.*—*O. incarnata* L. 4. Combe St. Nicholas; 8. Rare at Bruton, *W.*—**O. incarnata* × *maculata.* 6. Widcombe, *W.*—*O. maculata* L. (*ericetorum* Linton). 4. Combe St. Nicholas, *W.*

Ophrys apifera Huds. 4. Puckington; Barrington, *D.*

Habenaria bifolia Br. 6. Whitestaunton; Bewley Down, *W.*—*H. virescens* Druce. 3. Blagdon, and on the White Lias ridge from Pitminster to Langport (extending into dis. 4); 4. Castle Neroche and Combe St. Nicholas; 6. Whitestaunton and Combe St. Nicholas, *W.* 5. Woods at Kingsdon, *G.*

Iris fœtidissima L. 2. Kilve!; 3, 4. White Lias ridge, from Pitminster to Curry Rivell!, *W.*

[*Tritonia* (*Montbretia*) *aurea* × *Pottsii* = × *T. crocosmiflora* Nicholson. Banks of the Barle below Simonsbath, at intervals, for nearly two miles. Two clumps were noticed by Lady Davy in 1916, and it seems to be spreading quickly.]

Polygonatum multiflorum All. 1. Wood at Exford, *E. J. Piper.* 10. Melcombe Wood, Mells, *T.*—*P. officinale* All. 10. Babington; Melcombe Wood; Asham Woods, *T.*

Allium vineale L. 2. East Quantoxhead, *W.*

Narthecium ossifragum Huds. 2. Elworthy; 6. Bewley Down, *W.*

Paris quadrifolia L. 3. Curry Rivell, *W.* Westcombe, *R.V.S.*

Juncus squarrosus L. 1. Common on the Exmoor hills up to 1500 feet. 4. Britty Common; Broadway Forest, *D.*—*J. effusus* L. var. **compactus* Lej. & Court. 1. Abundant on the high ground about Simonsbath and Exford; I did not see *J. conglomeratus*, for which it may easily be mistaken.—*J. effusus* × *inflexus* (*diffusus* Hoppe). 1. Barle Valley, *W.*—*J. maritimus* Lam. 2. Lilstock, *W.*—*J. subnodulosus* Schrank (*obtusiflorus* Ehrh.). 3. West Sedgemoor, below Burton Pynsent, *W.*

**Luzula Forsteri* × *pilosa* (*Borreri* Bromf.). Shady bank, south of Broomfield, with the parents, *C.S. and E.S.M.*; new for Somerset. —*L. sylvatica* Gaud. 1. Near Simonsbath, local; it reaches 1300 feet. —*L. multiflora* DC. 3. Thurlbear, and Quantocks; 4. Bickenhall; 6. Bewley Down; 8. Kingsettle Hill, *W.*

Typha latifolia L. 2. Lilstock, *W.*—*T. angustifolia* L. 4. Old canal, between Chard and Ilminster, *D.*

Sparganium erectum L. var. *microcarpum.* 1. One patch in the Barle, below Simonsbath.

Lemna trisulca L. 3. Milverton, *W.*

Alisma lanceolatum With. 3. West Sedgemoor, *W.*

Triglochin palustre L. 4. Britty Common, *W.*

Potamogeton pusillus L. 3. Taunton; Staplegrove, *W.*—*P. pectinatus* L. 3. In the Tone near Taunton, *W.* 4. In the Ile near Donyatt, *D.*, sp.

Zannichellia palustris L. 3. Stoke St. Mary; Fitzroy, near Taunton, *W.*

Eleocharis multicaulis Sm. 1. Exehead; 6. Wambrook, *W.*

Scirpus cæspitosus L. and *S. pauciflorus* Lightf. 4. Britty Common.—*S. fluitans* L. 1. In the White Water, near Simonsbath, at about 1100 feet.—*S. setaceus* L. 1. Withypool; 2. Halsway and Herridge Combes, *W.* 4. Old canal, between Chard and Ilminster, *D.*

Eriophorum vaginatum L. 4. Britty Common, local, *C. S. and E. S. M.* *E. angustifolium*, *E. latifolium*, and *E. gracile* grow close by—a remarkable association.—*E. angustifolium* Roth. 2. Herridge Combe; 3. Triscombe; 6. Bewley Down, *W.* Var. **triquetrum* Fr. 6. Culmhead, *W.*

Rynchospora alba Vahl. 6. Bewley Down, *W.*

Carex pulicaris L. 3. Triscombe; 6. Bewley Down, *W.*—**C. disticha* Huds. 3. West Sedgemoor, *W.*—*C. paniculata* L. 1. Exford; above 1300 feet near Exehead. 2. Below Alderman's Barrow, *N. G. H.*—*C. echinata* L. 3. Triscombe; 6. Bewley Down, *W.*—*C. leporina* L. 1. Ascends to 1200 feet near Simonsbath.—*C. pilulifera* L. 6. Bewley Down, *W.*—*C. pallescens* L. 4. Bickenhall; 6. Combe St. Nicholas, *W.*—*C. strigosa* Huds. 9. Between Tickenham and Nailsea, *T.*—*C. binervis* L. 6. Bewley Down, *W.*—*C. fulva* Host. 1. Near Exford.—*C. Œderi* Retz. 1. Withypool; 3. Triscombe, *W.*—*C. riparia* L. 2. Lilstock, *W.*

Milium effusum L. 3. Kingston; Norton Camp, *W.*

Phleum pratense L. var. *nodosum* L. 1. Withypool; 2. Frequent about Kilve, *W.*

Agrostis setacea Curt. 2 and 3. Quantocks!, *W.*—*A. canina* L. 2. Quantocks; 3. Bathpool, *W.*—*A. alba* L. var. *major* Gaud. 3. Creech St. Michael, *W.*—*A. tenuis* Sibth. (the state called *A. pumila* L.). 2. Quantocks, *W.* 9. Cart-track between Blackdown and Shipham, *T.*—*A. nigra* With. 3. West Sedgemoor; 6. Chard Common, *W.*

Calamagrostis epigeios Roth. 3. Cannington, *H. Slater*, sp.

Aira caryophyllea L. var. **divaricata* (Pourr.). 2. Quantoxhead, *W.*—*A. præcox* L. 1. Common on Exmoor up to 1300 feet. 2. Kilve, &c., *W.*

**Holcus lanatus* × *mollis?* 2. Kilve and Stogumber; 6. Wambrook; 9. Berrow, *W.* The specimen shown to me was too scrappy; it seems likely enough to occur, but has not been previously reported anywhere, so far as I know.—*H. mollis* L. 2. Kilton; 8. Wambrook; 9. Berrow, *W.*

Deschampsia cæspitosa Beauv. var. *argentea* Gray. 3. Woods at Curry Rivell, Thurlbear, and Pitminster, *W.* This is probably an albino.

Arrhenatherum elatius Mert. & Koch var. *nodosum* Koch (*A. precatorium* Dietrich). 1. Withypool, *W.*

Molinia cærulea Mœnch. 1. Abundant on Exmoor up to 1500 feet. Vars. *robusta* (Prahl) and *viridiflora* Lej. 6. Bewley Down, extending into Devon, *W.*

Catabrosa aquatica Beauv. 3. Staplegrove; Bishop's Lydeard, *W.*

Melica uniflora Retz. 1. Exford. 3. Norton Fitzwarren and West Hatch: 4. Bickenhall; 6. Whitestaunton and Combe St. Nicholas, *W.*

Poa nemoralis L. 1. Dulverton, *W.*, sp.—*P. compressa* L. 1. Wall at Simonsbath (1050 feet). 9. Purn Hill, Bleadon, *W.*—*P. pratensis* L. var. *subcœrulea* (Sm.). 6. Whitestaunton, *W.*

Glyceria plicata Fr. 2. Porlock; 3. Bagborough, *W.*

Festuca bromoides L. 2. Kilton; 3. Thurlbear, *W.*—*F. rubra* L. var. *arenaria* Fr. 2. Quantoxhead, *W.*—*F. pratensis* Huds. 3. Corfe, *W.*—*F. elatior* L. 3. Orchard Portman; Hillfarrance, &c., *W.*—Subsp. *F. arundinacea* Schreb. 2. Perry's, near East Quantoxhead (confirms my suggestion in Fl. Som. Suppl.), *W.*

Bromus giganteus L. 2. Kilve (type and var. *triflorus*); 3. Stoke St. Mary, *W.*—*B. ramosus* Huds. 2. Kilve, &c.; 3. Taunton, &c., *W.*

[*Lolium multiflorum* Lam. 2. Crowcombe; 3. Taunton, Corfe, and Dodhill, *W.*]—*L. perenne* L. var. *tenue* Syme. 3. Holway, *W.*

Agropyron caninum Beauv. 4. Combe St. Nicholas, *W.*—*A. repens* L. var. *Leersianum* Gray. 3. Kingston; Stoke St. Mary, *W.*—*A. pungens* Roem. & Schult. 2. Lilstock, *W.*

Nardus stricta L. 1. Common near Simonsbath, &c., up to 1450 feet.

Blechnum Spicant With. 1. Exford; Withypool; Simonsbath, &c. 2 and 3. Combes on Quantock, *W.*

Athyrium Filix-fœmina Roth. var. **convexum* (Newm.). 1. Common about Exford, Withypool, &c.!; 3. Clatworthy!; 4. Barley Hill and Castle Neroche, *W.*

Ceterach officinarum Willd. 1. Plentiful in two places near Exford; a few plants at Simonsbath (1000 feet). New for this district, I believe.

Cystopteris fragilis Bernh. 1. Fine and typical near Exford, at 1050 feet. Extinct at Dulverton, *W.*

Polystichum aculeatum Roth. 6. Whitestaunton (type and var. *lobatum*), *W.*—*P. angulare* Presl. 1. Exford. 6. Whitestaunton, *W.*

Lastrea montana T. Moore (*Oreopteris* Presl.). 1. Locally plentiful, especially in lanes, about Exford, Withypool, and Simonsbath, reaching 1300 feet. 6. Blackwater, near Buckland St. Mary. 8. One plant, near Westcombe, *R. V. S.*—*L. spinulosa* Presl. 2 and 3. Combes on Quantock, *W.*—*L. æmula* Brackenridge. 2. Near Holford, *H. Corder* (about two dozen plants).

Polypodium vulgare L. var. **serratum* Willd. 3. West Monkton!, *R.*

Phegopteris polypodioides Fée. 1. Fine and locally plentiful in a second station near Simonsbath, at about 1300 feet.—*P. Dryopteris* Fée. 1. On a bank over the Exe; shown to *W. S. Price*, 1908. We did not see it in Murray's station, above Landacre Bridge.

Ophioglossum vulgatum L. 4. Bickenhall, *W.* 5. Kingsdon, *G.*

Equisetum maximum Lam. 1. Lime Combe, Simonsbath, with a small state of *E. sylvaticum* L., at 1050 feet.—*E. arvense* L. var. *nemorosum* Braun. 3. Adcombe Wood; 4. Ely Wood, near Chard, *W.*—*E. palustre* L. 1. Frequent on Exmoor!, *W.* Var. *polystachyum* Weigel. 1. Sparingly, with the type, near Codsend, Quarme Valley. Var. *nudum* Newm. 4. Britty Common; 6. Culmhead; 9. Berrow, *W.*

Lycopodium Selago L. 6. Bewley Down, *W.*

Nitella opaca Agardh. 10. Canal, near Bathampton, *C. S.*

THE AFRICAN SPECIES OF ALLOPHYLUS.

By Edmund G. Baker, F.L.S.

(Concluded from p. 160.)

15. **A. toroensis**, sp. nov.

Frutex gracilis. *Rami* teretes, glabri vel fere glabri, ramulis pubescentibus ad *A. latefoliolatam* Bak. fil. accedens. *Folia* trifoliolata, papyracea, glabra, siccitate triste viridia, foliolis intermediis margine serratis apice acuminatis apice ipso obtusis, supra opacis ellipticis vel elliptice-obovatis basi cuneatis, 12–17 cm. longis, 5–6 cm. latis, lateralibus valde inæquilateralibus parum minoribus, petiolo communi ±3 cm. longe prædita. *Thyrsi* simplices folia superantes vel subæquantes, multiflori. *Flores* majusculi in cymulas plurifloras dispositi, pedicellati. *Sepala* membranacea, extus puberula ±2 mm. longa. *Antheræ* 0·5 mm. longæ. *Fructus* rubri, 5–7 mm. diam.

UGANDA: Toro, near Mpanga river, *Bagshawe* 1128! alt. 4000 ft. At edge of stream, forest near mouth of Mpanga, *Bagshawe* 1150! in fruit, Hb. Mus. Brit.

A shrub with trifoliolate acuminate papyraceous leaves, simple thyrse, and red fruits; intermediate leaflets cuneate at the base, petiolulate (10–15 mm.), the lateral very unequal-sided.

16. A. LATEFOLIOLATUS Bak. fil. in Journ. Linn. Soc. xxxvii. 137 (1905).

UGANDA: Lake shore Musozi, *Bagshawe* 153! Hb. Mus. Brit.

17. A. CHAUNOSTACHYS Gilg in Engl. Jahrb. xxx. 347 (1901).

EAST AFRICA: Kinga Hills, *Goetze* 1196! Hb. Berol.

18. **A. gazensis**, sp. nov.

Arbuscula vel frutex ramis cortice cinereo obtectis lenticellosis glabris vel glabriusculis. *Folia* trifoliolata, chartacea, glabra, foliolis terminalibus majoribus oblongo-ovatis inferne sensim in petiolulum 10–15 mm. longum cuneato-angustatis, 9–12 cm. longis, 3·5–4·5 cm. latis, lateralibus ovato-lanceolatis acuminatis, omnibus argute serratis, petiolo communi glabro 3–4 cm. longo suffulta. *Flores* majusculi in cymulas plurifloras et pedunculatas dispositi. *Thyrsi* cum pedunculo 14–18 cm. longi, laxi, folia superantes vel adæquantes, rhachi glabriuscula. *Calyx* glabriusculus. *Ovarium* pilis albidis vestitum. *Fructus* cocci subglobosi, primum pilis vestitum demum glabri ±7 mm. diam.

GAZA-LAND: Chimanimani Mts. at 7000 ft., *Swynnerton* 1321! Hb. Mus. Brit.

Allied to *A. chaunostachys* but leaflets larger and petiolules of terminal leaflets longer.

19. A. MACRURUS Gilg in Engl. Jahrb. xxiv. 287 (1897).

LAKE REGION: Between Balaibo and Daki, *Stuhlmann* 2783. Hb. Berol.

20. A. SPECTABILIS Gilg in Deutschen Zentral-Afr. Exped. ii. 474 (1911).

RUGEGE: *Mildbraed* 932. Hb. Berol.

21. A. OREOPHILUS Gilg in Engl. Jahrb. xxiv. 289 (1897).

RUWENZORI: *Scott Elliot* 7938! Hb. Mus. Brit.

22. A. BUCHANANI Gilg ex Radlk. in Sitz. Bayer. Akad. l. c. 279 (1909).

NYASALAND: *Buchanan* 363! (1891) *Buchanan* 14264! Natal Government Herb.

Var. nov. UGANDENSIS.

Rami cinerei. *Folia* quam iis typi majora foliolis terminalibus, 12–14 cm. longis, 5·5–6·5 cm. latis. *Thyrsi* laxiflori foliis breviores ±8 cm. longi. *Fructus* cocci subglobosi, 5–6 mm. diam.

UGANDA: Kasala Forest, *Dummer* 542! Hb. Mus. Brit. "6 ft. Flowers white"; Mabira Forest near Mubango; shrubby, 6 ft., flowers white; *Dummer* 1388! in fruit.

Differs from type in the larger leaves which do not turn black when dried.

23. **A. cuneatus**, sp. nov.

Frutex usque ad 4-pedalis ramulis cortice cinereo obtectis. *Folia* trifoliolata, papyracea, glabra, viridia, foliolis intermediis cuneato-obovatis in parte $\frac{1}{3}$–$\frac{1}{2}$ superiore grosse crenato-serratis petiolulatis 11–14 cm. longis, 4–6 cm. latis, lateralibus minoribus 8–10 cm. longis, petiolis 4–6·5 cm. longis glabris longitudinaliter canaliculatis. *Flores* albi, mediocres, pedicellati, in cymulas paucifloras dispositi. *Thyrsi* simplices, laxiflori, petiolos longiores, foliis breviores, 8–15 cm. longi, rhachi pubescente. *Calyx* extus fere glaber. *Petala* alba. *Fructus* ignotus.

EAST AFRICA: Limoru, *Dummer* 1566! In wooded ravines alt. 7000 ft. Hb. Mus. Brit.

The green glabrous leaves, the intermediate distinctly cuneate towards the base and crenate-serrate towards the apex, and the simple thyrse, rather laxly flowered, longer than the petioles but shorter than the leaf, distinguish this species.

24. A. VOLKENSII Gilg in Engl. Jahrb. xxiv. 290 (1897).
KILIMANJARO: *Volkens* 2077! Hb. Berol.

25. A. FERRUGINEUS Taub. in Engl. Pflanzenwelt Ost-Afr. c. 249 (1895).
EAST AFRICA: Ruanda, *Mildbraed* 563. Hb. Berol.

26. **A. cazengoensis**, sp. nov.

Frutex scandens. *Rami* glabri, longi, sarmentosi. *Folia* membranacea, petiolata, foliolis oblongo-ovatis apice acuminatis intermediis basi cuneatis margine argute serratis, 6·5–8·0 cm. longis, 3·0–3·5 cm. latis, lateralibus basi inæqui-lateralibus, petiolo communi 2·5–3·5 cm. longo prædita. *Thyrsi* longissimi, graciles, simplices foliis longiores, laxiusculi 10–20 cm. longi. *Flores* mediocres vel parviusculi albi, in cymulas 1–3-floras dispositi. *Calyx* glaber vel fere glaber. *Fructus* siccitate nigrescens.

CAZENGO: In sunny thickets at the Granja de San Luiz. *Gossweiler* 5666! Hb. Mus. Brit.

A climber with long sarmentose branches and white flowers; leaves membranous, glabrous except below in the axils of the nerves, trifoliolate; leaflets generally more or less serrate; thyrse long slender simple, longer than the leaves; flowers rather small.

27. A. DASYSTACHYS Gilg in Engl. Jahrb. xxiv. 293 (1897).
KILIMANJARO REGION: *Pospichal*, Hb. Berol.

28. A. ANTUNESII Gilg in Engl. Jahrb. xxiv. 289 (1897).
ANGOLA: Huilla, *Antunes* 222 & 255. Hb. Berol.

29. A. GOETZEANUS Gilg in Engl. Jahrb. xxviii. 423 (1900).
EAST AFRICA: Uhehe, *Goetze* 652. Hb. Berol.

30. **A. andongensis**, sp. nov. *A. africanus* Hiern, Cat. Welw. Afr. pl. i. 167 pp., non Beauv.

Frutex vel arbuscula. *Rami* fusco-hirti. *Folia* papyracea, foliolis triste viridibus terminalibus rhombeo-obovatis lateralibus basi inæquilateralibus utrinque molliter pubescentibus ad nervos pilosulis lamina 6–9 cm. longa, 4–5 cm. lata, petiolo communi rufo vel fusco-pubescente, 6–9 cm. longo. *Thyrsi* laxiusculi, simplices, 7–8 cm. longi petiolos certe longiores folia breviores. *Flores* mediocres, albi, in cymulas paucifloras dispositi. *Alabastra* pubescentia. *Flores* generis.

ANGOLA: Pungo Andongo, in sylvis densioribus de Mata de Pedro Cabondo, *Welwitsch* 4512! Hb. Mus. Brit.

Shrub or small tree with trifoliolate serrate leaves and fuscous or ferrugineous pubescent petioles; thyrse lax 7–8 cm. long, cymules few-flowered. Allied to *A. ferrugineus* Taubert. Differs from *A. Antunesii* Gilg by broader leaflets and longer petioles.

31. A. CONGOLANUS Gilg in Engl. Jahrb. xxiv. 294 (1897).

CONGO: MTowa, *Deschamps*. NYASALAND: *Buchanan* 1224! (1891) Hb. Kew.

Var. nov. MONOPHYLLUS.

Foliola solitaria, sessilia, 8–10 cm. longa, 4–5 cm. lata, margine serrata, subtus griseo-tomentosa. *Thyrsi* foliis longiores, parviflori, densi.

EAST COAST: Lake Nyasa, *Johnston* 43! Hb. Kew.

32. A. APPENDICULATO-SERRATUS Gilg in Engl. Jahrb. xxx. 348 (1901).

EAST AFRICA: Livingstone Hills, *Goetze* 853. Hb. Berol.

33. A. YERU Gilg. l. c.

EAST AFRICA: Kondeland: *Goetze* 832! Hb. Berol. Hb. Mus. Brit.

34. A. SPICATUS Radlk. in Engl. & Prantl. Plflanzen-fam. iii. 5, 312 (1895). *Schmidelia spicata* DC. Prodr. i. 611 (1824). *S. magica* Baker in Fl. Trop. Afr. i. 423 (1868). *Ornitrophe spicata* Poir. Encycl. viii. 265 (1808). *O. magica* Schum. & Thonn. Beschr. Guin. 186 (1827).

NIGER EXPED.: *Barter* 402! & 1648! Hb. Kew. LAGOS: *Foster* 96! Hb. Kew. *Scott-Elliot* 5411, from Sierra Leone may also belong here.

35. A. ELONGATUS Radlk. in Sitz. Bayer. Akad. l. c. 221 (1909).

USAMBARA: *Holst* 288. Hb. Berol.

36. A. TENUIFOLIUS Radlk. l. c.

NYASALAND! *Buchanan* 363! Hb. Mus. Brit.

37. A. WELWITSCHII Gilg in Engl. Jahrb. xxiv. 287 (1897).

ANGOLA: Golongo Alto, *Welwitsch* 4510! 5408! Pungo Andongo, *Welwitsch* 4511! Hb. Mus. Brit. CAMEROONS: Yaunde, *Bates* 839! Hb. Mus. Brit. UGANDA: *Dawe* 477! Hb. Kew.

38. A. Conraui Gilg ex Radlk. in Kgl. Bayer Akad. l. c. 221 (1909).
Cameroons.

39. A. leptocaulos Radlk. in Ann. Mus. Congo, ser. 2, i. i. 17 (1899).
Congo.

40. A. integrifolius Blume, Rumphia, iii. 129 (1847). *Ornitrophe integrifolius* Willd. Sp. Pl. ii. i. 322 (1799). *Schmidelia integrifolia* DC. Prod. i. 610 (1824). *S. racemosa* Linn. var. *integrifolia* Baker Fl. Maur. 56 (1877).
Africa: *fide* Radlkofer; also Mauritius and Bourbon.

41. A. repandus Engler in Bot. Jahrb. xvii. 160 (1893). *Schmidelia repanda* Baker in Fl. Trop. Afr. i. 422 (1868).
East Africa: Lower Shire Valley, *Kirk*! *Meller*! Hb. Kew. Mozambique: Mfusi, *W. Johnston* 150! Ndi (Taita), *Hildebrandt* 2562! Hb. Kew.
This is quite distinct from *A. alnifolia* Radlk., but I doubt whether it is advisable to separate *A. tenuis* Radlk.

42. A. subcoriaceus Bak. fil. in Journ. Linn. Soc. xxxvii. 186 (1905).
Uganda: Near Mulema, *Bagshawe* 254! Hb. Mus. Brit. Koki and Ankole, *Dawe* 401! *Fyffe* 103! Hb. Kew.
The fruits are small, subglobose, 4–5 mm. diam.

43. A. Warneckei Gilg MS. in Hb. Mus. Brit.
Rami cortice cinereo vestiti. *Folia* trifoliolata, petiolata foliolis ovatis vel ovalibus utrinque pilis adspersis lateralibus perspicue minoribus inæquilateralibus remote serratis, terminalibus in parte $\frac{2}{3}$ superiore serratis basi cuneatis 5–6 cm. longis, 4–5 cm. latis, petiolulis brevibus, petiolo communi 15–20 mm. longo. *Thyrsi* simplices pseudospicati et ramosi folia subadæquantes 5–8·5 cm. longi. *Flores* parvi in cymulas paucifloras dispositi, pedicellis brevibus, rhachi tenue. *Sepala* concava. *Fructus* cocci rubri, glabri, globosi, ± 6 mm. diam.
Togoland: Near Lome, *Warnecke* 376! & 160! Hb. Mus. Brit.
A plant with trifoliolate serrate papyraceous leaves allied to *A. rubifolius* Engl. and *A. stachyanthus* Gilg.

44. A. grandifolius Radlk. in Engl. & Prantl. Naturl. Pflanzenfam. iii. 5, 313 (1895). *Schmidelia grandifolia* Baker in Fl. Trop. Afr. i. 421 (1868).
Princes Island: *Barter* 1990! Hb. Kew. Cameroons: Bipinde, *Zenker* 1142 & 4374! Hbb. Berol. Mus. Brit.

45. A. bullatus Radlk. in Sitz. Bayer. Akad. l. c. 223 (1909), *Schmidelia abyssinica* Hook. fil. in Journ. Linn. Soc. vii. 1864, 189.
Cameroons: *Mann* 1184! & 2167! Hb. Kew.

46. A. abyssinicus Radlk. in Engl. & Prantl, l. c. 313 (1895). *Schmidelia abyssinica* Hochst. in Flora (1843) 10.

Abyssinia: Many collectors. Mt. Ruwenzori: *Scott Elliot* 7910! Hb. Mus. Brit. Usafua: *fide* Gilg.

47. A. camptoneurus Radlk. in Sitz. Bayer. Akad. l. c. 224 & 227 (1909).

Cameroons: Bipinde, *Zenker* 3161. Hb. Berol.

48. A. **Talbotii**, sp. nov.

Rami lenticellis subprominentibus subcopiose onusti. *Foliola* trifoliolata, papyracea, foliolis elliptico-obovatis acuminatis basi cuneatis glabris margine integris terminalibus 8–9 cm. longis, 3–4 cm. latis, lateralibus 5–6 cm. longis, petiolo communi 4–4·5 cm. longo prædita. *Thyrsi* ramosa folia superantes a medio deorsum nudi apicem versus densiflori. *Flores* parviusculi, breviter pedicellati. *Calyx* parvus externe pubescens. *Fructus* ignotus.

Nigeria: Oban, *P. Talbot* 1713! Hb. Mus. Brit.

Allied to *A. Zenkeri* Gilg. The papyraceous leaflets when dried are silvery-brown and smaller; petiole glabrous; thyrse 10–20 cm. long, longer than the leaves, in the upper portion fairly densely floriferous; buds globose, small, pubescent.

49. **A. Gossweileri**, sp. nov.

Frutex a basi ramosus circ. 8-pedalis ad *A. Zenkeri* Gilg accedens. *Rami* teretes, glabri, lenticellosi. *Folia* trifoliolata glaberrima, apice acuminata ovalia vel elliptico-obovata, nervis lateralibus subtus conspicuis utrinque 5–6, foliolis terminalibus 14–16 cm. longis, 7–7·5 cm. latis, lateralibus 10–11 cm. longis, 5–5·5 cm. latis, petiolo communi 4–5 cm. longo prædita. *Thyrsi* ramosi inferne nudi sursum rumos 3–4 emittentes, ramis longiusculis densifloris. *Flores* mediocres in cymulas plurifloras dispositi, rhachi pubescente. *Fructus* globosus, ± 6 mm. diam. rubro-brunneus, majusculus.

Angola: Pungo Mongo: in swampy situations among bog Ferns. *Gossweiler* 6020! Hb. Mus. Brit.

Noticeable on account of the glabrous shining trifoliolate leaves, the densely-flowered branched inflorescence, and the reddish-brown globose fruits.

50. A. rutete Gilg in Deutschen Zentral-Afr. ii. 476 (1911).

East Africa: Bukoba, *Mildbraed* 318. Hb. Berol.

51. **A. Ussheri**, sp. nov.

Rami lenticellis sparse obtecti, glabri vel fere glabri. *Folia* trifoliolata, foliolis ellipticis vel ovalibus crassiusculis margine integris demum glabris 13–15 cm. longis, 5–6·5 cm. latis, basi cuneatis, ad apicem attenuatis, petiolulis brevibus, nervis lateralibus erecto-arcuatis utrinque 9–12, petiolo communi glabro 4–8 cm. longo suffulta. *Thyrsi* ramosi ramos paucos emittentes multiflori foliis breviores, pedunculo longitudinaliter striato 5–8·5 cm. longo. *Flores* mediocres, pedicellati, in cymulas paucifloras dispositi. *Calyx* 1·5–2·0 mm. longus, extus pubescens. *Fructus* ignotus.

UGANDA: Mabira Forest, Chagwe, *Ussher* 61! Hb. Kew.

The noticeable features of this species are the rather thick leaflets, elliptical or oval in shape, with entire margins, which do not turn black or brown on drying. The thyrse is branched, the lower part being bare, the branches thickly covered with medium-sized flowers.

In some respects allied to *A. Schweinfurthii* Gilg, which, however, when dried turns a chocolate colour.

52 A. SCHWEINFURTHII Gilg in Engler Jahrb. xxiv. 286 (1897).

NIAMNIAMLAND: *Schweinfurth*, 3696 & 3668. CAMEROONS: Barombi, *Preuss* 56. Hb. Berol.

53. **A. Dummeri**, sp. nov.

Arbuscula circ. 30-pedalis ramulis glabris. *Folia* trifoliolata, viridia, foliolis terminalibus rhombeo-ellipticis utrinque præter nervos glabris nervis lateralibus 10–12 margine grosse et remote serratis, apice acuminatis, 15–18 cm. longis, 6–7·5 cm. latis, lateralibus parum minoribus 14–15 cm. longis, petiolo 9–13 cm. longo prædita. *Inflorescentia* 6–8 cm. longa. *Thyrsi* ramosi sursum floriferi deorsum nudi foliis breviores, rhachi pubescente. *Flores* lactei, majusculi, pedicellis pubescentibus. *Sepala* obtusa pilis sparse obtecta. *Fructus* ignotus.

UGANDA: Kivuvu, *Dummer* 552! Hb. Mus. Brit.

Small tree 30 ft. Flowers creamy, arranged in few flowered cymules. Noticeable on account of the nearly glabrous, papyraceous, rhombeo-elliptical leaves and branching thyrse, which altogether measures 8–12 cm. and is about the same length as the petioles or slightly longer.

54. A. KIWUENSIS Gilg in Deutschen Zentral-Afr. Exped. ii. 477 (1911).

LAKE REGION: Lake Kiwu, *Mildbraed* 1194. Hb. Berol.

55. A. MAWAMBENSIS Gilg, l. c. 475 (1911).

CONGO: Ituri, *Mildbraed* 3046. Hb. Berol.

56. A. SCHIRENSIS Gilg in Engl. Jahrb. xxiv. 289 (1897).

KILIMANJARO: *Volkens* 1937. Hb. Berol.

57. **A. crebriflorus**, sp. nov.

Arbuscula ± 20-pedalis. *Rami* fere glabri. *Folia* trifoliolata, foliolis intermediis cuneato-ovatis vel cuneato-oblongo-oblanceolatis demum præter nervos glabris apicem versus attenuatis, apice ipso obtusis, sparse serratis, 11–14 cm. longis, 5–6 cm. latis, foliolis lateralibus parum minoribus, petiolo communi 6–8 cm. longo prædita. *Thyrsi* ramosi, densiflori, folia breviores petiolos longiores, rhachi pilosa. *Flores* brunneo-virides, mediocres, pedicellati. *Fructus* parviusculus, subglobosus ± 3 mm. diam.

UGANDA: Kipayo Forest, small tree—20 ft. *Dummer* 680! Hb. Mus. Brit.

A small tree with intensely green trifoliolate leaves, somewhat serrate at the margins, and a very densely flowered branched thyrse shorter than the leaves. The fruits are small and subglobose.

58. A. ZENKERI Gilg ex Radlk. in Sitz. Bayer. Akad. l. c. 224 (1909).

CAMEROONS: *Zenker* 3134! 3303! 3633! Hbb. Berol. Mus. Brit.

59. A. LONGIPETIOLATUS Gilg. in Engler Jahrb. xxiv. 236 (1897).

MONBUTTULAND: *Schweinfurth* 3523! CAMEROONS: Bipinde, *Zenker* 4051. Hb. Berol. Yaunde, *Bates* 878! Hb. Mus. Brit.

60. A. TRISTIS Radlk. in Sitz. Bayer. Akad. l. c. 225 (1909). *Schmidelia rubifolia* Baker in Fl. Trop. Afr. i. 423. Quoad stirp. zambesiaca.

ZAMBESI: *Kirk*! Hb. Kew.; *Stuhlmann* 668 & 670. Hb. Berol.

61. A. PSEUDO-PANICULATUS Bak. fil. in Journ. Linn. Soc. xxvii. 137 (1905).

UGANDA: near R. Rufua, *Bagshawe* 544! Hb. Mus. Brit.

62. **A. Kassneri**, sp. nov.

Ramuli novelli fusco-velutini. *Folia* trifoliolata, chartacea, foliolis ovatis vel obovatis apice acutis vel subobtusis supra glabris subtus pubescentibus terminalibus basi cuneatis 7–10 cm. longis, 5–6 cm. latis, longiuscule petiolulatis (8–10 mm.) foliolis lateralibus paullo minoribus. *Petiolus* communis 2–3 cm. longus, fusco-tomentosus. *Thyrsi* inferne nudi in toto 5 cm. longi foliis brevioribus sursum ramos paucos emittentes, rhachi fusco-tomentosa, subdensi. *Flores* mediocres in cymulas paucifloras dispositi. *Sepala* membranacea, concava. *Fructus* ignotus.

CONGO: Lufonzo, *Kässner* 2849! Hb. Mus. Brit.

Branches covered with a velvety tomentum; leaves chartaceous, glabrous above, pubescent below; thyrse branched, shorter than the leaves.

63. A. CHIRINDENSIS Bak. fil. in Journ. Linn. Soc. xl. 48 (1911).

CHIRINDA: *Swynnerton* 112! Hb. Mus. Brit.

64. A. AFRICANUS Radlk. in Engl. & Prantl. iii. 5. 313 (1895). *Schmidelia africana* Pal. Beauv. Fl. Owar, ii. 54, t. 107 (1807); *S. affinis* Guill. Perr. Fl. Seneg. Tent. 121 (1830–33).

Widely distributed. Radlkofer retains the following forms:—

Forma GENUINA Radlk. Foliola glabriuscula.

Forma SUBVELUTINUS Radlk. Foliola subvelutina.

Forma CHRYSOTHRIX Radlk. Petioli ramulique pilis flavidis induti.

Forma TIMBOENSIS (*A. timboensis* Hua). Foliola intermedia vix serrata.

Forma SENEGALENSIS Radlk. Foliola in axillis nervorum barbata.

Many plants have been wrongly distributed as this speeies.

65. **A. brachycalyx**, sp. nov.

Frutex ramis glabris ramulis pilis vestitis. *Folia* trifoliolata papyracea petiolata, foliolis parviusculis terminalibus ovalibus in petiolulum brevissimum cuneato-angustatis, in siccitate triste viridia, 5–6 cm. longis, 2·5–3·0 cm. latis, in parte superiore inæqualiter serratis, lateralibus minoribus 3–3·5 cm. longis, petiolo communi pilosulo 15–20 mm. longo prædita. *Flores* parvi, albi, in cymulas paucifloras dispositi. *Thyrsi* ramosi, 5–8 cm. longi, ramis gracilibus multifloris, pedunculis ramisque pilosulis. *Calyx* 1–1·5 mm. longus, pilis adspersus. *Fructus* ignotus.

UGANDA: Forest near Mizizi, Lake Albert, alt. 2300 ft., *A. Bagshawe* 1325! Hb. Mus. Brit.

Allied to *A. tristis* Radlk. but with a distinctly branched thyrse and small flowers.

66. **A. Holubii**, sp. nov.

Ramuli tomento brevi cinereo obtecti. *Folia* parviuscula, herbacea, trifoliolata, foliolis internodiis margine serratis apice acutis vel obtusis subtus tomento brevi obtectis, 4–5 cm. longis, 25–28 mm. latis, petiolulis ± 2 mm. longis præditis, foliolis lateralibus parum inæquilateralibus 35–40 mm. longis, 16–21 mm. latis, petiolo communi 18–22 mm. longo suffulta. *Thyrsi* ramos 1–2 emittentes folio longiores pedunculo 3·5–4·0 cm. longo prædita, rhachi tomentosa. *Flores* mediocres, pedicellis brevibus, in cymulas paucifloras dispositi. *Calyx* glaber. *Fructus* ignotus.

ZAMBESI: Leshumo Valley, *Dr. Holub*! Hb. Kew. On termite heaps.

Allied to *A. stachyanthus* Radlk. Noticeable on account of the small serrate tomentose leaflets and branched densely-flowered thyrse about twice as long as the leaves.

67. A. STACHYANTHUS Gilg. in Engl. Jahrb. xxiv. 292 (1897).

KILIMANJARO REGION: *Volkens* 618, 495; Teita, *Johnston.* Hb. Kew. UKAMBANI: *Scheffler* 114! Hb. Kew. LAKE REGION: Bukome, *Stuhlmann* 3460. Hb. Berol.

68. A. GRISEO-TOMENTOSUS Gilg. in Engl. Jahrb. xxiv. 290 (1897).

A. usambaricus Gilg. in Herb. Berol.

EAST AFRICA & NYASALAND. Widely spread.

69. A. FULVO-TOMENTOSUS Gilg in Engl. Jahrb. xxiv. 293 (1897).

LAKE REGION: Nr. Utundua, *Stuhlmann* 3474. Hb. Berol. Lake Kiwu, *Mildbraed* 1146. S.W. Uganda: Kagehi, *Mildbraed.* Hb. Berol.

70. **A. cataractarum**, sp. nov.

Rami cortice cinereo tecti, novelli flavescenti-tomentosi. *Folia* trifoliolata, foliolis oblongo-ovatis vel obovatis primum tomentosis apice acutis vel subobtusis margine remote serratis intermediis 5–7 cm. longis, 3–4 cm. latis, petiolo communi 15–20 mm. longo prædita. *Thyrsi* ramosi, longi, flexuosi, folio perspicue longiores, rhachi tomentosa. *Flores* numerosi parvi in cymulas plurifloras dispositi. *Calyx* glaber. *Fructus* ignotus.

Rhodesia: Victoria Falls, *Rogers* 5538! Hb. Mus. Brit.

Allied to *A. stachyanthus* Gilg, but both the terminal and lateral leaflets are narrower and of a different shape. The flowers are numerous and small in a long slightly branched thyrse. The plant at first is flavescent tomentose.

71. A. calophyllus Gilg in Engl. Jahrb. xxiv. 291 (1897).
East Africa: Useri, *Volkens* 1973. Hb. Berol.

72. A. melanocarpus Radlk. in Engl. & Prantl, iii. 5 (1895). *Schmidelia melanocarpa* Arn. in Hook. Journ. Bot. iii. (1841) 152. *S. Rehmanniana* Szysyl. Enum. Polypet. Rehmann, ii. (1888) 47.

Natal: many collectors.

Radlkofer does not separate *S. leucocarpa* from this. A form with very long inflorescence was gathered in the Makwongwa Forest, Barberton, Transvaal, by Galpin (909).

73. A. erosus Radlk. in Engl. & Prantl, l. c. (1895). *Schmidelia erosa* Arn. in Hook. Journ. Bot. iii. 152 (1841). *S. natalensis* Sonder in Harvey & Sonder, Fl. Cap. i. 239 (1859–60). *Rhus erosa* Drège ex Presl, Bot. Bemerk. 41 (1844).

Natal: many collectors. Durban, *Rehmann* 9040! 9042! Hb. Kew. East London: *Galpin* 1848! Hb. Kew.

Species exclusa.

Schmidelia thyrsoides Baker=*Aphania senegalensis* Radlk.

NORFOLK NOTES.

By C. E. Salmon, F.L.S.

In 1915, Mr. J. W. White and I spent the last week in June and the first in July botanizing in East Norfolk, dividing our time between the coast village of Hemsby and the delightful hamlet of Ranworth.

Owing to the War and consequent military activity upon the eastern coasts, it was not easy to allay suspicions whilst botanizing, and upon one occasion near Winterton we were closely questioned and the contents of our vasculums were examined. Fortunately these showed that we were not in the habit of fraternising with aliens! It was a happy coincidence, too, that our maps had just been stowed away safely in inner pockets and that the awkward bulge in my venturesome companion's coat—denoting a camera—did not attract attention.

Plants that appear to be additions to Norfolk are distinguished by an asterisk.

Flora=W. A. Nicholson, *Flora of Norfolk*, 1914.

Fumaria Boræi Jord. Ormesby St. Michael, scarce; in greater quantity by Roadside between Caister and Hemsby: the latter was reported upon by Mr. Pugsley as "a lax pale-flowered form." The one locality mentioned in *Flora* is in W. Norfolk, but Mr. Druce has found the plant at "Ormsby" (Journ. Bot. 1912, Supp. 1, 28) (E. Norfolk), which *may* be the first locality given; there are, however, three or four "Ormesbys" in E. Norfolk distinguished by various suffixes.—**F. Bastardi* Bor. Roadside hedge-bank, Ranworth. New to v.c. 27.—*F. officinalis* L. forma **scandens* Pugsl. Cultivated ground, Ranworth. A glorious sight, festooning a row of peas with its long racemes of flowers and clambering over them to a height of six feet.

Nasturtium officinale Br. var. **siifolium* Reichenb. Dike near Horning; particularly well marked in ditch by lane side near Shallam Dike, Thurne.—*Sisymbrium officinale* Scop. var. *leiocarpum* DC. Woodbastwick; near Horning; here and there about Ranworth; Thurne; near South Walsham; Cargate Green; in plenty at Scratby.—*Thlaspi arvense* L. Near Horning.

Polygala serpyllacea Weihe. Ormesby Common.

Cerastium tetrandrum Curt. Coast north of Winterton.

Geranium striatum L. Firmly established by the roadside for 50 yards or so between South Walsham and Upton; a beautiful sight.—*G. molle* L. var. **grandiflorum* Lange. On a roadside bank at Ranworth plants with flowers 11–12 mm. in diameter were noted which may presumably be placed under this variety.

Rhamnus Frangula L. Near Ranworth Dike.

Trifolium medium L. Hedgebank, Cargate Green.—*Vicia tetrasperma* Moench. Roadside between Ranworth and Cockshoot Broad.

Agrimonia odorata Mill. A fine clump, six feet high, by the roadside between Cargate Green and Pilson Green. Not yet in flower but unmistakeable.

Sedum rupestre L. var. **minus* Syme. Quite extraordinarily abundant and a feature of the vegetation by the roadside between South Walsham and Upton. Named by J. W. W., who is very familiar with the plant at Bristol.

Callitriche obtusangula Le Gall. Dike, Flegg Burgh Common. Only two stations in *Flora*.

Sium latifolium L. Near Upton Broad.—*Peucedanum palustre* Moench. By Upton, Rollesby and Martham Broads; Shallam Dike, Thurne.

Sambucus Ebulus L. Between South Walsham and Upton.

Valeriana Mikanii Syme. Near Upton Broad and near Horning Ferry. Only two localities in *Flora*.

Carduus tenuiflorus Curt. Near Horning.—*Crepis virens* L. var. **agrestis* W. & K. Roadsides at Woodbastwick.

Scrophularia aquatica L. var. **appendiculata* Mérat. About Upton Broad.—*Veronica Beccabunga* L. var. *limosa* Lej. Between Horning and Horning Ferry.

**Symphytum peregrinum* Ledeb. Near Upton Broad.

Glaux maritima L. Inland near Martham Broad.

Rumex pulcher L. South Walsham.

Mercurialis annua L. Near Horning.

Potamogeton zosterifolius Schum. Dykes, Ranworth and near Fleet Dike, near South Walsham Broad.—*P. Friesii* Rupr. Upton Broad.

Scirpus Tabernaemontani Gmel. Near Martham Broad.

Carex disticha Huds. Near Burnt-fen Broad and between Horning and the Ferry.—*C. teretiuscula* Good. Abundant between Horning and the Ferry, the same district yielding *C. paradoxa* Willd.—*C. paniculata* L. forma **simplicior* And. Near Ranworth Dike.—*C. curta* Good. Near Burnt-fen Broad. A scarce plant over the whole county.—*C. panicea* L. var. **tumidula* Laestad. By Rollesby Broad near Ormesby St. Michael.—*C. flava* L. var. *lepidocarpa* Tausch. Flegg Burgh Common and near Upton Broad.—*C. Œderi* Retz. var. *cyperoides* Marss. Flegg Burgh Common; marsh near Martham Broad; near Ranworth Dike. A very distinct Sedge.

Calamagrostis lanceolata Roth var. *pallida* Lange. See Journ. Bot. 1917, 254.

Ammophila baltica Link. This we found in one or two fresh stations some miles away from its well-known Caister locality, occurring south of Hemsby north of Winterton as well as between these two places. It grows intermingled with *A. arenaria*, as it does at Caister, but it may be recognised, even at a distance, by its long tapering panicle *invariably* tinged with purple. At a closer view the more lanceolate glumes also readily distinguish it. The former more obvious character, which was borne out in some hundreds of examples examined, I do not see mentioned in Babington, Hooker, Hayward, etc.

It is suggested that *A. baltica* is the result of the crossing of *A. arenaria* with *Calamagrostis epigeios*, but the latter plant does not grow anywhere in the immediate neighbourhood and, as far as the Norfolk stations are concerned, there is nothing to support this theory.

Mr. A. Craig-Christie has an interesting note upon *A. baltica* in this Journal for 1908, p. 300, his observations bearing upon the Ross Links (Northumberland) plant, and I thoroughly agree with his view that it is a good species allied to, but well separated from, *A. arenaria* and not a hybrid. On the Continent, however, where the plant is no doubt more widely distributed than in Britain, the consensus of opinion is seemingly in favour of its hybrid origin, Lange (Danske Fl. 68, 1886) being one of the few who treat it as a good species. Marsson (Fl. Neu-Vorpomm. 563, 1869) goes so far as to divide the "hybrid" into *a. subarenaria* (=*A. baltica* Link etc.) and *β. subepigeios*, an arrangement followed by Ascherson and Graebner (Syn. Mittel. Fl. ii. 222, 1899) and others.

**Glyceria declinata* Bréb. Flegg Burgh Common. New to Norfolk.—*Festuca Myurus* L. Wall at Hemsby.—*F. oraria* Dum. Abundant on the sandhills at Hemsby.

Osmunda regalis L. Near Filby Broad.

Chara connivens Braun. Found in Martham Broad, apparently a new station, the second in the county, for this pretty little Chara.—*C. polyacantha* Braun. Martham Broad.—*C. hispida* L. Upton Broad.

NOTES ON RADNORSHIRE HEPATICS.

By William Henry Pearson, A.L.S.

To judge by the meagre list of hepatics recorded for Radnor VI. 43 in the *Census Catalogue of British Hepatics* compiled by Mr. William Ingham (1913), few counties have been less explored for hepatics, so I was glad to examine a collection made last April at Aberedw by Mr. Harry Bendorf of Manchester, whom I have interested in the study of these plants.

In the *Census Catalogue* only 19 species are recorded; I have been able to identify 43 in Mr. Bendorf's collection, which he informs me was made within a radius of two miles from Aberedw. I have no doubt a further exploration of other parts of the county would very much increase the number enumerated, especially if the more alpine parts of the county were searched—Radnor Forest attains the height of about 2000 ft.

Amongst the most interesting of the discoveries is *Lejeunea cavifolia* (Ehrh.) var. *heterophylla* Carr. As Macvicar remarks (Handb. Brit. Hep. p. 419) this is a distinct-looking plant; the somewhat distant leaves, with lobule minute or obsolete distinguish it at once from the type; although there were plenty of perianths on the plants I was not able to find a single stem with the short male branches which are to be found on the monoicous type. Should this prove to be dioicous I should have no hesitation in considering it a distinct species, *Lejeunea heterophylla* (Carr.) Pears. MS. This name may perhaps be criticized by Prof. Stephani.

In Journ. Bot. 1894 (p. 328) I described a species, *Frullania microphylla*, which had up to then been considered a variety of *F. Tamarisci* (*F. Tamarisci* var. *microphylla* Gottsche). Stephani (Sp. Hepat. 568) lists it as *Frullania microphylla* Gottsche, and adds a footnote, "The plant is correctly published by Gottsche, since it was distributed in G. & R. Hep. Ex., the name Pearson as author (who first described the plant) is therefore not admissible." In my Hep. Brit. Isles I described it as *F. microphylla* (Gottsche) Pearson, which I think is correct.

Lophocolea spicata Tayl. is another interesting record for the county. I am sorry this characteristic name has been supplanted by that of *L. fragrans* Moris & De Not., on the authority of Schiffner & Mueller; Stephani, who draws up his description of *L. fragrans* from the actual plant, holds that they are distinct, and I agree with him. *L. spicata* has not the fragrant smell which distinguishes the genus. It is one of our rarest species, having a very limited distribution. For a long time it was only known from the south of Ireland, afterwards it was found in Cornwall and Wales very sparingly, and later by Mr. Macvicar in Scotland; it has been recorded from the Channel Islands and north of France. Many years ago, when the only known stations for this rare hepatic were the south of Ireland and Cornwall, the late George Stabler sent me a specimen from Wilson, labelled "near Conway." I made several visits to Conway and searched the likely glens about there in vain: later I found that Wilson had collected plants at Trefriw, a matter of 10 miles away from Conway. I took the first opportunity I had of visiting that delightful spot, and to my joy I met with the plant in quantity on the rocks near the Falls. Wilson had the reputation of being very reticent as to the definite locality of the rare plants he collected, and when he noted on his specimen "near Conway"—a station ten miles away—I felt he had left open a wide field for search.

Marchesinia Mackaii (Hook) Gray, is also a good find and would indicate that other species usually peculiar to the limestone would be found, if looked for.

Riccia Crozalsii Levier is the rarest of the species collected.

Cat. stands for the *Census Catalogue* and *H. B.* for Harry Bendorf: the species marked with an asterisk are new records.

Riccia glauca L., Cat.; **R. Crozalsii* Levier, *H. B.*; **R. sorocarpa* Bisch., *H. B.*

Targionia hypophylla L., Cat.

Reboulia hemisphærica (L.) Raddi, Cat.

**Conocephalum conicum* (L.) Dum., in fruit, *H. B.*

**Preissia quadrata* (Scop.) Nees, *H. B.*

Metzgeria furcata (L.) Dum. Cat., *H. B.*; **M. conjugata* Lindb., *H. B.*

**Pellia epiphylla* (L.) Corda, *H. B.*

**Fossombronia pusilla* (L.) Dum., *H. B.*

**Marsupella Funckii* (Web. & Mohr) Dum., *H. B.*

* *Alicularia scalaris* (Schrad.) Corda, *H. B.*

**Aplozia gracillima* (Sm.) Dum., *H. B.*; **A. riparia* (Tayl.) Dum. *H. B.*; *A. pumila* (With.) Dum., *H. B.*

**Gymnocolea inflata* (Huds.) Dum., *H. B.*

**Lophozia ventricosa* (Dicks.) Dum., *H. B.*; **L. alpestris* (Schleich.) Evans, *H. B.*; *L. incisa* (Schrad.) Dum., Cat.

**Plagiochila asplenioides* (L.) Dum. var. *minor* Lindenb., *H. B.*; **P. punctata* Tayl., *H. B.*

Lophocolea bidentata (L.) Dum. Cat. *H. B.*; **L. cuspidata* Limpr., *H. B.*; **L. spicata* Tayl., *H. B.*

Saccogyna viticulosa (Sm.) Dum. Cat., *H. B.*

Cephalozia bicuspidata (L.) Dum. Cat., *H. B.*; *C. connivens* (Dicks.) Lindb., Cat.; **C. media* Lindb., *H. B.*; *C. fluitans* (Nees) Spruce, Cat.

Cephaloziella byssacea (Roth.) Warnst. Cat., *H. B.*

**Calypogeia Trichomanis* (L.) Corda, *H. B.*; *C. fissa* (L.) Raddi Cat.; **C. arguta* Nees & Mont., *H. B.*

**Bazzania trilobata* (L.) Gray, *H. B.*

**Lepidozia reptans* (L.) Dum., *H. B.*; *L. setacea* (Web.) Mitt. Cat.

**Blepharostoma trichophyllum* (L.) Dum., *H. B.*

**Ptilidium ciliare* (L.) Hampe, *H. B.*

**Diplophyllum albicans* (L.) Dum., *H. B.*

* *Scapania compacta* (Roth.) Dum., *H. B.*; *S. subalpina* (Nees) Dum. Cat.; **S. gracilis* (Lindb.) Kaal., *H. B.*; *S. dentata* Dum. Cat., *H. B.*; *S. irrigua* (Nees) Dum. Cat.; **S. curta* (Mart.) Dum., *H. B.*

**Madotheca lævigata* (Schrad.) Dum., *H. B.*; **M. rivularis* Nees, *H. B.*

Lejeunea cavifolia (Ehrh.) Lindb. Cat., *H. B.*; **L. cavifolia* (Ehrh.) var. *heterophylla* Carr., *H. B.*

**Marchesina Mackaii* (Hook.) Gray, *H. B.*

Frullania germana Tayl. Cat.; **F. Tamarisci* (L.) Dum., *H. B.*; *F. fragilifolia* Tayl. Cat.

A set of Mr. Bendorf's specimens has been deposited in the Manchester Museum.

HABITATS OF HYPERICUM HUMIFUSUM.

By H. Stuart Thompson, F.L.S.

Bentham stated in his *Handbook of the British Flora* that this plant grows "In stony heaths, pastures and bogs, fields and waste places"—a comprehensive group; Hooker, in *The Student's Flora*, said "Roadsides, commons, etc.; ascends to 1100 ft. in Yorkshire"; Babington, often more accurate than either of these greater botanists in his first-hand knowledge of British plants, gave "Gravelly and heathy places." Mr. J. W. White, whose notes on habitats and similar matters in the *Flora of Bristol* are the most carefully compiled of any "Flora" known to me, gives "Native; on commons and in open woodland. Frequent, but very thinly distributed. There are seldom more than one or two plants at a place."

Until last year, when my work took me daily into the woods of N. Somerset, I had been much struck, especially about Blackdown, Mendip, by the truth of Mr. White's remarks on this pretty little St. John's Wort in the large area treated. But last summer and autumn I found the plant in Somerset on various occasions in considerable quantity on "rides" in woodlands, and especially on "rides" and green paths in larch and mixed woods, such as at Wrington Warren (larch 30 years old), Court Hill (Clevedon), King Wood above Cleeve, Tyntesfield Plantation, and to a less extent in Leigh Woods.

Just as the recently discovered and rapidly extending *Juncus tenuis* keeps rigidly and uniformly to the rides and paths in Leigh Woods, so does *H. humifusum*, as far as my observation goes, rarely stray far from the paths in any of the above woodlands. In like manner *Erodium maritimum*, when growing inland in N. Somerset, frequents either the bare limestone rock, as at Goblin Combe, or the short grassy paths on hills, as above Axbridge, Rowberrow and Wrington, and much used "rides" in limestone woods such as those above Clevedon Court and Tyntesfield. It actually grows on the modern brick paving outside the engine-house and saw-mill at Tyntesfield.

It is interesting to note that whereas all the above-mentioned woods are upon Carboniferous Limestone*, Coste says of *H. humifusum* in France "Champs et coteaux sablonneux des terrains siliceux dans presque toute la France; rare dans le Midi." Joseph Woods in his *Tourist's Flora* also gives merely "Gravel and sand." Taking

* Though not always of the same Carboniferous Limestone Series; and parts of certain of these woodlands are on other formations.

Britain as a whole, I believe this species is more often seen on sandy or red gravelly soil than on limestone, but evidently it likes the close turf though sometimes sandy soil of the rides in woods on limestone.

On the Continent, *e. g.* in Switzerland and the Jura, it appears that this plant is sometimes found in damper and more cultivated places *e. g.* in arable ground. Two modern authors mention "Fields after the crops, clearings in woods"; and another botanist speaks of "Damp fields, clay soils, cultivated and cleared, clearings in woods, unequally spread" (Godet, *Flore du Jura*, an excellent work).

In conclusion, it seems that a plant one has usually associated with dry hill-sides, sandy commons, and open woods, or road-sides near them, may have its erratic and sparse distribution markedly effected by the agency of man; and Bentham's habitats probably referred to the plant throughout its known geographical range, and not only to that in the British Isles. Such, indeed, was apparently the case in regard to all the plants in the *Handbook*, a point worth drawing attention to, and not hitherto properly appreciated by myself.

SHORT NOTES.

Female Flowers in Plantago lanceolata. Some interesting observations have been made this spring on plants growing wild in Kew Gardens, and the following seem worth recording:—Plants of *Plantago lanceolata* are common in the grounds round the Herbarium; and amongst grass which has not yet (May 28) been cut, several have been observed with the stamens in all the flowers reduced in size, the filaments very short, and the anthers producing no fertile pollen. All the spikes on each plant have their flowers in a similar state of functional unisexuality through reduction of the stamens. The flowers, like those of a normal *Plantago*, are protogynous, the styles and stigmas of the lower flowers being the first to appear. When these have become brown and shrivelled the yellowish-green (not cream-coloured or very pale yellow) sterile anthers appear, but since they have extremely short filaments the stamens are not nearly so conspicuous as in normal spikes. The ovaries are fully formed and the ovules are developing into seeds. Growing near the abnormal plants, and subjected to the same external conditions, are some with quite normal flowers and inflorescences. The abnormal nnisexual state must be due to inherent causes affecting the entire plant independently of external conditions, and may be compared with the reduction of the stamens in the small-flowered form of *Glechoma hederacea*. In the *Botanical Bulletin* (afterwards the *Botanical Gazette*), i. 45 (1876), is recorded a plant of *P. lanceolata* which had flowers without a trace of stamens or anthers. The styles and stigmas developed normally at first, but "soon began to bend down so that the stigma entered the tube of the corolla and soon the whole style was coiled up in the corolla tube, remaining there for a day or more in some instances, when it resumed its erect position." Nothing like this has been observed in the Kew specimens, in which the styles drop off when the seeds are partly formed.—W. B. Turrill.

Yew on Oak. On May 31st, I saw in Leigh Woods, near Clifton (N. Somerset), a small shrubby Yew-bush about a foot high growing upon a rather young Oak tree: I do not remember having noticed before a Gymnosperm epiphytic upon an Angiosperm. In Leigh Woods the Yew is doubtless native, as it is in most of the woods on the Carboniferous Limestone of North Somerset, and also on the limestone cliffs and screes at Cheddar, Burrington Combe, Bourton and other combes. The plant now reported grows by a path within half a mile of the rocky ridge where *Polygonatum officinale* and Lilies-of-the-valley grow together—fortunately by no means extinct, as was feared by Syme (Engl. Bot. ed. 3, ix. 180). This year many of the Solomon's-Seal are no taller than the Lilies-of-the-valley, and some are shorter.—H. S. Thompson.

The Brodrick Herbarium (see Journ. Bot. 1904, 295). Through the kindness of Lord Midleton I have recently examined the above at Peper Harow. The collection is bound in the form of a volume with the inscription "Tho. Brodrick 1672" upon the title-page. There are 138 leaves (c. 17″ × 10″) with several plants upon each, British, exotic and garden species being mingled; unfortunately many have been damaged by insects, and not a single plant is either localized or dated. The Latin name of the period—and in these changeful days it is comforting to note that *Mentha cardiaca* of to-day was the identical Mint prescribed for heart affections in Elizabeth's time—and the quaintly expressed English name is appended to each specimen, and there is a full index at the end of the volumes with page references.—C. E. Salmon.

Tolypella glomerata Leonh. in the Isle of Wight. On the 13th May I found this charophyte in fair quantity in some shallow pits near Elmsworth brick-works, just to the east of the mouth of the Newtown River. This is, I think, the first record of a *Tolypella* for the Island.—James Groves.

REVIEWS.

Eléments de Botanique par Ph. Van Tieghem. Cinquième édition. 8vo. Tome I. Botanique Générale, revue et corrigée par J. Costantin, pp. xv, 619, tt. 260. Tome II. Botanique Speciale remaniée et augmentée par J. Costantin, pp. xx, 743, tt. 326. Masson: Paris, 1918. Price 30 fr.

The present edition of the late Prof. Van Tieghem's well-known smaller textbook of Botany follows closely the plan of earlier editions. The editor, Prof. Costantin, does not supply any prefatory note or introduction indicating the changes or additions for which he is responsible, but these do not appear to be extensive and the book remains the expression of Van Tieghem's views as to the presentation of the science and especially on methods of classification.

The first volume deals with morphology, including structure, and physiology. In the first chapter a general account is given of the plant-body in two sections, the first entitled morphology, the second physiology, and a similar plan is adopted in the following chapters dealing in succession with the root, stem, leaf, and flower. While this method has the advantage of correlating structure and function, it leads to a somewhat disjointed study of plant-physiology and involves some repetition. The chapter on the flower is followed by one on "the development of the Phanerogams," in which the development of the ovule, the seed, and the fruit, germination, and the growth of the adult plant from the seedling are considered. The formation of the egg and the life-history of the plant in the Vascular Cryptogams, the Muscineæ and the Thallophytes are studied in the next three chapters. To emphasize the differences in the origin of the "spores" in the several great groups, the term spore is restricted to those which develop to form an individual like that from which they were produced. The spores of Ferns and Mosses are designated respectively, *diodes*, or spores of passage from the asexual to the sexual stage, and *tomies*, as the life-history of the plant is cut into two very unequal parts at the stage of their production. The relation between the Gymnosperms and Vascular Cryptogams is recognised, the pollen-grain being in reality a microdiode and the mother-cell of the female prothallium a macrodiode.

The second volume is a systematic study of the plant-kingdom. Two subkingdoms are recognised, Arhizophytes, including Thallophytes and Muscineæ, and Rhizophytes, including Vascular Cryptogams (Exoprothallées) and Phanerogams (Endoprothallées). The Thallophytes contain two classes, Fungi and Algæ; the Myxomycetes form the first order of the Fungi and the Bacteria are regarded as a family of the Blue-green Algæ. Phanerogams comprise two classes, Astigmatées or Gymnosperms and Stigmatées or Angiosperms. The former has four classes, Pteridosperms, Natrices with motile male cells, including Cycads and *Ginkgo*, Vectrices (Coniferæ), and Saccovulées (ovule enclosed in an ovary which forms a sac with no style)—including *Welwitschia*, *Ephedra*, and *Gnetum*. The Angiosperms have three classes, Monocotyledons, Liorhizal Dicotyledons, and Dicotyledons. The second is a very unnatural group, comprising two orders, Grasses and Nymphæaceæ; the Grasses are regarded as having two cotyledons and the water-lilies are classed with them owing to the similarity of the mode of development of the piliferous layer of the root. The method of the grouping of the families of Dicotyledons is widely different from that of other well-known systems. Special stress is laid on the details of the structure and development of the ovule, which Van Tieghem had studied exhaustively. The resulting system may interest the student as an exercise in taxonomy, but cannot be regarded as an advance towards a natural system or a contribution to the study of phylogeny. A. B. R.

Standard Cyclopedia of Horticulture, Vol. VI. S–Z. with Supplement, pp. 3043–3639, figs. 3516–4056. Edited by L. H. Bailey, 1917.

The present volume is the last of the imposing work edited by L. H. Bailey, the doyen of American scientific horticulturists, who is much to be congratulated on its completion. In the Supplement he makes a characteristic statement:—"To spend five years in a review of the vegetable kingdom, with all its marvels and its unsolved problems, is in itself a great privilege. If in addition one may see the applications to the desire of man, may hold associations with several hundred enthusiastic and competent correspondents, may have relations with the commercial and financial questions involved, and may at the same time catch some glimpse of the reaches of evolution and feel a new contact with the earth, the making of a Cyclopedia of of this kind becomes not a task, but an experience in life . . . . The Editor is well aware of the shortcomings of the volumes and he would like to do the work all over again for the delight of it." With such a spirit as driving-force, the rapidity with which the volumes have followed one another may be understood.

The articles in the present volume and the general and specific descriptions are of the same high quality which has throughout characterized the work. Besides being of a more scientifically exact type than is common in horticultural books, they abound in points which, though referring principally to American horticulture, are very suggestive to British growers. In the six volumes over 3000 genera and 12,000 species have been fully described: more than four hundred collaborators have been employed on the work. There is a "Cultivators' Guide" to the articles, and a very complete index to synonyms, vernacular names and miscellaneous references not in alphabetical order in the body of the work. In the Supplement is a section with the American-sounding title of "Finding List"; this contains the names in common use in North America with their equivalent in the Cyclopedia. Herein is to be found a statement of the American Joint Committee on Horticultural Nomenclature, whose aim has been "so far as is practicable . . . . . to secure the standardizing of a single botanical name, together with a single vernacular or common name for every tree, shrub, and herbaceous plant in the American Horticultural trade." Such a committee is much needed in this country, where we suffer from the confusion and inconvenience resulting from the abuse of different names for the same plant or the same name for different plants. We gather from the article on *Welwitschia* that Dr. Bailey is in favour of long-accepted usage rather than priority as making for stability.

A page is devoted to new combinations made during the progress of the work. These refer principally to varietal names, but the following specific combinations occur:—*Cissus oligocarpa* (Lev. & Van) Bailey; *Helenium aromaticum* (Hook.) Bailey; *Hosta Fortunei* (Baker) Bailey; *H. longipes* (Franch. & Sav.) Bailey; *Lactuca Bourgæi* (Boiss.) N. Taylor; *Lithocarpus densiflora* (Hook. & Arn.) Rehder; *L. cornea* (Lour.) Rehder; *L. glabra* (Thunb.) Rehder; *L. thalassica* (Hance) Rehder; *Maurandia Lophospermum* Bailey; *Rhododendron candidum* (Small) Rehder; *R. lætevirens* Rehder; *R. austrinum* (Small) Rehder. Many new combinations in *Pyrus*, *Prunus*, *Statice* were published in *Rhodora*,

xviii. (1916). No new species are described and very few new varieties.

The whole work is a model of its kind—printing, figures, plates, and get up being worthy of the valuable horticultural and botanical matter contained in the volumes.

J. K. R.

BOOK-NOTES, NEWS, ETC.

At the meeting of the Linnean Society on June 5, Mr. H. N. Dixon gave the following abstract of his paper on Mosses collected on Deception Island, South Shetlands, by Mr. James C. Robins. Deception Island is in lat. 63° S., long. 60° 30′ W., closely adjoining the Antarctic continent (Graham Land). It has been very little visited, and until the present century only two plants—an unnamed moss and a lichen—had been observed. Two mosses were collected there in the second French Antarctic Expedition (1908–10) by MM. Gain and Gourdon. The present collection consists of eight species, one known from most of the colder regions of the world, one hitherto only recorded from the South Orkneys, three of general Antarctic distribution, two hitherto known only from the Antarctic continent, and one new species. The interior of the island is a vast crater, into which the sea has irrupted, and is about 5 miles across. Connected with this is a small lagoon, some 500 yards in diameter; Mr. Robins describes it as giving no bottom at 200 fathoms, and as fed by warm or hot springs from the volcano. The whole crater would seem, in the middle of extreme glacial surroundings, to afford an almost unique example of an isolated biological area, and would appear to deserve a careful survey as regards its fauna and flora, especially in so far as concerns that of the warm springs and the lagoon fed by these.

Sir Frank Crisp, who was born at Bungay, Oct. 25, 1843, died at his residence, Friar Park, Henley-on-Thames, on April 29, where his gardens, and especially his rock garden, were among the most remarkable in the country. From 1881 to 1906 he was Vice-President and Treasurer of the Linnean Society, at whose Annual Meetings his financial statements were looked forward to with interest, on account of the amusing comments with which his figures were interspersed. He was also Hon. Secretary of the Royal Microscopical Society from 1878 to 1889, to whose Journal he contributed papers dealing with practical microscopy.

The *Irish Naturalist* for March contains an interesting paper (with plates) by Dr. George H. Pethybridge on heterocarpy in *Picris hieracioides*.

A Correction.—Mr. Moore calls our attention to a curious error in our review of *The Life and Letters of Sir Joseph Hooker*, where (p. 132, l. 2 from bottom) "Lyell" should be substituted for "Banks." The phrasing of the letter quoted is somewhat obscure, but as Banks died in 1820 he obviously could not have been seen by Hooker in 1836. We may take the opportunity of correcting a mistake in the book itself (ii. 275), where it is stated that "a fourth edition of the *Student's Flora*" appeared in 1897; the last (third) edition appeared in 1884.

THE GENUS FAGARA
AS REPRESENTED IN THE SOUTH AFRICAN HERBARIA.

By Inez C. Verdoorn, Division of Botany, Pretoria.

The genera *Fagara* (Syst. ed. 10, 897; 1759) and *Zanthoxylum* (Hort. Cliff. 487; 1737) were founded by Linnæus, who appears to have used the number of parts in the perianth for separating them: in *Fagara* the flowers are 4-merous, in *Zanthoxylum* 5-merous. Thunberg (Fl. Cap. 141; 1823) followed Linnæus, and when describing the South African species placed them under *Fagara*. DeCandolle (Prodr. i. 725; 1824) sunk *Fagara* under *Zanthoxylum*, which genus he placed in *Rutaceæ*, and in this he was followed by Oliver (Fl. Trop. Afr. i. 304; 1868). Harvey (Fl. Cap. i. 445; 1860) adopted the same view, but placed the genus in *Xanthoxyleæ*, although later (Gen. S. Afr. Pl. ed. 2, 45; 1868) he put it under *Rutaceæ* as a separate tribe. Bentham and Hooker (Gen. Pl. i. 297; 1862) also combined the genera under *Xanthoxylum* in *Rutaceæ*: Engler, however (Engl. & Prantl, Pflanzenfam. iii. 4, 115; 1897), reverted to the two Linnean genera, and this arrangement has been adopted by all subsequent authors.

All the South African species which Wight and Arnott included under the genus *Rhetsa* were placed by Engler (*l. c.*) in the genus *Fagara* under the section *Macqueria*, which is characterized by having 4-merous flowers.

Engler (Bot. Jahrb. xxiii. 149; 1896) describes two species from Pondoland, *F. Bachmannii* and *F. multifoliolata*. I have not seen these, but none of the material which has passed through my hands agrees with the descriptions. The specific name *capensis* will have to stand for the plants called *Xanthoxylon capense* and *Thunbergii* in the *Flora Capensis* as it was the first name used by Thunberg.

In the *Flora Capensis* Harvey divides the South African specimens into two species with a possible third. *Xanthoxylon capense* Harv. is separated from *X. Thunbergii* DC. on the fact that the petioles are unarmed; I have found that this character is not constant. Through the kindness of the Director of the South African Museum, Cape Town, I have had the opportunity of examining Ecklon and Zeyher's specimens quoted by Harvey, which are mounted on sheets written up by Harvey. On the leaves of one of the specimens (*E. & Z.* 921) quoted as *X. capense* there are decided spines. I have noticed on specimens growing in the garden of the Division of Botany, Pretoria, and on many herbarium specimens, that while some of the leaves are armed, others on the same tree are devoid of thorns. Sim points this out on a label attached to one of his specimens; the coppice shoot is armed with numerous spines, of which there is no trace on the older foliage.

Mr. T. R. Sim (*Forests and Flora of Cape Colony*, 155) is of opinion that the species in Fl. Capensis can all be reduced to one variable species, and my examination of the material in the South African herbaria supports this view. Specimens collected from different localities differ in general appearance, but I have not been able to find a constant character on which they can be separated into groups. Two specimens (not in flower) collected by Galpin on the mountain-tops at Queenstown at an altitude of 4700 ft. (*Galpin* 2560 & 2561) differ from the other specimens examined in the leaves being more or less membranous. This however, as pointed out by Mr. Galpin himself, is probably due to the altitude and the fact that the specimens were growing in the shade of rocks and almost prostrate on them. The material of the specimen (*E. & Z.* 923) which Harvey names *Xanthoxylon? alatum* is very poor and leaves one in doubt as to whether it belongs to the genus, especially as *Xanthoxylon* does not appear to be represented in the western parts of the Cape Province.

Key to Species.

Inflorescence bearing male and female flowers... *F. Thorncroftii.*
Inflorescence bearing flowers of one sex only.
  Lateral veins numerous, 20 or more .... *F. Davyi.*
  Lateral veins few, less than ten .... *F. capensis.*

Fagara Thorncroftii, mihi, sp. n. *Ramuli* glabri, spinosis rectis 4–6 mm. longis armatis. *Folia* petiolata, 3–5 cm. longa; petiolus 3–5 mm. longus, canaliculatus, pubescens; foliola sessilia, ·6–3 cm. longa, ·4–2 cm. lata, obliquo-elliptica, aliquando subacuminata, apice retusa, basi rotunda vel paullo angustata, plerumque auriculata, glabra, infra costa conspicua et venis lateribus 3–7, supra distinctus, margine serrato et glandula una in sinu. *Inflorescentia* paniculata, floribus masculinis et femineis; pedunculus pubescens, petiolo longior. *Sepala* 1·5 mm. longa, elliptica, apice obtusa, ciliata. *Petala* 3·5 mm. longa, elliptica, apice obtusa. *Fl.* ♀ staminis rudimentariis. *Ovarium* 3 mm. longum, globosum, obliquum, glanduloso-punctatum, 1-locularia, 2-ovulis; stylus 1 mm. longus, teres; stigma capitatum. *Fl.* ♂ 4-staminis; filamenta linearia, 3 mm. longa; antheræ globosæ. *Ovarium* rudimentarium. *Fructus* ignotus.

Transvaal: Barberton District; Barberton, December, *Thorncroft* in Herb. Transvaal Museum 9616!

Branches glabrous, armed with straight spines 4–6 mm. long; bark dark brown. *Leaves* petioled, 3–5-jugate, 3–5 cm. long; petiole 3–5 mm. long, channelled on the upper surface, pubescent; rachis channelled and slightly pubescent above, usually glabrous beneath; leaflets sessile, ·6–3 cm. long, ·4–2 cm. broad, obliquely elliptic, mostly subacuminate, usually retuse at the apex, rounded or slightly narrowed at the base and usually eared, glabrous, with a prominent mid-rib beneath, distinct above, and 3–7 lateral veins, slightly darker on the upper surface; margins serrated with a single gland at the base of each sinus; terminal leaflet obovate. *Inflorescence* an axillary or terminal panicle bearing male and female flowers; peduncle and branches minutely pubescent and with the peduncle much longer than the petiole of the subtending leaf. *Flowers* unisexual. *Sepals* 1·5 mm. long, elliptic, obtuse, ciliated. *Petals* 3·5 mm. long, elliptic, obtuse. *Stamens* absent or rudimentary in female flowers. *In male flowers* filaments 3 mm. long, linear; anthers globose. *Ovary* rudimentary in male flowers. *In female flowers* 3 mm. long, globose, hardly unequal-sided, uni-locular, 2-ovuled, glandular; style 1 mm. long, terete, stigma capitate. *Fruit* not seen.

Fagara Davyi, mihi, sp. n. *Ramuli* glabri, spinosis curvis armatis. *Folia* petiolata, 8–23 cm. longa; petiolus 1–2 cm. longus, canaliculatus glaber; foliola sessilia, 1–10 cm. longa, ·5–3 cm. lata, lanceolata vel ovato-lanceolata, acuminata, apice obtusa et aliquando retusa, basi angustata inæqualis et auriculata, discolor, glabra, infra costa conspicua et venis lateribus ∞ (plus 20), supra distinctis, margine crenato-serrato et glandula una in sinu. *Inflorescentia* paniculata, 3·5–6 cm. longa, omnibus vel ♂ vel ♀; pedunculus glaber, petiolo brevior. *Sepala* 1 mm. longa, elliptica, apice obtusa, glabra, aliquando ciliata. *Petala* 3–4 mm. longa, oblonga, apice obtusa, glabra. *Fl.* ♂ 4-staminis; filamenta linearia, 2·5 mm. longa, glabra; antheræ globosæ, 1 mm. longæ. *Ovarium* rudimentarium. *Fl.* ♀ staminis 0 vel squamæformis. *Ovarium* 3 mm. longum, subglobosum, distincto-obliquum, glanduloso-punctatum, 1-locularia, 2-ovulis. *Stylus* ·5 mm. longus, teres, curvus; stigma capitatum. *Capsula* rubrafusca, 6 mm. longa, 4 mm. lata, globosa, glandulosa. *Semina* nigra nitidaque.

Xanthoxylon capense Sim, l. c. 155, ex parte; t. xxiv. fig. 5. *X. Thunbergii* DC. var. *grandifolia* Harv. in Fl. Cap. 1, 446.

Transvaal: Zoutpansberg District; Woodbush, *Grenfell* in Colonial Herb. 1094!; near stream Pototato Bush, 4750 ft., *Burtt-Davy* 1166!; *Eastwood* in Col. Herb. 1298!

Swaziland: Forbes's Reef Bush, *Burtt-Davy* 2753!

Zululand: In Woods at Qudeni, 6000 ft., *Davis* 53! *Wood* 7771! *Wylie* in Natal Govt. Herb. 7112!

Transkei: Movenyane Forest, *Kiviet* in Herb. Dept. Forests 2670!

Branches glabrous, armed with slightly upward-curved spines and with dark brown bark. *Leaves* petioled, compound, 4–6-jugate, abruptly or imparipinnate, 8–23 cm. long; petiole 1–2 cm. long, channelled on the upper side, glabrous; leaflets sessile, opposite or alternate, 1–10 cm. long, ·5–3 cm. broad, lanceolate or ovate-lanceolate, acuminate, obtuse, narrowed, unequal and eared at the base, glabrous, dark and shining above, paler beneath, with a prominent mid-rib beneath and numerous (over 20) lateral veins distinct on the upper surface; margins crenately serrated and with a single gland in the sinus. *Inflorescence* a panicle, 3·5–6 cm. long, bearing either all male or all female flowers; the peduncle and branches glabrous with the naked portion of the peduncle shorter than the petiole of the leaf. *Calyx* 4-parted; sepals free, 1 mm. long, elliptic, obtuse, glabrous, sometimes ciliated. *Corolla* 4-parted; petals free, 3–4 mm. long, obtuse, glabrous. *Male* flowers: *Stamens* 4; filaments 2·5 mm. long, linear, glabrous; anthers 1 mm. long, globose. *Ovary* rudimentary. *Female flowers*: *Staminodes* minute. *Ovary* 3 mm. long, subglobose, very distinctly unequal-sided, glandular, unilocular with 2 ovules; style ·5 mm. long, terete, curved; stigma capitate. *Fruit* a reddish-brown capsule, 6 mm. long, 4 mm. in diameter, globose, glandular. *Seeds* black, shiny.

F. CAPENSIS (Thunb. Fl. Cap. 141; 1823). *Branches* glabrous, armed with straight spines 2–10 mm. long; bark dark brown. *Leaves* petioled, 3–9-jugate, 3–7 cm. long; petiole ·5–1·2 cm. long, channelled above, pubescent, rarely glabrous; rachis channelled above; leaflets sessile, ·5–4 cm. long, lanceolate, elliptic or obliquely elliptic, mostly sub-acuminate and retuse at the apex, rounded or slightly narrowed at the base and usually eared, glabrous, with the mid-rib prominent above and distinct beneath and with 3–9 lateral veins, the upper surface slightly darker than the lower; margins serrate or crenately-serrate, with a single gland in each sinus; terminal leaflet mostly obovate and distinctly retuse at the apex. *Inflorescence* an axillary or terminal panicle bearing flowers of one sex only; peduncle and branches minutely pubescent; the naked portion of the peduncle shorter than and occasionally as long as the petiole of the subtending leaf. *Sepals* 1–1·5 mm. long, ovate-elliptic, sometimes ciliate. *Petals* 1·5–2·5 mm. long, elliptic, obtuse. *Stamens* rudimentary in female flowers; filaments of fertile stamens 1·5–3 mm. long, linear; anthers globose. *Ovary* 3 mm. long, globose, sometimes unequal-sided, unilocular, 2-ovuled, glandular; style ·5–1 mm. long, terete; stigma capitate. In male flowers the ovary is rudimentary. *Fruit* a reddish-brown capsule. *Seeds* black, shiny.

Fagara armata Thurnb. Fl. Cap. i. 141.

Xanthoxylon capense Harv. in Fl. Cap. i. 446; Sim, l. c. ex parte, t. xxiv. excl. fig. 5; and in Forest Fl. Portuguese E. Afr. 23, 115, t. xvii.

Zanthoxylum Thunbergii DC. Prodr. i. 726; Harv. l. c. excl. var. *grandifolia*.

COAST REGION: Uitenhage Div.; Winterkoeksberg, *E. & Z.* 922! 921!; in forests of Adow, *E. & Z.* 300!—George Div.; *E. & Z.* 921!—Port Elizabeth Div.; van Stadens, *Paterson* 740!—Emeral Hill, Walmer Estate, *Paterson* 740! Albany Div.; Grahamstown, *MacOwan* 916; *E. & Z.* 921!—Bathurst Div.; Port Alfred, *Tyson* in Govt. Herb. 12655! in Herb. Transvaal Mus. 17116; in Herb. Bolus; *Burtt-Davy* 7934! *Salisbury* in Herb. Albany Mus. 5! in Herb. Mus. Austro-Afric. 8207!—East London Div.; East London Park, *Wood* in Herb. Galpin 3130!—King Wm. Town Div.; Tamacha, *Sim* in Herb. Galpin!

CENTRAL REGION: Somerset East Div.; Boschberg, 2200 ft., *MacOwan* 916!—Bedford Div.; Bedford, *Weale* in Herb. Albany Mus.!—Queenstown Div.; Queenstown, mountain tops among rocks, 4700 ft., *Galpin* 2560! 2561!

EASTERN REGION: Komgha Div.; Woods near Komgha, 2000 ft. *Flanagan* 494! *Schlechter* 6161!—Kentani Div.; a forest tree 15–20 ft. high, Kentani, Transkei, 1000 ft., *Pegler* 802! *Doran* in Herb. Dept. Forests 2183! Natal: *Cooper* 1153! *Zeyher*;

KALAHARI REGION: Witwatersrand Div.; Jeppestown Ridge near Johannesburg, 6000 ft. *Gilfillan* 871! and in Herb. Galpin 6092!—Pretoria Div.; Mentjes Kop, Pretoria, *Burtt-Davy* 2452! 535! Pretoria, *Collins* in Herb. Transv. Mus. 6838! *Leendertz* 470! and in Herb. Transv. Mus. 3202. Muchleneuk, *Stent* in Govt. Herb. 15107. Daspoort, *Mundy* in Col. Herb. 4094! Groenkloof, *Robertson* in Herb. Dep. Forests, 1489! Onderstepoort, *Mogg* in Govt. Herb. 15671!—Rustenburg Div.; Rustenburg, *Collins* in Herb. Transv. Mus. 6995!—Heidelberg Div.; Schoongezicht, 5000 ft., *Burtt-Davy* 17112!—Waterberg Div.; Warmbaths, *Leendertz* in Herb. Transv. Mus. 7592!—Potchefstroom Div.; in shade of cabbage palms on mountain, Klerksdorp, *Nelson* 312! and in Herb. Transv. Mus. 11769!—Lydenberg Div.; Sterk Hill, June, *Burtt-Davy*, 454!—Zoutpansberg Div.; Pietersberg, *Rogers*, 14141! and in Herb. Transv. Mus. 15486!

RHODESIA: Bulawayo, *Zeally* 52!—Melsetter Div.; Victoria, *Munro* 791;

Sim (*l. c.*) writes: "A most variable species in regard to the size of the tree, the size of the leaves, the size number and cutting of the leaflets, and the size and laxity of the panicles, all these characters varying with age and surroundings. In dense high forest it forms a fine umbrageous tree with large leaves, large open panicles, and stems set with the very remarkable knots from which the vernacular names [knobwood, &c.] are derived; these sometimes measure 3 inches long and $1\frac{1}{2}$ inches diam., with an abrupt point. In scrub, the stems, petioles, and nerves are sometimes very prickly, and sometimes devoid of prickles, and the panicles much reduced, while on the coast more succulent and less prickly foliage prevails."

F. capense is reserved in each conservancy. It flowers in early summer, fruits ripen in autumn, about 20,000 clean seeds weighing a pound. Pappe (Fl. Cap. Med. Prodr. 6) calls the fruit "Wild Cardamom," which he states, on account of its aromatic qualities, is prescribed for flatulency and paralysis." Smith states that a decoction of the root is used for snake bite; that the inner bark pounded into paste is applied to an aching tooth, takes away all pain, and that the leaves are used for disinfecting *Miltziek* meat. The Conservator of Forests, Midland Conservancy, Knysna, in a letter to the Chief Conservator of Forests states that *F. capense* and *F. Thunbergii* occur very sparingly in the conservancy. Of the timber of *F. capense* when worked into yokes and axe-handles woodcutters speak well, and it makes an excellent pick-handle. In the Zitzkamer I saw a bowl of a pipe made of one of the conical protuberances which stud the bark. Woodcutters do not regard the timber of *F. Thunbergii* highly; they say it lacks durability and seldom use it. The Conservator, Maritzburg, writes:—"As far as Natal is concerned, I think there is only one species. Specimens examined by me show that older leaves are without prickles, while young trees and coppice shoots show the rhachis to be armed. In the neighbourhood of Paulpietersberg, *Xanthoxylon* is frequently found as isolated shrubby growth amongst rocks of dolerite. The tree or shrub is represented all over Natal but is nowhere very abundant." Forest Guard Kiviet states that natives use the bark as medicine for horses and cattle when affected with gall-sickness.

MYCOLOGICAL NOTES.—IV.

By W. B. Grove, M.A.

I. Phyllosticta and Phleospora.

The species assigned to the form-genus of the Cœlomycetes named *Phleospora* have long afforded a curious ground of controversy, the point in dispute being whether there is a true pycnidium or not. Both sides of the dispute have been hotly maintained: Klebahn says that *Phleospora Ulmi* has no pycnidium, and therefore he places it in *Septoglœum*. As in most controversies both sides are right: the shield is golden on one side, silvern on the other. The fact is that the answer at which one arrives in considering this question depends upon the state of development of the fungus under examination. In the early stages of growth, some at least of the species of *Phleospora* have a pycnidium, in the latter stages it may be nearly or completely wanting. But this is not all; the spores produced by the same hymenium may change in character also in a remarkable way. The same little black dot on a leaf, *obiter visum*, would be placed, according to its age at the moment of observation, in *Phyllosticta*, or in *Phleospora*, or in *Septoglœum*, or even in *Leptothyrium* or *Septoria*.

The differences between the first two form-genera appear very considerable. In *Phyllosticta* there is a complete, thin, all-round pycnidium, formed of delicate closely interwoven (plectenchymatous) hyphæ, at the summit furnished with a small round pore about which the cells are often darker in colour, while the spores are unicellular, oval-oblong, usually small, and most often provided with two polar oil-guttules: in *Phleospora* the spores are elongated and vermiform, often pluriguttulate, occasionally 1- or 3-septate, and the pycnidium in its finished state is merely a shallow cup with a wide opening, edged by a narrow margin. Yet the former can change by degrees into the latter, and finally, if all trace of the pycnidium had vanished, it would undoubtedly be considered a *Septoglœum*.

Specimens of *Phleospora Oxyacanthæ* Wallr. when closely examined show, intimately mixed among pycnidia which accord with the description of that species, others belonging to *Phyllosticta*, and in fact indistinguishable from *Phyllosticta monogyna* Allesch. except in having slightly smaller spores. The appearances are exactly what would be seen if the same pycnidium, which at first when small produced the *Phyllosticta*-spores, afterwards from the same proliferous stratum (enlarged) began to produce the *Phleospora*-spores, which then by their size and abundance burst the pycnidium open and finally left it cup-shaped. The loose cellular structure of the wall is of identically the same character in both; two pycnidia, one of each kind, can be found in close contact, and all the steps between can be traced in the sections.

Moreover, the spores of the *Phyllosticta*-stage vary continuously in size. Allescher gives the size of the spores in his *P. monogyna* as $6–8 \times 2\frac{1}{2}\,\mu$; in my specimens most of the spores measured $4–6 \times 1–1\frac{1}{2}\,\mu$. It may therefore easily be surmised that *Phyllosticta cratægicola* Sacc. (Syll. iii. 6) is nothing but a still earlier state, in which the spores are smaller ($2\frac{1}{2}-3 \times 1-1\frac{1}{2}\ \mu$). A great deal of the confusion which exists in the synonymy of the Cœlomycetes is due to the failure to recognize the fact (easily demonstrated on hundreds of species) that the spores may gradually increase in size, as well as alter in colour and complexity, as the fungus advances in age. Thus all *Diplodia*-spores pass through the states of being (1) hyaline and continuous, (2) pale-brown and continuous, and (3) darker brown and septate, sometimes also increasing in size *pari passu* as they change in form and colour. In the first state they have been called *Macrophoma*, in the second *Sphæropsis*, and in the third *Diplodia*, the choice of genus being merely the accident of the occasion, the maturity of the fungus, or the amount of time bestowed by the observer on its investigation. Thus the actual specimens of Dr. Ellis which are recorded in British Journals as *Macrophoma Fraxini* yield, when more deeply probed, both *Sphæropsis* and *Diplodia* spores in the same pycnidia; and similarly I have proved by the examination of a long and fine series of examples that *Phoma Pinastri* Lév. and *Sphæropsis Ellisii* Sacc. are merely growth-states of *Diplodia Pinastri* Grove.

The same remark applies, with the necessary limitations, to the three spore-sizes of the *Phyllosticta* mentioned above, and one may be forgiven for suggesting that there is no reason why *Phyllosticta Cratægi* Sacc. = *Cheilaria Cratægi* Cooke (in Grevill. xii. 25) should not be considered to be the same species just before passing into the *Phleospora*-stage, when the upper part of the pycnidium is bursting into laciniæ. The *Phleospora*-stage would then be a later one, when the elongated spores are being produced, but this is mere surmise.

There is little, if any, difference between the way in which these two kinds of spores appear successively on the same mycelial bed, and the way in which, in the Rusts, the same spore-bed will produce in succession uredospores and teleutospores, and equally in both cases each kind of spore may appear alone on its spore-bed, unaccompanied by the other. The necessity then arises, when only a few specimens are available, of describing each spore-form as if it were an independent species, as was done on such a large scale in the Uredinales, but also in both cases alike a wider knowledge, based on more numerous examples, enables the evil to be remedied.

If then, in studying this injurious disease of Hawthorn hedges *, we take the indications given above as proving that *Phyllosticta monogyna* is the fore-runner of *Phleospora Oxyacanthæ*, we should expect to find a similar state of things in connection with other Phleosporas, and that is exactly what we do find. For *Phleospora Aceris* Sacc., is accompanied by *Phyllosticta Platanoidis* Sacc., which at one of the intermediate stages looks like a *Leptothyrium*, and has been called *L. Platanoidis*. In the same way *Phleospora Ulmi* Wallr. is accompanied by a species of *Phyllosticta* which apparently has not received a name, and a similar but

* To help in the investigation of the fungi which grow upon the common Hawthorn, the author will be grateful if mycologists will send to him, at the University, Birmingham, any species of *Cytospora* which they may find upon that host, with notes of the locality and mode of occurrence.

stranger case is seen in what has usually been called *Septoria Podagrariæ* Lasch. This latter common fungus is frequently accompanied on the same spot by *Phyllosticta Ægopodii* Allesch. The "Septoria" really has a thin pycnidium, but this soon disappears, so that some mycologists have wished to place it in *Cylindrosporium*, a genus which should not have the slightest trace of a pycnidial wall. To do so would be a serious error, confusing together two unlike things; it is really a *Phleospora*, since the genus *Septoria* should be confined to those species with elongated spores in which the thin pycnidium persists in its complete form up to and after the dispersal of the spores.

All these fungi appear to develop at a later stage into species of *Mycosphærella*. Klebahn proved that *Phleospora Ulmi* is the pycnidial stage of his *Mycosphærella Ulmi* (Jahr. Wiss. Bot. 1905, p. 492), Jaap did the same for *P. Oxyacanthæ* and *M. Oxyacanthæ* (Bot. Ver. Brand. 1907, p. 15), while *P. Aceris* is often accompanied by an immature Pyrenomycete, which has the external characters of a *Mycosphærella*, but contains only an oily mass of globules—this is presumably *M. septorioides* (Desm.). There are other similar cases, e. g. *Phyllosticta Ægopodii* and *Phleospora Podagrariæ* are almost certainly the early stages of *M. Ægopodii*.

The consideration of the varying forms of these pycnidial stages, like those of *Phomopsis* (*Kew Bulletin*, 1917, p. 49), shows how closely the various groups of Fungi enumerated in the third volume of Saccardo's *Sylloge* are connected together; how necessary it is, therefore, to have a term (Cœlomycetes) which shall include them all, and, finally, how groundless is the attempt made to distinguish between them by calling the spores "sporulæ" in one group, and "conidia" in the other.

It is, of course, desirable that some mycologist with the requisite facilities should carry out a series of cultures to verify these statements, but it must be admitted by all that, when a parasitic fungus occupies a definite "spot" (caused by the mycelium) on a leaf, the spore-forms seated thereon may usually be taken as the equivalent of a pure culture, whenever the sequence of events occurs over and over again without variation in the same order, saprophytes and other intruders being then naturally out of the question.

II. Sphærulina intermixta (B. & Br.) and its Allies.

In 1852 Berkeley and Broome described, in the *Annals and Magazine of Natural History*, a fungus with scattered perithecia on dead twigs of Rose to which (because it grew mixed with *Sphæria fuscella*) they gave the name *Sphæria intermixta*. In 1866 Cooke recorded, in one of the early volumes of this Journal, a similar fungus on dead stems of *Rubus* to which he gave the name *Sphæria abbreviata*. The name was derived from the habit of the fungus, which has its perithecia mostly not scattered, but arranged in short straight black rows of three or four, placed longitudinally on the stem. Saccardo, in his *Sylloge*, vol. ii. p. 187, assigned the former species to the genus *Sphærulina*, and recorded it on living bark of *Rubus*. He ascribed to it, what neither Berkeley and Broome nor Cooke had mentioned, "ascos diu in globum fasciculatim junctos," adding that he suspected *S. abbreviata* Cooke to be a very closely allied species. Against this was to be set Cooke's statement that his *abbreviata* had brown spores ("pale brown when mature"), whereas the spores of *S. intermixta* are always perfectly hyaline.

Now it happens that round Birmingham there occurs, on small dead shoots of *Rubus*, in considerable quantity, a fungus which accords exactly in external appearance with Cooke's species, and has its asci cohering at the base into a persistent globose fascicle, but its spores always entirely free from colour. Both the species mentioned above were described by their authors as having triseptate spores, Saccardo says of *S. intermixta* "spores 3–4-septate." One concludes that Cooke's description of the colour of his spores was merely a slip of the pen, and that the two forms are alike in the asci and spores, but differ in the arrangement of the perithecia.

This is not all. On further examination of these specimens on *Rubus* it will be found that, while the younger perithecia contain triseptate spores, showing here and there also a fourth transverse septum, yet some older ones will disclose (mixed with those just mentioned) many larger spores having five or even six septa. There is every reason to believe that the former of these states is *Metasphæria sepincola* (Fckl.) Sacc., on dead stems of *Rosa* and *Rubus*; whether it is the *Sphæria sepincola* of Fries is doubtful. The later 5–6-septate stage may be considered with equal probability to be the same as *Metasphæria brachytheca* (B. & C.) Sacc., on *Rosa*, the details being exactly as described so far as the short diagnosis goes, and especially the description of the spores as like those of *Patellaria (Lecanidion) atrata* (see in Grevill. 1876. iv. 146).

But there is still another development to be considered. Recently I found at the Botanic Gardens, Birmingham, on dead twigs of *Rosa damascena*, a fungus which externally was very like *S. intermixta*, having somewhat scattered perithecia, oblong sessile asci collected into a persistent globose fascicle, and all the other points of that species, except that it had larger spores with 5 to 7 septa and one or two of the loculi occasionally divided by a thin but unmistakably longitudinal septum. This can evidently be nothing but a later and more evolved form of *S. intermixta*.

Cooke records his *S. abbreviata* as accompanied by *Hendersonia Rosæ*. Most mycologists would now call this *H. Rubi*, although an examination of many specimens on both *Rosa* and *Rubus* has furnished me with absolutely no morphological criterion by which they can be distinguished. Exactly in the same way the fungus on *Rosa damascena* was accompanied by what is usually called *Hendersonia Rosæ*, though in this case the triseptate spores characteristic of this species occasionally become 4-septate and, moreover, showed frequently one or even two plain longitudinal septa, so that it became technically a *Camarosporium*, as many Hendersonias do. In fact this increase of septation as the spores of Cœlomycetes and Ascomycetes become older and longer is a very common phenomenon, though its occurrence and its fundamental influence on future taxonomy is only just beginning to be recognised.

The conclusion at which one must arrive is that *S. abbreviata* (Cooke) and *S. intermixta* (B. & Br.) are distinguished solely by the arrangement of their perithecia (a difference which future observations may entirely remove), and that they probably constitute one species (*S. intermixta*), occurring indiscriminately on *Rosa* and *Rubus*, and having in addition, on *Rubus*, a var. *abbreviata* (Cooke).

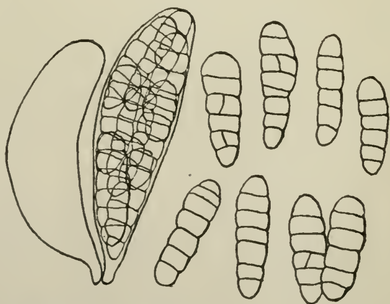
The fungus on *Rosa damascena* may then also be described as a variety or form of *S. intermixta*. It would be a negation of all the rules of common sense to place it, where it technically belongs, in *Pleospora*, § *Catharinia*, for it does not resemble the species of that section at all, while it does in every way recall to mind *S. intermixta*. Saccardo's method of arrangement, though wonderfully useful and in fact indispensable (without it chaos would have reigned in the Sphæriaceæ), must not be forced upon us in disregard of obvious affinities.

A description of the new form is appended :—

SPHÆRULINA INTERMIXTA, f. VALDE-EVOLUTA.

Perithecia sparsa, globosa, 200–250 μ diam., tecta, dein erumpentia ac subsuperficialia, contextu crasso minute parenchymatico atro-olivaceo, poro pertusa. Asci oblongo-clavati v. obovati, ampli, diu in globum fasciculatim juncti, 50–75 × 15–20 μ, apice rotundato, efoveolato, brevissime pedicellati, aparaphysati. Sporidia tristicha, oblongo-clavata, utrinque rotundata, juniora 1-septata, dein 3–4-septata, ad septa præsertim medium leviter constricta, postremo 5–7-septata, tunc rarius uno vel rarissime duobus loculis septo longitudinali instructis, perfecte hyalina.

Hab. in ramulis emortuis *Rosæ damascenæ*, socia *Hendersonia Rosæ*, in Horto Botanico, Edgbaston, Birmingham, Maio, 1919.



Sphærulina intermixta f. *valde-evoluta*.

Asci and spores, × 600.

BARBAREA RIVULARIS IN ENGLAND.

By the Rev. E. S. Marshall, M.A., F.L.S.

About the middle of June Mr. W. D. Miller brought me fresh specimens of a Crucifer which he had found growing plentifully in a ditch on the west side of a by-road dividing the parishes of Cossington and Chilton Polden (dis. 8), v.c. 6 N. Somerset. The very small pale yellow flowers and crowded pods (erect when full-grown) at once suggested *B. stricta*; and a comparison with my only two herbarium-sheets so named showed a complete agreement. One, from Thirsk, Yorks (Herb. Syme), was gathered by Mr. J. G. Baker in June, 1854; the other, from a ditch side, Upton-on-Severn, Worcs., was collected by Mr. S. H. Bickham on May 29th, 1905, in good flower and young fruit. On June 26th Mr. Miller (who had also observed one plant on a peat-moor "drove," near Edington) took me to the Cossington locality, where it is unquestionably native. On July 8th I found several hundred plants, apparently the type, in good fruit, on a broad, peaty "drove," about ¾ mile S.E. of Edington Junction.

The Thirsk plant was confirmed by Svante Murbeck and A. B. Jackson as *B. stricta* Andrz., and the Upton one by A. B. J., who wrote:—"Yes; a most distinct species; and obviously nothing to do with *B. vulgaris*, under which Bentham placed it as a variety!" I fully agree as to its specific rank; but, happening to refer to Rouy & Foucaud (Fl. de France, i. 198–9), I was much surprised to find that our British plants have apparently been misnamed; some translations from their account of the two species concerned may be helpful.

B. rivularis Martrin-Donas in Fl. Tarn, p. 44. *B. stricta* Boreau, Fl. du Centre, ed. iii. p. 89, non Andrz. nec. Fries. *Exsiccata*:—Billot, No. 3011.

"Plant annual; stems solitary. Radical and lower leaves with small lateral pairs of leaves, clearly shorter—even, as a rule, the uppermost—than the breadth of the terminal lobe, sometimes with lateral lobes none, or very much reduced. Flowers small, in dense racemes, subcorymbose at the flowering-stage. Pods slender, crowded, almost imbricate, erect, apiculate by the lengthened style. Seeds oval-oblong, darker [than in *B. vulgaris* and *B. arcuata*], blackish. Plant has a nauseous taste."

β. longisiliquosa Carion, Cat. Pl. Saône et Loire, p. 16. "Pods about twice as long as in the type."

"The form [*sic*; this denotes a distinct segregate, apparently halfway between a species and a subspecies, in the authors' opinion] *B. stricta* Andrz. in Besser, Enum. Pl. Volh. p. 72; *B. parviflora* Fries, Nov. Fl. Suec. ed. 2, p. 207, which we have not seen from France, though it has been reported from several stations, through confusion with the form *B. rivularis*, and especially with the var. *longisiliquosa*, can be separated by the following characters:—Plant biennial; stem solitary. Radical and lower leaves with small pairs of lateral lobes, evidently shorter—even, as a rule, the uppermost—than the breadth of the terminal lobe, sometimes with lateral lobes none, or much reduced. Flowers small, in long, dense racemes. Pods longer and thicker than in the form *rivularis*, crowded, appressed to the axis or convergent, mucronate by the thick, blunt, very short (½ to 1 millim.) style. Seeds oval-oblong, blackish. Plant has a harsh, sharp, non-nauseous taste."

Syme's figure (Engl. Bot. ed 3, Plate 122) fairly well represents the type of *B. rivularis*. Babington describes the pods as short, and the pods as adpressed, with a subulate point. I have not seen any Thames-side plants; but probably they are, as a rule, the type. With the exception of one or two specimens brought home, the Cossington gatherings, having pods up to a full inch in length, evidently belong to var. *longisiliquosa*, as do both my herbarium-sheets.

The young pods are often arcuate-ascending, and resemble those of *B. arcuata* (which seems to me a fairly good subspecies of *B. vulgaris*); their slender, subulate points are quite as long as in *vulgaris*. The petals (as Syme says) exceed the sepals by about a quarter; their claw is long and slender, and their limb, which starts from the tips of the sepals, is squarish. I only observed solitary stems in the very numerous individuals seen.

In his Novitiæ Fl. Suec. ed. 2, p. 207 (1828) Fries gave only one station—in wet spongy places near Skårby, in Scania—and describes his plant, for which he preferred the name *B. parviflora*, as there was another "*B. vulgaris, stricta*" (apparently var. *sylvestris* Fr.); but of course this cannot stand. The expression "petalis linearibus," if correct, should help to distinguish *B. stricta* Andrz. from *B. rivularis*, in which the linear claw abruptly terminates in a short, squarish limb. In *Mantissa*, iii. p. 77 (1842) Fries reluctantly gave up the name *B. parviflora*, and observed:—"*B. stricta* est certe biennis. Majo floret B. vulgari praecocior; *sapor crudus, sed non acri-acerbus*" [*i.e.* as in *B. vulgaris*]. Having no suspicion that our plant was wrongly named, I did not apply this test.

It is, of course, possible that the real *B. stricta* Andrz. may occur in Britain, as it grows in Scandinavia, &c.; but, on present evidence, this seems rather unlikely. *B. rivularis* appears to be a western species. I could see no hairs on the few unopened buds; but they were probably too far advanced.

ALABASTRA DIVERSA.—Part XXXI.*

By Spencer Le M. Moore, B.Sc., F.L.S.

1. Miscellanea Africana.

Ericaceæ.

Philippia kundelungensis, sp. nov. *Ramulis* ultimis crebro foliosis sparsim pubescentibus; *foliis* mox patentibus plerumque ternatim verticillatis linearibus obtusis vel obtuse acutis dorso profunde sulcatis scabriusculis; *floribus* paucis ad apicem ramulorum approximatis pedicellis brevibus sparsim pubescentibus insidentibus; *calyce* cam-

* Types in the National Herbarium.

panulato lobis brevibus 3–4 inter se subæqualibus; *corolla* 4-mera calycem breviter superante ob lobos brevissimos ore modo repanda; *staminibus* inclusis 8 filamentis liberis; *ovario* globoso 4-loculari ovulis quove in loculo 2.

Belgian Congo, Kundelungu; *Kassner*, 2769.

Folia 2–3 mm. long., ·5 mm. lat., sicco griseolo-viridia. Pedicelli 1–1·5 mm. long. Calyx 1 mm. long decoloratus, lobis apice viridibus. Corolla 1 mm. paullulum excedens. Filamenta ·3 mm. long.; antheræ ·4–·5 mm. long., breviter bifide rarius integræ vel subintegræ. Ovarium circa ·5 mm. diam. Stylus ovario circiter æquilongus; stigma ·5 diam.

The foliage, short pedicels and included anthers are the chief marks of the species.

Philippia congoensis, sp. nov. *Ramulis* ultimis tenuibus inferne cicatricibus foliorum delapsorum signatis apicem versus foliosis pubescentibus; *foliis* mox patentibus breviter petiolatis anguste linearibus obtusis vel obtuse acutis dorso profunde sulcatis sparsim pubescentibus; *floribus* paucis ad apicem ramulorum approximatis brevipedunculatis; *calyce* 3–4-lobo unico certe majore; *corollæ* calycem subæquantis lobis 4 rotundatis tubo paullulum brevioribus; *staminibus* 8 filamentis inter se liberis; *ovario* 4-loculari ovulis pro loculo 2.

Belgian Congo, Katanga: *Kassner*, 3352.

Folia 2–3 mm. long., ·3 mm. lat. Pedicelli 1 mm. long. Vel paullulum ultra. Calyx pubescens, 1 mm. long., addito lobo uno lineari dorso sulcato crassiusculo fusco 1 mm. long. Corolla 1·25 mm. long.; lobi denticulato-ciliolati soli ·5 mm. long. Filamenta ·5 mm. long.; antheræ 1 mm. long., bifidæ. Ovarium subglobosum, longitrorsum sulcatum, sericeum, ·5 mm. diam. Stylus ·4 mm. long.; stigma 1 mm. diam.

Differs from the last in its narrower leaves, calyx with one prominent lobe, plainly-lobed corolla, and larger anthers. The branchlets naked except for a few leaves at the top—so common a feature among these plants, gives it a very different appearance from the other.

Asclepiadaceæ.

Fockea Monroi, sp. nov. *Caule* verisimiliter repente primo tereti subtiliter pubescente deinde angulato glabro; *foliis* oblongis vel anguste oblongo-lanceolatis obtusissimis apice ipso mucronatis basi in petiolum brevem angustatis firme membranaceis leviter scabriusculis; *cymis* interpetiolaribus brevissimis paucifloris; *bracteis* minutis ovatis acutis scariosis ut cymarum axis pedicelli calycis segmenta necnon corolla pubescentibus; *pedicellis* manifestis calyci æquilongis; *corollæ* tubo calyce breviore lobis a basi lata ligulatis revolutis æstivatione tortis in anthesi patentibus; *corona* apice circa 15-fida dentibus subulatis acuminatis interdum bifidis dente intermedio quam laterales majori tubo ligulis 5 elongatis integris vel bifidis fere usque apicem tubi eidem adnatis carinasque formantibus parte libera ex tubo longe eminente onusto addita ligula satis elongata integra vel bifida carinis quibusque memoratis infra medium tubi affixa; *antherarum* appendicibus oblongis quam antheræ duplo longioribus; *folliculo* fusiformi glabro.

Hab. Rhodesia, Victoria; *Monro*, 828, 837.

Folia plerumque 4–7 cm. long., 8–10 mm. lat., in sicco viridia; costa media supra plana subtus eminens; petioli 2–3 mm. long., validi, supra excavata. Pedicelli 2–2·5 mm. long. Calycis segmenta 2 mm. long. Corollæ tubus 1 mm. long.; lobi 15 mm. long., juxta basin 2 mm. lat., superne 1 mm. vel etiam minus. Coronæ tubus ægre 5 mm. long.; hujus dentes intermediæ 1·5 mm. long., laterales 1 mm. vel minus; laminæ exsertæ circiter 1 mm. infra coronæ os liberæ ægre 4 mm. long., inferne ·3 mm. lat., superne attenuatæ necnon curvatæ. Columna staminea 1 mm. long. Antherarum alæ ·5 mm. long., harum appendices ægre 2 mm. long. Pollinia pyriformia, ·25 mm. long. Folliculus 12·5 cm. long., inferne fere 2 cm. superne circa 1 cm. lat. Semina 9 mm., coma 3·5 cm. long.

Ceropegia degemensis, sp. nov. *Caule* volubili distanter folioso glabro; *foliis* petiolatis oblongo-ovatis acuminatis basi obtusis in sicco membranaceis glabris; *floribus* mediocribus pedicellatis in umbellas pedunculatas paucifloras dispositis; *pedunculis* sat validis petiolis circiter æquilongis; *pedicellis* pedunculos æquantibus puberulis; *calycis* segmentis lineari-subulatis acutis puberulis; *corollæ* extus glabræ tubo basi inflato medio constricte inde usque ad fauces gradatim dilatato lobis tubo brevioribus apice connatis ovato-oblongis obtusis replicatis margine longiuscule sed sparsim ciliatis; *coronæ* phyllis ext. inter se liberis vel fere liberis oblongis longiuscule bifidis ciliatis segmentis linearibus divaricatis phyllorum int. lobis phyllis ext. fere æquilongis lineari-oblongis obtusiusculis glabris.

Nigeria, Degema Division; *Talbot*, 3652.

Folia pleraque 3·5–5 cm. long., 1·2–1·5 cm. lat., in sicco viridi-brunnescentia, viva verisimiliter aliquanto crassiuscula; costa media pag. inf. prominens, costæ laterales vix aspectabiles; petioli plerumque 8–10 mm. long. Pedunculi validi, striati, usque 8 mm. long. Calycis segmenta 2 mm. long. Corolla 2·5 cm. long.; basis inflat. 5 × 7 mm.; pars intermedia medium 6 × 3 mm., pars superior 6 mm. long., ipso sub limbo 8 mm. lat.; lobi 8 mm. long. Corona phylla ext. 2 mm. long. (segmentis 1 mm. long. inclusis); phyllorum int. lobi vix 2 mm. long.

To be inserted in the genus next *C. volubilis* N. E. Br., which has ovate-cordate leaves and corollas with a much less inflated base and a narrower throat.

Scrophulariaceæ.

Craterostigma Monroi, sp. nov. Herba annua, glabra, basi copiose fibrillifera; *caulibus* cæspitosis erectis gracilibus pauci-foliosis; *foliis* radicalibus linearibus obtusis inferne dilatatis cau-lemque laxe vaginantibus crassiusculis foliis caulinis sessilibus anguste linearibus obtusis; *floribus* paucis axillaribus terminalibusve pedicellis sæpe folia subæquantibus insidentibus; *calycis* campanulati triente superiore divisi lobis deltoideis obtuse acutis; *corollæ* tubo calycem excedente subcylindrico (basin versus leviter angustato) labio postico ovato bifido antici lobis obovatis obtusissimis intermedio quam laterales longiore; *antheris* per paria approximatis; *ovarii* sphæroideo; *stylo* leviter exserto; *stigmate* late lamelliformi.

Rhodesia, Victoria; *Monro*, 788, and a later gathering under No. 1879.

Tota planta 3–7 cm. alt. Folia radicalia inferne decoloria, summum circa 10 mm. long., etsi sæpe breviora, juxta medium fere 1 mm. lat., basi fere 3 mm.; caulina 5–10 (raro fere usque 20) mm. long., ·2–·4 mm. lat., raro 1 mm. adæquantia. Pedicelli plerumque 5–10 mm. long. Calyx in toto vix 3 mm., lobi vix 1 mm. long. Corollæ tubus 4 mm. long., basi 1·5 mm. sursum 2 mm. lat.; labium posticum 3 × 3 mm., labii antici lobi laterales 3 mm. long., lobus intermedius 5 mm. Antheræ 1 mm. lat. Ovarium vix 1 mm. diam. Stylus 4·5 mm. long. Stigma 1·2 mm. lat.

A very distinct species apparently nearest *C. linearifolium* Engl., but with several differences in leaf and flower.

Craterostigma chironioides, sp. nov. Planta spithamea, glabra; *caule* ascendente gracili angulato distanter folioso; *foliis* sessilibus anguste lanceolato-oblongis obtusis margine denticulatis paucis infimis subradicalibus nonnunquam paullo latioribus; *floribus* in glomerulos bracteatos aggregatis; *bracteis* latis calycem æquantibus ovatis superne attenuatis apice obtusis; *calyce* ovoideo 5-costato costis alato-cristatis 5 dentato dentibus triangularibus acutis; *corollæ* tubo calycem excedente ima basi angustato labio postico ovato rotundato apice retuso labii antici lobis lateralibus ovatis quam intermedius suborbicularis brevioribus; *antheris* approximatis; *stylo* breviter exserto; *stigmate* lamelliformi.

Belgian Congo, Kundelungu Mt.; *Kassner*, 2594.

Folia pleraque 1·5–2·5 cm. long., 2–4 mm. lat., perpauca radicalia usque 5 mm. lat., trinervia, costa media subtus prominente. Florum glomeruli 7–10 mm. diam. Bracteæ vetustiores 6 mm. long., basin versus 4·5 mm. lat., interiores gradatim imminuti. Calyx 6 mm. long.; hujus dentes 1 mm. long. Corollæ tubus ægre 7 mm. long., ima basi vix 1 mm. sub limbo fere 3 mm. lat.; labium posticum 3 × 3 mm.; anticum 5 mm. long.; hujus lobus intermedius 4 × 5 mm. Antheræ 1·25 mm. lat. Ovarium ovoideum 1·5 mm. long. Stylus 6 mm. long. Stigma ·5 mm. lat.

Undoubtedly close to *C. latebracteatum* Skan, which is a taller plant diverse in foliage and also in calyx and corolla.

Ilysanthes Gossweileri, sp. nov. Herba parvula, scaposa; *caule* repente crebro radicante fibrillas copiose emittente; *foliis* radicalibus oblongo-obovatis apice rotundatis uninervibus crassiusculis glabris vel fere glabris; *scapis* tenuibus pubescentibus ad medium bracteis 2 oblongis obtusis onustis; *floribus* pro rata parvis in umbellam terminalem paucifloram digestis; *pedicellis* calyce longioribus pubescentibus; *calyce* cylindrico 5-dentato sparsim breviterque pubescente; *corollæ* tubo cylindrico calyci circa æquilongo labio postico obovato-oblongo apice retuso labii antici lobis obovatis margine undulatis intermedio quam laterales paullulum longiore; *staminibus* breviter exsertis antherarum loculis distantibus; *staminodiis* ovoideis basi obtusis; *ovario* ovoideo aliquanto compresso; *stylo* exserto complanato; *stigmate* bilamellato.

Angola, Kubango, in meadows subject to inundation at Forte Princeza Amelia; *Gossweiler*, 2337.

Folia 5–10×3–4 mm. Scapus 5–6 cm. alt., hujus bractearum par 3–4 mm. long. Bracteæ at basin umbellæ circa 2 mm. long. Pedicelli summum 10 mm. long. Calyx 4–5 mm. long., 1·5 mm. lat.; dentes 1 mm. long. Corollæ tubus 5 mm. long., vix 1 mm. lat.; labium posticum 3×1·75 mm.; labium anticum 3·25×5 mm. Antheræ 1·25 mm. long. Staminodia vix 1 mm. long. Ovarium 1·5 mm., stylus 4·5 mm. long.; stigma ·5 mm. lat.

Differs from *I. Welwitschii* Engl. chiefly in the broader leaves, the narrow calyx, small corolla, and bluntly ending staminodes.

No. 3991 from the same place is referable here.

Ilysanthes yaundensis, sp. nov. Caulibus cæspitosis ascendentibus fibrillas permultas basi gignentibus; *foliis* radicalibus spathulato-oblongis obtusis crassiusculis caulinis paucis paruvlis anguste oblongis obtusis omnibus glabris; *floribus* paucis ex axillis summis ortio sat longe pedicellatis; *calyce* cylindrico glabro 5-dentato dentibus triangularibus acutïs; *corollæ* tubo calycem superante anguste infundibulari labio postico subpanduriformi bidentato dentibus a basi lata anguste linearibus labii antici lobis inter se subæqualibus obovatis margine crispulis; *staminibus* breviter exsertis; *staminodiis* basi obtusis; *ovario* ovoideo; *stylo* breviter exserto; *stigmate* infundibulari.

Cameroons, Yaunde; *Zenker*, 1487.

Planta 6–8 cm. alt. Folia radicalia 6–15 mm. long., superne 1–2 mm. lat.; caulina plerumque 2–4 mm. long. Pedicelli plerumque 1–2 cm. long. Calyx totus 4·5 mm. long.; dentes 1 mm. Corollæ tubus 5·25 mm. long., inferne 1 mm. sub limbo 2 mm. lat.; labium posticum 4·5 mm. long., basi 3 mm. lat., hujus dentes 1 mm. long. Antheræ 1·5 mm., staminodia fere 1 mm., ovarium ·8 mm., stylus 6 mm. long. Stigma 1 mm. lat.

Distributed as *I. Welwitschii* Engl., an Angolan plant from which it can be distinguished by the possession of cauline as well as radical leaves, smaller calyx, upper lip of corolla with narrow teeth and staminodia ending bluntly.

Alectra gracilis, sp. nov. Herba gracilis fere spithamea; *caule* erecto simplici vel rariramoso sat crebro folioso scabrido; *foliis* oppositis sessilibus oblongis vel oblongo-linearibus obtusis integris utrinque scabridis; *floribus* ex axillis foliorum paucorum summorum oriundis pedicellis brevibus bracteis 2 linearibus donatis insidentibus; *calyce* campanulato extus scabriuscule triente superiori diviso lobis triangularibus acutis; *corolla* calycem breviter superante lobis quam tubus plane brevioribus oblongo-ovatis obtusis; *filamentis* subæquilongis duobus barbatis duobus calvis antherarum loculis inter se subsimilibus basi mucronatis; *ovario* ovoideo compressiusculo; *stylo* clavato glabro.

Angola, moist meadows between the Kutchi and Kutato; *Gossweiler*, 3391.

Folia plerumque 5–10 mm. long., 1·5–2·5 mm. lat. Pedicelli circa 1 mm. long. Bracteæ usque 5 mm. long. Calyx totus 6 mm. long.;

lobi 1·5–2 mm. Corollæ tubus 7 mm., lobi 2 mm. long. Antheræ circa 1 mm., ovarium 2 mm., stylus 7 mm. long.

The slender habit, entire leaves, together with the mucronate anthers, afford the best means of distinguishing this species.

Buchnera quadrangularis, sp. nov. *Caule* sat valide erecte ramoso quadrangulari scabriusculo deinde lævi; *foliis* (summis alternis suboppositisve) sessilibus oblongo-oblanceolatis obtusis vel obtusissimis optime 3–5-nervibus utrinque scabridis; *spicis* sessilibus terminalibus simplicibus vel basi 2–3-ramosis quadrifariatim densifloris; *bracteis* ovatis acutis dorso margineque hispidulis; *bracteolis* lineari-oblanceolatis obtuse acutis bracteis æquilongis; *calyce* bracteolas superante latiuscule quadrangulari 4-nervi hispidulo lobis 4 quam tubus plane brevioribus oblongis obtusiusculis; *corollæ* tubo calycem breviter excedente subcylindrico paullulum curvato glabro lobis obovatis obtusissimis tubo brevioribus, *filamentis* imberbibus antheris acutis.

Angola, in Mandioca plantations toward U'Golo; *Gossweiler*, 1056.

Planta ⅔-metralis. Folia plerumque 3·5–5 × 1–2 cm. Spicæ 2–3 × 1 cm. Flores sec. cl. detectorem albi. Calyx totus 5 mm. long. (sub fructu usque 8 mm.), 2 mm. lat.; lobi longit. vix 2 mm. adæquantes. Corollæ tubus 6 mm. long., circa 1 mm. lat.; lobi 1·75 × 1·25 mm. Filamenta longiora circa ·75 mm. long. Ovarium ovoideum, 1 mm. long.; stylus clavellatus, 1·5 mm. long. Capsula late ovoidea, 3 × 2·75 mm.

Can be told at a glance from *B. lippioides* Vatke by the entirely different flowers.

Buchnera convallicola, sp. nov. *Caule* erecto robusto circiter 4-spithameo pauciramoso; ramulis sat tenuibus uti caulis scabriusculis; *foliis* inferioribus oppositis ceteris sæpissime alternis nisi suboppositis sessilibus oblongis obtusis nonnunquam obtusissimis superioribus gradatim imminutis omnibus pagina utravis scabridis in sicco haud nigrescentibus, *floribus* in glomerulis terminalibus brevipedunculatis subglobosis vel ovoideis dense multifloris dispositis; *bracteis* inferioribus quam glomerulus brevioribus omnibus lanceolatis breviter acuminatis calyci circiter æquilongis uti bracteolæ calyxque scabriuscule pubescentibus; *bracteolis* lineari-lanceolatis acuminatis quam bractea paullulum brevioribus; *calyce* 10-nervi lobis 5 lanceolatis acuminatis; *corollæ* tubo recto sub limbo leviter dilatato lobis inter se fere æqualibus suborbicularibus; *ovario* oblongo-ovoideo quam stylus apice clavatus integerque breviore; *capsula* ovoidea, obtusissima.

Belgian Congo, in valley at Mt. Senga; *Kassner*, 2984.

Folia (uti, bracteæ, bracteolæ, calycesque) in sicco brunneo-vel griseo-viridia, plerumque ± 3 cm. long., 5–7 mm. lat., raro 5 × 1 cm. attingentia, summa in bracteas transeuntes. Glomeruli 1–2 × 1·5 cm. Bracteæ 8·5 mm. long., bracteolæ 7 mm. Calyx in toto 8 mm. long., inferne 1·5 mm. superne 2 mm. lat.; hujus dentes 2 mm. long. Corollæ tubus 9 mm. long., inferne vix 1 mm. lat. ipso sub limbo 2 mm.; lobi 3 × 4 mm. Filamenta 1·5 mm. long., antheræ totidem.

Ovarium 1 mm., stylus 1·75 mm. long. Capsula fusco-brunnea, glabra, 3·5 × 2·5 mm.

Near *B. quangensis* Engl., *B. subcapitata* Engl. and *B. pulchra* Skan, but distinguished on sight by the indumentum and retention of colour when dried. It would seem closer still to *B. affinis* De Wild., known by description only, which has much larger lower leaves and more or less amplexicaul upper ones, lowermost bracts as long as, or a little longer than, the inflorescences, differently-shaped upper bracts, smaller calyx with only 4 (and smaller) teeth, narrower corolla lobes, and larger beaked capsules.

To get the above measurements of bracts, bracteoles, and calyx, it is necessary to select perfectly expanded flowers, as those not quite so advanced have those organs smaller.

Buchnera Gossweileri, sp. nov. *Caule* ascendente simplici vel perpauciramoso leviter scabriusculo; *foliis* sessilibus caulinis oblongis vel oblongo-lanceolatis obtusis basi 3–7-nervibus supra scabridis subtus leviter scabriusculis; *spicis* densifloris primo ovoideis postea oblongis pedunculis folia superantibus insidentibus; *bracteis* calyce paullo brevioribus ovatis acuminatis margine ciliolatis dorso scabriusculis; *bracteolis* spathulatis acutis longit. bracteas circa semiæquantibus; *calycis* late cylindrici 9-nervis lobis 5 inter se inæqualibus triangularibus acutis; *corollæ* tubo calycem duplo superante lobis suborbicularibus margine leviter ciliolatis; *filamentis* omnibus glabris antheris optime acuminatis.

Angola, forests of Mudobua; *Gossweiler*, 1059.

Planta circa spithamea. Folia plerumque 3–4 cm. long., 8–11 mm. lat. Pedunculi ægre usque 10 cm. long. sæpius vero breviores. Spicæ primo 10–15 × 10–12 mm., posthac usque saltem 2·5 cm. elongatæ. Bracteæ 3–3·5 mm. long., inferne 2·5 mm. lat. Bracteolæ fere 2 mm. long. Calyx 4·5 mm. long., 2 mm. lat.; lobi 1–1·5 mm. long. Corollæ tubus 8 × 1·5 mm.; lobi ægre 3 mm. diam. Filamenta longiora 1 mm. long. Ovarium ovoideum, ægre 1·5 mm. long.; stylus ovario æquilongus.

B. ensifolia Engl., to which this comes closest, has narrower (linear-lanceolate) leaves, broader bracts glabrous except for the ciliate margin, a shorter and broader calyx, and corollas with smaller lobes. In addition, its leaves have but one nerve, and though the nerves of the other are difficult to see on the upper side of the leaf, they are very plain on the lower face, especially near the base.

Buchnera granitica, sp. nov. Herba hispidule scabrida circiter spithamea; *caule* subsimplici erecto angulato folioso; *foliis* sæpissime oppositis basalibus rosulatis oblongis vel oblongo-ovatis obtusis manifeste (interdum obscure) trinervibus ceteris linearibus vel lineari-oblongis mucronatis; *spicis* foliis brevioribus ovoideis basi parum interruptis; *bracteis* lanceolatis acutis uti calyx extus hispidule scabridis; *bracteolis* calyce multo brevioribus linearibus acutis; *calyce* 9-nervi lobis 5 abbreviatis subulatis; *corollæ* tubo ex calyce plane eminente sub limbo hispidulo lobis obovatis obtussimis; *filamentis* omnibus glabris antheris acuminatis.

Rhodesia, Salisbury; *Rand*, 1431.

Folia basalia summum 3·5–4 cm. × 7–12 mm., sæpius 2–3 cm. long., 5–5 mm. lat.; caulina plerumque 2·5–4 cm. × 3–4 mm. Spicæ nondum profecto evolutæ circa 12 × 10 mm. Bracteæ 4–5 mm. long. Bracteolæ 2 mm. long. Calycis tubus 7 mm. long., inferne 1 mm. superne 1·5 mm. lat.; lobi 1·5 mm. long. Corollæ tubus ægre 9 mm. long., 1 mm. lat.; lobi 3 × 2·5 mm. Filamenta longiora 1·5 mm. long., breviora ·75 mm.; antheræ 1·25–1·5 mm. long. Ovarium 1 mm. long.; stylus sursum clavato-lamellatus 2 mm. long.

To be inserted in the genus next *B. pusilliflora* S. Moore. The diverse foliage and ovoid spikes at once point to specific difference.

Buchnera congoensis, sp. nov. *Caule* simplici erecto circiter spithameo quadrangulari scabiusculo crebro folioso; *foliis* amplis infimis rosulatis ovatis obtusissimis ceteris oppositis sessilibus oblongo-oblanceolatis basi apiceque obtusis omnibus trinervibus utrinque scabridisque; *spicis* terminalibus sessilibus basi compositis subglobosis densifloris; bracteis obovatis acuminatis extus hispidule scabridis quam bracteolæ lineari-lanceolatæ longioribus; *calycis* tubo cylindrico-infundibulari bracteam plane excedente plurinervi extus hispidule scabrido lobis 5 subulatis breviter acuminatis inter sese paullulum dissimilibus; *corollæ* tubo calyce paullulum breviore superne leviter ampliato extus fere glabro lobis oblongo-obovatis obtusissimis; *filamentis* imberbibus antheris acuminatis.

Belgian Congo, Kundelungu in moist places; *Kassner*, 2787.

Folia basalia 4–6 × 2–2·5 cm., cetera 5–7 × 1–2 cm., omnia in sicco tenuiter papyracea. Bracteæ usque 10 mm. long., apicem versus 4·5 mm. lat.; bracteolæ 7 mm. long. Calycis tubus 11 mm. long., inferne 1·5 mm. superne fere 3 mm. lat.; lobi 2–2·5 mm. long. Corollæ tubus 10·5 mm. long., deorsum 1 mm. ipso sub limbo 2 mm. lat.; lobi circa 5 × 3 mm. Filamenta longiora vix 1 mm. long., antheræ 1·25 mm. Ovarium ovoideum, 1·5 mm. long.; stylus quam ovarium duplo longior.

Can be distinguished easily from its nearest ally *B. andongensis* Hiern by the much larger bracts, the longer and differently-shaped calyx without hairs on the ribs, and the larger corolla.

Buchnera orgyalis, sp. nov. Planta orgyalis: *caule* erecto sursum ramoso subtereti scabride pubescente; *foliis* sessilibus inferioribus oppositis vel suboppositis oblongo-oblanceolatis obtusis prominenter 5-nervibus utrinque scaberrimis superioribus sæpius alternis nisi suboppositis lineari-oblanceolatis obtusis trinervibus scaberrimis; *spicis* terminalibus raro itaque ex axilla summa oriundis subsphæroideis basi compositis; *bracteis* obovatis obtusissimis cuspidulatis dorso margineque hispidulis quam bracteolæ oblongo-obovatæ obtusissime hispidulæ paullo longioribus; *calycis* tubo subcylindrico (basi paullulum angustato) 10-nervi 5-lobo lobis breviter triangularibus hispidulis; *corollæ* tubo calycem facile superante parum incurvo extus glabro lobis oblongo-obovatis obtusissimis intus basi pilosulis; *filamentis* longioribus puberulis antheris utrinque acutis.

Angola, open "Mumua" woods, at Katoco-Kubango; *Gossweiler*, 3823.

(To be continued.)

ANDROECIUM AND GYNOECIUM.

By A. H. Church.

As the rule for spelling these very essential botanical terms is still somewhat vague and casual, while writers using the above orthography are frequently snubbed by would-be purists, it may be of interest to place on record the history and various modes of writing these terms; they have undoubtedly come to stay as convenient conventions in Floral Terminology, and it is time that some ruling was accepted in the matter by English writers. For example, in a recent publication (*Botany of the Living Plant*, 1919, p. 221), Professor Bower retains the present spelling as distinctive and suitable, for the sake of uniformity, though acknowledging that the etymology may be faulty. In support of Prof. Bower's usage, continued from his well-known *Practical Botany* (in several editions, 1894, 1902), it may be stated at once that there is much more to be said for this method etymologically than for the popular variant *gynaeceum*; though it is again possible that to others both methods of spelling may be equally open to criticism. It may be also admitted that it is ridiculous to spell two such homologized expressions on a different plan; while to have to explain such subtle distinctions to a class of students with ordinary common sense is apt to make a teacher of elementary botany both look and feel a fool; there can be no doubt that the retention of such complexities of terminology in a science already over-burdened with vestigial and traditional phraseology encourages a disrespect for the pedantries of pseudo-science. Good terms are necessary, and there should be no difficulty about their correct presentation.

The first appearance of the two words now considered dates from an essay written in Latin (*Linnaea*, i. 433) by J. Roeper, so far a classicist, and the words are given quite clearly and definitely with their proposed etymology (p. 437), as *androeceum*, ex ἀνηρ et ὀικος (without accents), and (p. 438) *gynoeceum*, ex γυνη et οικος: "Hic verticillus foliis foemineis efformatus haud inepte forsan *gynoecei* nomine designari posset." To the apostle of priority the terms are thus established once for all on a reasonable basis, and there is no more to be said; the expressions are good words, fairly euphonious, conceived in correlated form, *i. e.*, made to match, both involving the idea of a *locus* (οἶκος), and with no necessary reference to *women* (γυναῖκες). The terms are quoted in this form, though indicated as redundant, by Schleiden in his text-book, 1842 (*cf.* Eng. Trans. 1849, Lankester, p. 316, the *oe* being written as a diphthong); but the latter term made little headway so long as Linnean writers were still obsessed with the herbalist's term *pistil* (= "pestle," with a variant as *pointal*), which apparently dates from Tournefort (1700). Similarly even at the present day the terms are frequently omitted by many writers (*cf.* Engler & Prantl) to whom the conception of the androecium and gynoecium as specialized regions of the flower with a certain individuality of their own, to be reduced or elaborated independently of the other parts, is still unfamiliar. The expressions really imply much more than a mere aggregate of stamens or carpels, and they supply a need in floral terminology which cannot be readily expressed or made intelligible in any other way.

It is interesting to note that in this country the anglicized version *gynoecium* (with a diphthong), as correlated with *androecium* was early adopted by George Bentham (1832, Labiatarum Gen. et Sp. p. xxvii), and was continued into the *Genera Plantarum* (1862, i. p. v) of Bentham and Hooker; the same usage may be noted in Hooker's edition of Le Maont and Decaisne (1873, p. 64), as also in J. H. Balfour's *Class Book of Botany* (1854, p. 239); just as Lindley's *Glossary of Botanical Terms* gives gynoecium (1848). Hence the spelling of *gynoecium* may be accepted as the standard established for English writers, by botanists of such rank as Bentham, Hooker, Lindley, and Balfour, and has been correctly continued by Bower (1919), as it was also accepted by Asa Gray (1879, *Structural Botany*, p. 165 in 1887 edit.), the latter following Bentham and misquoting Roeper, whose paper he had probably not seen. On these grounds the same spelling was adopted in *Floral Mechanism* (Church, 1908).

A little knowledge of Greek may it is true be often worse than none at all (*cf.* Kraus, Verhand. Würzburg, 1908, p. 10), and it is perfectly true, as anyone with a lexicon can find out, that the Greeks had a name for the "female apartments" of a house, based on the stem γυναικ—as γυναικεῖον, commonly rendered *gynaeceum* in Latin (but also *gynecium*, with another word *gynaeconitis*), the word "gynaeceum" being even continued by the Romans for a factory employing female labour, the superintendent of which would be a *gynaecius*. These facts may be interesting to a philologist, but they have nothing to do with the words coined by Roeper for strictly botanical purposes, and not involving any question of actual women at all. As a matter of fact, the Greeks, as might be expected, also had a word for the "men's apartments" as ἀνδρεῖον, ἀνδρών, latinized as *andron* (andreum, andrium, *cf.* andronitis); these terms being equally correlative; *i. e.*, the use of one implying the use of the other. The choice is obviously between Roeper's pair and the Greek pair or their Latin equivalents; to mix them is futile. Who the interfering busybody may have been who first resurrected *gynaeceum* is not clear, nor does it much matter; the word spelt in this manner appears in Link (1837, p. 86) and Lindley (1832, p. 138), apparently as a misunderstanding. But it is important to note that it also appears in Sach's *Lehrbuch* of 1870 (p. 458), associated with the original form *androeceum* (p. 444); and as more modern text-books have been largely based on this work in Germany and in this country, people brought up on Sachs have contended for or continued the erroneous version of the word (Goebel, Drude, Frank, Schumann). That is to say, the *c* of *androecium* represents the *k* of οἶκος (as in "dioecious" and "monoecious" of Linnæus), and so would the *c* of *gynoecium*; but the *c* of *gynaeceum* represents the κ of γυναικ, the full stem of γύνη (woman), and any association with an οἶκος vanishes. It may be asserted that Roeper to be technically perfect, should have written *gynaec-oeceum* (Kraus), but no Greek would have thought of doing so: his instinct for portmanteau words would have in fact telescoped this to *gynoeceum*; and Roeper was perfectly justified in following the accepted and traditional usage dating from Linnæus of taking the clipped root *gyn-* as expressing a certain suggestion of femininity without implying any necessary connection with actual "women." This botanical usage is freely recognized by the Oxford Dictionary (1901).

It is interesting to note in fact that the full root γυναικ- does not occur anywhere in botany; a few genera beginning with *gynaec-* were proposed by Hasskarl (1844), but they have been since cut down (as *Gynaecura* to *Gynura* (*cf.* Baillon, Dict., and *Index Kewensis*); and no botanical name or term carries the *c* (κ) of γυναικ-, as in the significant expression "gynaecology." On the other hand *gyn-*, as in gynandrous trichogyne, *Coelogyne*, *Gynerium*, gynophore, &c., and even gyno-dioecious, is one of the accepted commonplace units of botanical terminology, following the Linnean *Monogynia*, *Digynia*, &c. Hence Roeper was not only justified in his nomenclature, but perfectly accurate. The connotation of the modern use of the term is even more significant as expressing the locus of the "female" parts of the organism (*i. e.*, the "*mega-*" regions, including the megaspore of the sporophyte and the megagamete of the gametophyte), with even less application to the "women" of a "gynaeceum."

Roeper's solution of the nomenclature to be adopted was in every way admirable, and there can be no doubt whatever as to the legitimacy of the *oe* in both words. There cannot be the slightest objection to giving him the full credit of his priority in such a useful conception, the full value of which did not immediately appeal to his contemporaries. Thus, Payer (*Organogénie*, 1857) carries on *Androcée* (p. 714), but retains *Pistil* (p. 725): Van Tieghem (*Traité de Botanique*, 1884, 1891) similarly uses *androcée* and *pistil*; while in the first modern English "Practical" (Huxley and Martin, 1875) neither term is employed. Baillon (*Dictionnaire*, 1886) gives Gynécée as the gallicized form of *gynaeceum*. As previously indicated, most of the text-books of the period follow the error of Sachs (1870): thus Eichler (*Blüthendiagramme*, 1875, p. 190) writes *androeceum* but *gynaeceum*. In English translations the same spelling is commonly varied to *-ium*; while the *oe* and *ae* are obscured by the traditional printer's fad of using type diphthongs (in italic). The English translation of Sachs (1875, Bennett & Dyer, p. 488) writes *Androecium* (diphthong) with *gynaeceum* (diphthong), and the second edition (Vines, 1882, p. 557) follows; though in Prantl and Vines (1881, p. 189) *gynoecium* had been written. Henfrey (4th edit. 1884, Masters and Bennett, p. 119) gives *androecium* and *gynaecium* (diphthongs), and again Vines (*Student's Handbook*, 1895, p. 521) *gynaeceum*. Engler's Syllabus (1912, xix.) continues *gynaeceum*. It is also interesting to record that, while the credit of returning to the original terms of Roeper rests with A. F. W. Schimper (Strasburger's text-book, 1894, p. 365), the English translation (Porter, 1898) gives *gynoecium* (diphthong), and the revision by Lang (1912) returns to the *gynaeceum* (diphthong) with *androecium* (p. 483). In the *Glossary of Botanical Terms* (B. D. Jackson, 1916) *gynaeceum* is recorded as derived from γυναικεῖον, ignoring Roeper, though the Latin *gynecium* and the English (Gen. Plant.) form *gynoecium* are included as variants. The Oxford Dictionary, unfortunately restricted to books published in this country, with characteristic ineptitude in botanical matters gives *gynoecium* (diphthong) as "the usual but incorrect form of *gynaeceum*" (diphthong), "having been supposed to be from οἰκίον, house, and under the influence of this notion *androecium* has been formed as its correlative"—an interesting example of literary stupidity, all the points being incorrect; since, as already indicated, *androecium* is so far the elder twin of the pair, the word is legitimately formed from οἶκος, and it was the usual form in this country only up to 1875 or so.

Apart from the question of the *oe* and *ae*, it would also appear that continental writers and modern botanists have largely followed Sachs, retaining the *-eum* of Roeper (1826), while English writers tend to the *-ium* of Bentham (1832). The difference between *e* and *i* is quite optional, and both may be found in latinized terms, though the presumable association with -οἰκεῖον might lead to *-ium* as nearest in intention (Bentham). Apart from any philological bias, it may be noted that while *-eum* as a suffix is rare in botany (except in adjectives); *-ium*, whatever may be its etymological origin, is a commonplace ending of many words in general use, of the type:—*archegonium*, *antheridium*, *archesporium*, *amphithecium*, *sporangium*, *gonidium*, *sporidium*, &c., and it may be taken as a convenient and generalized termination. From such a standpoint of mere literary convenience the emended spelling *androecium* and *gynoecium*, as established by Bentham and Hooker (Gen. Plant.), omitting the unnecessary diphthong type, may be established as sufficiently legitimate to satisfy all claims, and the words as written in the heading of this note are entitled to stand permanently. To return to the *-eum* of Roeper may be satisfying to the more pedantic; the attitude of Bentham is good enough for any English botanist; but the use of *ae* instead of *oe*, is not only distinctly wrong but extremely foolish.

BIBLIOGRAPHICAL NOTES.

LXXVI. Henry W. Burgess's 'Eidodendron.'

This work, described on its singularly ugly title-page as "Eidodendron: Views of the general Character and Appearance of Trees, foreign and indigenous, connected with Picturesque Scenery, by H. W. Burgess: London, 1827," is, so far as the plates are concerned, of no botanical importance and hence rarely finds a place in botanical libraries. There is, however, a copy in the Department of Botany, and the book presents a few points of bibliographical interest which may as well be put on record.

The work is a folio volume containing 54 plates, of which a list is given, and a portrait of the author; it was published in numbers, each apparently containing six plates. Both title-pages—there is one preceding the plates—are dated 1827, but this for the whole work is manifestly incorrect: there are two dedications, one to George IV., the other to William IV.—from the latter it would appear that Burgess held some official position, as he speaks of having "trusted to show that the office of landscape painter has not been idly bestowed upon [his] Majesty's faithful and obedient servant." A notice by James Main in Loudon's Mag. Nat. Hist. (ii. 52; March, 1829) shows that 12 plates (two numbers) were then published; Loudon (*Arboretum*, i, cxci) says that nos. 5 and 6 were published in 1833.

It is in connection with these numbers that such botanical interest as the work possesses will be found. Prefixed to the volume is an essay extending over 26 folios, headed in very small capitals "Botanical Diversions I," followed by a large title "Amœnitates Querneæ." It includes a comprehensive account of the Oak in literature, history, poetry, and commerce: there is however no indication as to its authorship, although it was evident that it was written by a competent person and that Burgess had nothing to do with it beyond issuing it with his book. Dr. Daydon Jackson in his useful *Guide to the Literature of Botany* (1881) attributes it to Gilbert Burnett (1800–35), but at this distance of time does not remember whence he obtained this information; this will however be found in the *Arboretum*, as already quoted, where it is stated to be "by the late Professor Burnet" (*sic*). It is, as has been said, a very complete account: Loudon (*op. cit.* iii. 1722) refers to it as "a very curious and elaborate production—not so well known as it deserves to be; the history of the more celebrated Oaks is elaborated with much care, and the work as a whole should be consulted by anyone who may be interested in the subject." It may be noted that Burnett indicates various names not taken up in the *Index Kewensis* and proposes (fol. 3) three new ones for species already characterized:—

"Q. navalis [vel pedunculata]. The Ship or Naval Oak……

"Q. regalis [vel sessiliflora]. The Royal or Bay Oak……

"Q. Romer [vel pubescens]. The red-wooded, durmast, or downy Oak……"

James Britten.

SHORT NOTES.

New Variety of Tolypella glomerata. In examining a large number of specimens of *Tolypella glomerata*, we have come across some plants which, in the more rounded shape and the red colour of the oospore, exhibit a variation in the direction of *T. nidifica*. The decoration of the membrane is also somewhat intermediate in character between the two species, frequently showing smooth intervals between the granular lines. The points of difference from typical *T. glomerata* seem sufficient to justify the separation of the plants referred to as a distinct variety for which we propose the name ERYTHROCARPA:—Oospora late-ellipsoidalis c. 350–400 μ longa, coronulâ exclusâ, 300–350 μ lata; erythra, aut rubro-fulva aut rubida. Membrana lineariter-granulata, sæpe intervallas leves inter lineas granulatas exhibens.

The localities from which we have identified the variety are:—Anglesey, Llyn Coron (*J. E. Griffith*); Leitrim, Lough Melvin (*R. Ll. Praeger*); E. Donegal, L. Magheradrumman (*G. R. B.-W.*).

In typical *T. nidifica* the oospore is much larger than in any form of *T. glomerata*, and the membrane is wine-red in colour and quite destitute of decoration.—J. GROVES and G. R. BULLOCK-WEBSTER.

HYPERICUM HUMIFUSUM (p. 195). I possess a long analysis of the soils and habitats of this plant in Lincolnshire, and they practically agree with Mr. H. Stuart Thompson's notes and Bentham's, but methods of ecological research have been carried further. It is truly a woodland species, but not of the young thrusting growths, rather of the decaying stage, passing into *Calluna* moorland. The decay of our Pine-woods between A.D. 800–1400—*i. e.*, during the vine-growing period for wine—and later of our sandy Beech-woods, has practically ended this species with us generally, for it is only 4 to 6: 1 = very common, 2 = common, 3 = fairly common, 4 = rather rare, 5 = rare, 6 = very rare. It should always be most carefully noted ecologically when not on moorlands, if it is in the open; and even on them when with other species as *Pyrola minor*, *Equisetum sylvaticum*, and *E. hyemale*, as a proof of woodlands. Dr. F. A. Lees once told me that the plant was specially a bank species in West Yorkshire, I suppose on account of the heavy rainfall. It is not so in this dry county—at least I have not a single record in over 600 notes. It may be fairly classed as a lime hater, though it is often not so geologically, only ecologically; for the limey rocks where it is found are acid sandy above, or the upper-root soil is neutral from endless rain-wash and plant-decay in weathering—a species of moory humid soils in both cases. Here is a fifty years' soil list for Licolnshire—all the soils more or less sandy or peaty-decay moory: Lower-Lias-Clay 6; Lincolnshire-Limestone 6; Corn Brash 6; Spilsby-Sandstone 3–5; Chalky-Boulder-Clay 5–6; Sandy-Glacial-Gravel 6; Purple-Boulder-Clay 6; Plateau-Gravel 5–6; Old-River-Gravel 3–4; Modern-River-Gravel 6; Fresh-Water-Alluvium 6; Blown-Sand 4–6, rarely 1–2: quite fifty per cent. of the records are from this soil. Its habitats are: *Calluna* moors (85 per cent.) 1–4; Commons 2–4; Open-woodlands, rides, paths, scrubs and falls, 2–6; Pine woods 1–4; Oak-birch 3–4; Rough-pasture and golf-links, 5–6; Durmast oak-woods 6. In every known locality the plant occurs in open woods or as a residual of past ones. During the dry series of summers (1893–1910) the plant failed and departed, as did *Drosera anglica*, *Eriophorum angustifolium*, and many other species.—E. A. WOODRUFFE-PEACOCK.

—— Having spent a week among the hills north of Liskeard, E. Cornwall, and another in the Yelverton and Tavistock district of Dartmoor, S. Devon, it may be interesting to add to my note published in

July that in both those hilly districts this plant seems chiefly confined to the mossy crevices of stone walls and dry hedge-banks by road-sides on the granite and slate. Above Pensilva it reaches 800 ft. at least. Only twice did I observe it on heaths or commons (other than on the characteristic dividing walls of both districts); and though of rather frequent occurrence, it is, as everywhere, very thinly distributed, and there are rarely more than one or two plants at a place. That point was most noticeable. One plant was growing among a small quantity of Sphagnum at the edge of a diverted watercourse on the moor by Dousland, Yelverton. These observations tend to substantiate my belief that the distribution of *Hypericum humifusum* has been much affected by the agency of man.—H. S. Thompson.

Teratology in Papaver orientale. Noticing on June 11th one flower, out of many, in a large clump of the above-named Poppy to be of a peculiar erect and funnel-shaped appearance, I examined it more closely, and found it was indeed "corolliflorous," the petal showing no sign of seam or point of conjunction of any kind, being of perfect circular form, nor did there seem any sign of the basal "claws." Colour, the usual brilliant scarlet. So far as is discernible, the capsule seemed normal. I should be glad to know whether such an abnormality is of frequent occurrence. I have never myself observed anything like it previously. Measurement of petal 4½ inches long.—J. Cosmo Melvill.

[The abnormality is referred to by Worsdell (*Principles of Plant Teratology*, ii. 250; t. 51. fig. 10) as "one of the best known and most remarkable instances of sympetaly"; Penzig however (*Pflanzen Teratologie*) does not record it.—Ed. Journ. Bot.]

Mimusops parvifolia R. Br. In the recent number of his "Contributions to the Queensland Flora" (Botany Bulletin Queensland Dept. of Agriculture, xxi.) Mr. C. T. White points out that the plate and description assigned to *M. Kauki* in the *Illustrations to the Botany of Cook's Voyage*, "vol. 2, p. 59, pl. 194" should be referred to the species named above. The correction had already been made in the index to the volume, which Mr. White has overlooked. His citation of "vol. 2" is likely to mislead, as the work consists of only one volume, although it originally appeared in parts. *Diospyros longipes* Hiern in Journ. Bot. 1914, 338, is referred by Mr. White (*l. c.*) to this species.—James Britten.

REVIEWS.

Botany of the Living Plant. By F. O. Bower, F.R.S., etc. 580 pp.: Macmillan & Co. 8vo. 25*s*. net.

Professor Bower's new volume appears most opportunely at a time when the veneration of the more modern school of British botanists for everything German has received a fatal set back; and few things are more desirable than a definite presentation of the subject in an entirely English dress. To the rising generation, the works of continental writers will never acquire the hall-mark of super-scientific value with which they have been regarded; and as the Oxford University Press has apparently exhausted its supply of inferior translations, and the Cambridge Press has not yet found a satisfactory method of subsidizing really good work, Messrs. Macmillan are to be congratulated on filling the gap with an eminently readable and abundantly-illustrated volume of convenient size, though at an inconveniently high war-price. Seven shillings and sixpence should be about the limit for this class of work; the first edition of the Bonn text-book, of very much the same size and scope was issued at six-and-sixpence.

The volume comprises a series of 32 chapters, arranged as a sequence of lectures or pleasantly-written essays on plant-organization, beginning with the more familiar types of higher Land-Flora and extending in a cursory manner to some algal and fungus types, as generally introduced in an elementary course at all British Universities. The book in fact covers the general ground of all such class-work, and may be utilized for all elementary university examinations; though on the whole it is perhaps more particularly dedicated to the general scientific reader who wants a rapid review of a wide field, while the price will place it beyond the range of most students. After the experience of the Bonn text-book, in which four writers collaborate, it is a bold venture for one man to attempt an adequate presentation of the subject as a whole; but as this commonly falls to the lot of teachers in British institutions, it is interesting to see how Prof. Bower has covered the ground.

Emphasis as to the "Living Plant" is apparently intended to indicate that formal anatomy is cut down to the minimum; physiology possibly even beyond the margin of safety; while increasing attention is paid to the "biological" problems of the plant, as expressed in chapters on the "Water-Relation," "Mechanical Construction," "Vegetative Propagation," "Fruit and Seed-Dispersal"; the Angiosperm being covered in some 300 pages, few openings being without an illustration. As special features may be noted, a final chapter on "Sex and Heredity," while an Appendix in smaller type solves the difficulty of bringing in some sort of traditional account of Floral Families without trespassing on the main trend of the text.

The main chapters are written with the breezy directness one associates with the work of Prof. Bower, though one misses the dogmatic enthusiasm which led to the demonstration of *Lycopodium Selago* as the most archaic of Land-forms; and one's greatest admiration is exercised for the ingenious manner in which the writer so often evades the point rather than insist on any particular attitude or conclusion. Hence though the volume fulfils its mission of adding one more view of the subject to many existing works of much the same scope, it does not add any particularly new outlook on plant-life in general. One still finds little suggestion of answers to such fundamental questions as where a land-plant really came from, or why plants are made of cells at all, or why they reproduce in such an extraordinarily complex manner? While covering the conventional range of the subject very well, the writer does not break any new ground; and things have not apparently changed very much in the last thirty years of this teaching.

While acknowledging the care and multitudinous interests demanded in the production of such a volume, a botanical journal may be permitted to pick a few holes. As a detailed exposition of scientific botany the book does not compare in any way with the familiar Strasburger, though it may prove more attractive to the general reader. To the serious student the greatest demerit is the practically entire want of references to wider literature. The skimpiest account of any phenomenon may suffice in a text-book, provided one can be given reasonable references; such cases may be illustrated by the doubtful remarks on the vitality of seeds (p. 298); the speculations on the origin of Wheat (p. 548) which omit any reference to *Triticum Hermonis*; the case of *Cytisus Adami* without mention of Chimæra-forms, and the account of Mendelian segregation stopping short of the "sixteen square" which alone renders the subject of any practical value: even the account of *Protococcus* on the bark of a tree, on the very first page, may come as a shock to many algologists; Huxley's *Protococcus* had at least the merit of being flagellated. As examples of skating over thin ice may be compared the account of "falling starch" (p. 126), and the recognition of a *Fucus* plant as a "diploid sporophyte" (p. 387). The continual use of "germ" for embryo has an irritating effect, when the word is used in many senses from Bacteria to Germ-plasma, and much the same applies to the use of "egg" for oosphere; "Transpiration-Stream" is no improvement on the old Transpiration-Current, while "cohesion" and "adhesion" in floral organization seem somewhat archaic. Much of the text will bear steady revision, and many of the conclusions are loosely written:—"The whole vegetative system may be regarded as a physiological scaffold, while the mechanism of propagation is the substantive building which is erected by means of it" (p. 210), whatever it may be intended to imply, omits all reference to the fact that it is *reproduction* as devoted to the *improvement* of the race which is the main issue; similarly, "The Central Question of Evolution comes finally to the origin of the Heritable Mutations" begs the question as to why anything to begin with should be at all accurately heritable.

The publication of the volume also raises a wider issue; it undoubtedly epitomizes the class of work taught, not only at Glasgow by Professor Bower but also in many other botanical centres in this country, as the routine of "Elementary Botany"; and the point arises as to what extent this class of modern work, largely plausible and made "interesting," really does afford a foundation for accurate reasoning in terms of experiment, or deduction of generalizations from accurately observed facts, comparable with the general presentation of elementary chemistry or physics, with which botany, as the scientific analysis of the problems of plant-life, is expected to hold its own. Is "Elementary Botany" to deteriorate in "Nature Study," or is it to be an exact science in which facts are stated, and definite conclusions drawn, while the word "probably" is not so insistent at every point of difficulty. Students only too readily pick up the habit of vagueness and indefiniteness where precision is the more needed as the subject becomes the more complex. Professor Bower's volume may be thus welcomed as an admirable first draft of a useful text-book, and one may look for emendations in many details in later editions.

A Dictionary of the Flowering Plants and Ferns. By J. C. Willis, M.A., Sc.D. Fourth edition revised and rewritten. Cr. 8vo, cloth, pp. xii, 712, liv. Price £1 net. Cambridge University Press.

This work made its first appearance in 1897, when it formed the second part of the *Manual and Dictionary* which was noticed by Dr. Rendle in this Journal for that year (p. 109). The reviewer, while praising the *Dictionary*, criticized the *Manual* portion somewhat severely, and not without effect, as the notice of the second edition showed (Journ. Bot. 1904, 158). A third edition appeared in 1908 and was reprinted six years later: we now have it "completely revised and as far as possible brought up to date." The most noteworthy feature of this new edition is "the incorporation of all the parts into one general dictionary and the omission of Part I. of previous editions." The result is a volume which it would be impossible to commend too warmly. By an ingenious method of compression fully described in the introduction, an astonishing amount of information is conveyed. "All the genera of Bentham, Hooker, Engler, Prantl, and Linnæus are now included, as well as all given in the *Index Kewensis* and Supplements (except many synonyms) together with a large number published since the last Supplement, and which (*sic*) by the kindness of the Director at Kew, the compiler has been able to obtain from the MS. lists kept at Kew." Each name is followed by that of its author; then comes that of the family to which it belongs, with a statement of the number of species contained therein and its geographical distribution; "the histological peculiarities of the most important genera are dealt with pretty fully: in dealing with the pollination-methods of flowers a selection of important genera, illustrating the various methods, has been made; so too with epiphytes, xerophytes, the morphology of parts, and so on. Economic botany has been more fully treated, only comparatively few genera being omitted." English and colonial names are well represented, as are also botanical terms, with explanations. There are also general articles of considerable length, of which an index is given: the very full and practical instructions on collecting occupy more than four pages—the pamphlet on the subject issued by the Department of Botany should have been included in the literature indicated, than which it is more readily accessible. In an appendix is a key to the families of flowering plants, based on Engler's classification. In typography and arrangement the volume leaves nothing to be desired: it is a book which should find a place in every botanical library, however small.

We note that Dr. Willis invites additions and corrections, and even provides a "slip" on which these may be entered. The pages of this Journal will provide him with some: thus Miers's genus *Micræa*, entered as "Inc. sed.," was identified as long ago as 1880 (p. 20) with *Ruellia dulcis* Cav.; *Decadia* Lour. "inc. sed." is in the same Journal for 1914 (p. 146) shown by Mr. Moore (*op. cit.* 148) to be identical with *Symplocos,* as is also *Dicalyx* of the same author, which Dr. Willis omits; we miss Mr. Moore's *Capitanopsis* (*op. cit.* 1916, 249); his identification of *Phocea* Seem. (*op. cit.* 1918, 204) perhaps came too late for inclusion: but enough has been said to suggest a more careful search than appears to have been made.

The Living Cycads. By CHARLES JOSEPH CHAMBERLAIN. xiv + 172 pp., small 12mo cl., price $1.50. University of Chicago Press.

MR. C. J. CHAMBERLAIN has been engaged in the study of Cycads for over fifteen years, and his paper on the reproduction of *Dioon* (1906) will be regarded as a classic. The present handy little volume contains a general account of the living types of this remarkable group, and is preliminary to a more detailed monograph. The text comprises a useful summary of the more important factors of somatic and reproductive organization of the leading types, in the simplest terms possible; and in the theoretical discussion evolutionary dogma is not pressed beyond its legitimate bounds. The numerous clear illustrations aid in affording a very definite idea of the botanical interest and value of the living survivors of a once mighty race.

Perhaps the part that will be found of greatest interest to British readers will be the account of the plants as found growing in their natural surroundings in the West Indies, Mexico, South Africa, and Australia. For such information, at first hand, the author holds a unique authority. It is also a somewhat curious reflection that the types least known in essential details are those of our own colonies—as the great *Macrozamia* of Queensland, in process of extirpation, *Bowenia* and *Encephalartos*.

In a book intended to be semi-popular, exception may be possibly taken to one point—the prominence afforded to sexual terms as "female plant," "female" sporophyll, eggs and sperms. One might perhaps put up with "ova," but there are certainly no "eggs" in plants, and "fruiting" individual is quite as effective, and much more accurate, than "female" as applied to a tree. There is nothing in the way of sex-differentiation in a plant which may not be covered quite concisely and intelligently by "micro-" and "mega-" (whether in reference to "spore" or "gamete-" mechanism); and where all the customary terms are employed, it would be a matter of congratulation to find a botanist capable of choosing definite and accurate expressions, and scrapping all others.

A. H. C.

BOOK-NOTES, NEWS, ETC.

At the meeting of the Linnean Society on June 19, Mr. T. A. Dymes read a paper entitled "Notes on the Life-history of the Yellow Flag (*Iris Pseudacorus* Linn.), with special reference to the seeds and seedlings during their first year," of which the following is an abstract:—The xerophytic adaptations and contractile roots of the plant are a protection from some of the dangers of the physical world. Its acridity and astringency protect it from being readily eaten, but the larvæ of some insects feed upon it, those of a sawfly do considerable damage; a few molluscs resort to it for food. It appears that wild-fowl eat the seeds and the very young seedlings; it is also attacked by a parasitic fungus. Its height and strong growth protect it from practically all its associates. The plant hibernates and the normal minimum for the seeds is about seven months, the maximum being not less than twenty. It flowers in its fourth year; the capsules begin to dehisce in September. There are two kinds of seed, flat and round, and the difference between them has some significance both in dispersal and in germination. Uninjured seeds float for two years or more. The most important of the agents are diving wild-fowl and the least the wind; running water plays a very considerable part. The flat seeds are adapted to long-distance dispersal by wild-fowl and to being blown short distances by the wind. The round seeds, with the exception of those afloat on running water, serve to fill up the death gaps at home. There are two phases of germination:—(1) Internal plumular growth followed by (2) the extension of the radicle, the latter requiring the higher temperature. Seeds that have sunk automatically possess an internal water supply and germinate more freely than the floaters. The essentials are continuous moisture coupled with a high temperature. Floaters, seeds at the bottom of shallow water, and those in saturated mud, succeed best: under the most favourable conditions a full 40 per cent. germinate in their first year. In nature the general average is probably 20 per cent. The round seeds appear to germinate in the first year more slowly and to yield a lower average than the flat ones. For seeds in their second year the general average in nature seems to be about the same as for those in their first, 20 per cent., but a good deal more evidence is required. Burial of the seeds is effected by dead leaves and debris, and they are also trodden into soft mud by water-birds. The chief difficulty of the seedling from an unburied seed is to secure anchorage. Frost and air-bubbles lift or uproot the young seedlings. The floaters, which when borne afloat can be distinguished from the mud seedlings by the root system, are exposed to great dangers; when together or in debris they erect themselves, but unless they drift on to mud or into the shallows either before or after erection they are doomed to death. The height to which seedlings attain during their first year varies from two inches for the flat-floater to thirteen for those in mud from first-year seeds and 19½ inches from seeds in their second year. The seedlings perish in inconceivably great multitudes, and probably the vast majority of the floaters are a dead loss to the species.

At the same meeting Mr. S. L. Moore followed with "A Contribution to the Flora of Australia," which contains notices of rare and descriptions of new Australian plants preserved in the British Museum. Robert Brown's *Tribulus Hystrix* and *T. occidentalis* are shown to have been misunderstood by Bentham and succeeding writers, Bentham's *T. Hystrix* being really *T. occidentalis*, whereas *T. Hystrix*, unknown except in the type specimen, has much larger fruit with long subulate appendages quite unlike the short conical ones of *occidentalis*. Two recent West Australian collections, one by Dr. Stoward, the other by Mr. Maryon, have yielded many novelties, the most interesting being a second species of the Goodeniaceous genus *Symphyobasis*. This genus is peculiar in having an inferior calyx, but a corolla united to the ovary all the way up, together with epigynous stamens. A third part of the memoir relates to plants collected in various parts of the island-continent during the nineteenth century. Among the collectors of these special mention was made of Allan Cunningham, Rev. T. S. Lea, George Maxwell, and lastly of John Gilbert, among whose plants have been identified specimens of the recently described *Psammomoya choretroides* Diels. & Loesn., remarkable among Celastraceæ for its leafless habit. Gilbert explored in Queensland and West Australia for Gould, the ornithologist, but also did good botanical collecting; he was killed by natives in 1845 near the Gulf of Carpentaria. One new genus, *Leptospermopsis*, is proposed, differing remarkably from *Leptospermum*, which it much resembles, in the andrœcium.

Science Progress for July contains a long "article" by Mr. T. G. Hill on "The Water-Economy of Maritime Plants," dealing especially with the absorption and transpiration of water by halophilous plants, particularly by *Salicornia* and *Suæda*. Dr. Winifred Brenchley has an "essay"—the reason for the distinction between articles and essays is not obvious—on "The Uses of Weeds and Wild Plants," in which a great deal of information is brought together: the writer's acquaintance with recent British botanical literature does not seem to be extensive, as the authors chiefly referred to are Hogg and Johnson (1863), C. P. Johnson (1861–2), Anne Pratt, Woodville (1790–92), and Wilson (1847). Under "Recent Advances in Science," Dr. E. J. Salisbury summarizes papers published in various departments of Botany—the paragraphing might be improved—with the exception of Plant Physiology, which is undertaken by Mr. Ingvar Jorgensen. The singularly useless page-headings, to which we have already called attention, are continued, so we must assume they have some justification not obvious to the ordinary reader.

The *Journal of Genetics* for June contains two botanical papers: one, by E. J. Collins, on "Sex Segregation in the Bryophyta," based upon the papers of El. and Em. Marchal, but with much additional evidence, and a plate: the other on "Double Flowers and Sex-Linkage in *Begonia*," by Mr. Bateson and Ida Sutton, containing a series of observations and experiments on *B. Davisii*, of which a coloured plate is given.

BRUNFELS AND FUCHS.

By A. H. Church.

The projected issue of a second volume of the *Cambridge British Flora*, with a prospect of the continuation of this much-needed work, spaced over many years to come, as also the criticism it invites—that somehow it is not the sort of thing the ordinary British Botanist would put forward as his ideal of what a future work on indigenous vegetation should be (especially in the matter of figures, or even price),—suggests a comparison with the production of similar works in the past. Though the ordinary botanist may not be conversant with the complications of a modern University Press, he can comprehend the methods of meeting similar problems on the part of ancient craftsmen, who worked more or less single-handed; and it is legitimate to compare the results.

The original standard for all subsequent volumes of illustrations of plants was set up by the genius of one man, Leonard Fuchs *(1501–1566), a leading physician and professor of his time, a wealthy man of considerable influence and with great insight into the scientific needs of his day. His volume 'De Historia Stirpium,' published at Basle (1542), is generally recognized as the starting-point of floristic work, in addition to its significance as a compendium of the 'Virtues of Herbs.'

This volume comprises over 500 (519) folio drawings, with associated text, of plants growing in South Germany, drawn directly from nature, where possible of life size, on a page 14 in. by 9 †. Portraits of the men responsible for the figures, Heinrich Füllmaurer and Albrecht Meyer, are shown on the last page, with the methods by which they worked ‡, and also, as a special *chef d'œuvre* of his own wood-cutting, that of the engraver Vitus Rudolph Speckle. Bearing in mind the fact that Fuchs was at the time in his forty-second year, that Speckle as 'the best engraver in Strasburg' apparently cut all the blocks, and that the material had to be collected and drawn mainly in the summer months, it is evident that at the rate of a block a week, the work would have taken ten years to complete §, and that Fuchs must have conceived the idea when a comparatively

* *Cf.* Sachs, *History of Botany*, Oxford (1890), p. 20; Arber, *Herbals*, Cambridge Press (1912), p. 58. A number of figures from Fuchs and Brunfels are reduced for illustration in Mrs. Arber's volume; and page references will be given for Arber (*Ar.*), Brunfels (*Br.*), and Fuchsius (*F.*). On the whole, *Ar.* figures are coarse parodies of the originals.

† The letterpress block averages 11 in. by 7, and the illustrations 13 by 8 ($12\frac{1}{2}$–$8\frac{1}{2}$); an approximation to the ϕ ratio, which has been regarded as the expression of perfect taste, the more remarkable as modern books tend to a squarer sheet.

‡ Füllmaurer is shown making the final copy on the block, and Meyer is sketching a plant standing in a pot on the table; the plant is naturally drawn, but Meyer's figure is already conventionalized, and not much like the copy—possibly a joke on the part of the other man who drew it.

§ The issue of a somewhat similar collection of 500 figures of British-grown plants from drawings from nature, by Baxter, at the Oxford Botanic Garden similarly took 10 years (1833–1843), and worked out at the rate of about a plate a week: *cf.* "Biographical Notes, LXXIV.," *Journal of Botany*, 1919, p. 58.

young man, some time after 1530, and possibly while he was teaching at Tübingen (1535), and subsequent to the death of Brunfels (1534).

This conception of Fuchs, the first in botanical history, of deliberately devising a course of work and study on an indigenous flora, in addition to the medical standpoint of illustrating the herbs of the national pharmacopœia, was a great and original one, and it was carried out on broad and generous lines. He selected a page, folio size, as adapted to the dimensions of the general range of herbs which can be handled readily; the work was beautifully printed on good paper, which in an undamaged copy is as clean and good to-day as it was in 1542. Typography and make-up were perfect, and far superior to much of the work of subsequent herbals a hundred years later*. His illustrators were evidently well-trained and capable draughtsmen, brought up in the best school of the art and technique of the day, while Speckle the engraver, as shown in the cutting of his own portrait was an equally superior craftsman in his own line.

The special interest of the work of these men lies in the fact that they were not *botanists*, nor even *naturalists* in any sense as we should say to-day; there is no evidence that they had any taste for Botany or any æsthetic perception of the beauty of flowers: they drew the plants given them, and drew what they saw in very correct proportions and detail, as good draughtsmen, and greatly improved as the work proceeded—it is as remarkable to note how much detail they really did see, as to note what they left out. The technique of the work, using a line 250 μ wide, scarcely admitted of the representation of any really fine detail, as hairs, stamens, or parts of small florets less than 1–2 mm. diameter. But as draughtsmen, retaining a sense of proportion and balance, as in the form and arrangement of foliage-leaves, they had ultimately little to learn; while as designers, they showed a sound instinct for placing a type on paper and displaying it, even to the extent of more than a slight conventionalization in the design. They were more at home with fine large herbaceous plants suitable for decorative treatment, than in the strict natural study of the minutiæ of an organism, and even the name and number of the plant are conspicuously well placed †.

Perhaps the most striking feature of these plates is the recognition of the fact that these early draughtsmen did not pick and choose bits for illustration; they drew the whole plant, roots and all, as a scientific and dignified presentation of the organism as a whole. To give a man, for example, a cabbage, root and all, a quill pen or a fine brush, and to tell him to make a finished artistic presentation of it, in line only, on a sheet of foolscap, is no mean test of craftmanship. The solution of such a problem by the draughtsmen of Fuchs (F. 416: Ar. 59) may well be studied by any who propose to illustrate a British Flora ‡.

* *Cf.* in this country Gerard, ed. 2 (1633), Parkinson (1640).

† Ar. 149, 147, 126: F. *Quercus*, p. 229: above all, they did not worry to put their initials in the corner of every figure they did.

‡ Ar. 59. Much spoilt in reproduction (the original is much finer): the line block still prints at 250 μ, although reduced nearly $\times\frac{1}{2}$. Good process-blocks print clearly on smooth paper at 100 μ. F. 416: Curly Greens, 414, less satisfactory, the spiral arrangement of the leaves being omitted.

In these days when cheap methods of photographic reproduction have destroyed the future of wood-engraving, and cheap illustration implies the plainest line-work with no 'shading' to conceal deficiencies of workmanship, rapidity of work and output being considered more desirable than careful drawing, which takes time as well as skill—the tendency of botanical illustration will be to return to pen-work of the kind done by these old masters: line-work as represented by copper-plate engraving of the last century being also extinct, though undoubtedly in its capacity for delicate detail the ideal method for plant-representation *. For this reason the work of such draughtsmen as those of Fuchs, who set the standard for the sixteenth century herbalists of the Low Countries, from which all subsequent herbals deteriorated † for a hundred years (Parkinson, 1640), deserve to be more thoroughly studied by botanical draughtsmen of the present day.

These general remarks serve to draw attention to the probability that Fuchs did not originate the whole of this conception entirely *de novo*, but that there must have been some earlier work on which to build. Every botanist has to learn his science from a preceding generation; the very efficiency of Fuchs' work, "the culminating point of plant-drawing as an art" ‡, implies a something behind it, of which it may be the glorification, but on similar lines.

This work is seen in the more unpretentious volume of Otto Brunfels (1530–31), which stands out as the first recognized work of scientific botany of the new era §. Brunfels' work suffers from many deficiencies to our eyes, it is true; so does that of Fuchs: these do not require to be emphasized; the point is to distinguish its great advance beyond anything previously attempted or thought of; and to value it as giving the clue to the work of Fuchs which tends to overshadow it. From the little that is known of Brunfels, it may be gathered that he was not in inordinately good circumstances; he had been educated from a plain youth in a monastery, and he followed the profession of a schoolmaster at Strasburg, and ultimately that of a doctor in private practice. His book appeared in 1530, when he was apparently 66 years old, and thus beyond any youthful enthusiasm; while he died in 1534, not long after its partial completion (1531). The

* Sibthorp, *Flora Græca* (1806): Sowerby, *English Botany* (1770): Curtis, *Flora Londinensis* (1777): Baxter (1834): Sargent, *Silva of North America* (1892).

† Fuchs' noble volume *de luxe* was copied in many countries, and rapidly passed through translations and cheaper editions; the figures being first reduced to $4\frac{1}{2}$ by $2\frac{1}{2}$ in., the standard block affected by the Antwerp Herbals; and even to $2\frac{1}{2}$ by $1\frac{1}{4}$ in. (1550). Many of these illustrations lasted long in 'waistcoat-pocket herbals' (Du Pinet, 1561; Linocier, 1620). Such figures attempting to represent entire plants in quite a few lines are interesting examples of reduction, and are on a fair way to imitate Sumerian pictograms. The only work which really set out to improve on Fuchs is Besler's *Hortus Eystettensis* (1613) with copper-plate figures on a page 21 in. by 16, large enough to take a full-size Sunflower head. The book requires a wheel-barrow to take it about, but the figures are merely large and do not express increased detail.

‡ Ar. 175.

§ Sachs, Hist. Botany, p. 14: Arber, p. 47.

engraver of his blocks is known (Ar. p. 50), but the draughtsman is not otherwise recorded *. From internal evidence it may be sufficiently assumed that Brunfels drew the figures himself; he had little money to pay for them being done, and in the absence of any other claimant he should certainly be credited with them. No one but the man who had spent hours over them could have so insisted on the value and truth of his "vivæ eicones" †.

The figures are relatively few, inserted without special plan, and consist of individual *studies*, clearly done without premeditation, and not given for every plant, as they might have been if commissioned. The first volume contains 83; the second, published in the following year, 49: it is thus probable that the latter gives the time of engraving, at about one a week; and there seems every possibility that the figures were drawn by Brunfels in his younger days (a man does not do such fine work when over sixty), and that the existence of these figures determined him to publish the accompanying text, which is a compilation of no great value. It is interesting to note even at this early date the list of 47 authorities consulted; many of these are little known as botanists, the work being of a medical nature rather than scientifically botanical, except for the figures. The inclusion of these was evidently a special idea of Brunfels on his own initiative. He thus appears as the earliest Nature Student, of the type idealized by Ruskin, with a capacity for observing small points far beyond his time, and in fact beyond many who came after him. Even Fuchs' men attached no importance to the smaller details of a flower, and rarely drew them; they became great at 'stem and leaf,' but floral form and mechanism was beyond them, as also such minor points as bracts, stipules and adventitious roots. The first part (1530) shows Brunfels rather in the hands of the publisher, who inserted the title-page of the period (including a doubtful Venus, more definite Silenus, Dioscorides, and a melancholy Apollo with a 'cello); a flamboyant red and black escutcheon spoils a whole page, and large Biblical initials are used (the P of *Plantago* records Lot's daughters and the Pillar of Salt). In the second part (1531) such mediæval excrescences are removed; the title-page is sensible as a plain design, one ornamental border is retained for contents-page, and the initials are taken from a good fount. The make-up of the volume thus passes from one epoch to another. His page-block is 9½ in. by 5½ (or 10 by 6; again a good ratio); but only half the figures are printed on a whole page; the others are incorporated with the text. There is no attempt to design the page; a big plant may be doubled up to make it go in. (Ar. 48); small ones are put in corners; but are well arranged (vol. ii.) with the text balancing the design. (*Alchemilla*, ii. 53.)

As plant-studies, these figures are still admirable in every respect. It is difficult to realize that the man who did them knew no botany,

* Arber naively suggests that the engraver drew them—so used are we to the inferiority of the artistic profession; but there is no reason why they should have been so done, any more than modern work is left to the printer or process-engraver.

† "Summa cum diligentia et artificio effigatæ,": and truly so.

as we should say nowadays, and did not know the names of the parts or their functions; but merely copied them faithfully. He even copied the broken leaves and drooping damaged shoots *. He is also great on roots, fibrous, adventitious and borne at the nodes, or pulled up and stripped clean. Fuchs' men inclined to treat roots as decorative fibrous growths (F. 52, 88, 192, 317, 453, 623, 715). Brunfels had not evolved the idea of putting flowers and fruits on the same inflorescence, so common with his successors.

The figures of both Brunfels and Fuchs are often criticised, and, what is just as bad, admired, by people who have not the slightest idea of what they were intended for, or how they were done. These men did not set out to make pretty pictures or artistic sketches. In the absence of modern botanical superiority all parts were equally valuable. The whole plant was considered as an organism, roots and all: they were not biassed in favour of roots because these were used in medicine; roots do not form a predominant feature of the Materia Medica, any more than in Horticulture and Agriculture. Pharmaceutical material is restricted to the parts which may be more readily handled and stored without damage †. To dig up a plant and wash it clean, with as little damage as possible to radical leaves, etc., and then draw it, presents an aspect of the type very different from the same form growing in the ground. Anyone can try this for a Crocus or Daisy, Primrose or a White Dead Nettle (Br. i. 152) ‡, without attempting the more difficult case of a succulent Comfrey or draggled Water-lily. It is our own ignorance of the plant as a whole, and a preference for pretty floral shoots, which makes the rooted plants of the herbalists appear strange. It may be noted that neither Brunfels nor Fuchs, even at their best, went out of their way to find foliage-shoots with insect-eaten leaves as increasing the artistic effect. It is not to be supposed that all these figures are equally good; if they were they would be better known; but the marvel grows that they were apparently the first studies of the small and trivial plants of North Europe to be put on record in a scientific work §.

Among the finest examples of Brunfels' work, which thus appear

* Arber (p. 172) alludes to this as a failing, in the evolution of the 'ideal' figure; but this was before the days of the *Cambridge British Flora*: *cf.* Hunnybun, 74, 84, 91, 105.

† Dried stems, leaves, bark, roots, rhizomes: *British Pharmacopœia*, 10 % roots, 10 % rhizomes.

‡ One can see in Brunfels' figure the clinging of the wet root-fibres.

§ Nor need it be supposed that people in the sixteenth century could not draw. A charming study by Albert Dürer, 1526, (Ar. 168) of a Columbine and some grass, shows the perfect delicacy of possible presentation; the flower is poor, and if cut as a line-block would be no better than that of Fuchs (102): but making sketches, and figures for reproduction that can be cut in recognizable form by the engraver, are two very different propositions. The engraver and the printer are the stumbling-blocks, as admirably exemplified by Arber's valuable work, in which *Herbarius* and the *Ortus Sanitatis* seem quite at home. The same may be noted for example on comparing original drawings by Doyle with the early cuts in *Punch*: even Du Maurier has left on record his 'weekly pang.' The emulation of fifteenth century printing is not restricted to the Cambridge Press: translations of Pfeffer, Jost, and especially Knuth, by the Oxford Press, are similarly defaced by crude block printing.

as samples and specimens of technique, rather than a definite set course of illustration, may be mentioned the *Anemone Pulsatilla* (Br. i. 217), a beautiful study both in drawing and engraving of a softly hairy type (much spoilt in Arber, 171); a study of a Colts-foot shoot, pulled up and flagging (Br. i. 41) is good enough for a modern drawing-copy, and will be referred to later; the first drawing of a fern, *Scolopendrium* (Br. ii. 40: Ar. pirated reduction, 174). Examples showing the method of work, with flagging leaves or damaged basal portions, may be found in Tway-blade (i. 282), Wood-Anemone (ii. 80), Burdock (ii. 61), Saxifrage (i. 185)—the care taken in doing the figures shows the exact condition of the specimen. Further details may be noted in:—the Herb-Robert (ii. 37), from a dry situation; a small cut, yet showing flowers and fruits; the former with 5 petals and 5 stamens; even the sepal-fringes are indicated; the Wild Strawberry (ii. 35) shows runners and an offset, flowers and fruit; the fruits pendulous and the dichasial construction properly drawn; the Tway-blade (i. 182) is correct in the scale-leaves on the axis, the details of the flowers and buds, and the drooping of the wilting inflorescence; the Lamiums (i. 152) have quite well-drawn corollas with hoods; *Salvia* (ii. 26) shows the extended bilobed stigma; in *Helleborus* (i. 30; Ar. 49) the prefloration of the sepals is correct, and nectaries are indicated as well as stamens—the fine scale-leaf at the base is particularly well figured; the Yellow Flag (Br. ii. 47) is arranged to show two tunnels of the flower, with stigmatic flaps, the third being foreshortened, in the neatest way possible, though not clear at first sight. Knowing what the details of the flowers really are, one of course expects to see them in a botanical figure nowadays: but such details are not found in other herbalists; and modern floras may be conspicuously poor in representing detail which is there, but not seen. The sets of Plantains (i. 23–25), Malvas (ii. 70–72), and Orchids (i. 103–106) are particularly good: one of the last indicates the spiral twist of the ovary: the Bee Orchis and the *Spiranthes* are quite characteristic—the small flowers on the spiral of the latter show up with a lens.

Most remarkable of all perhaps are the figures of *Nuphar* (i. 36) and *Nymphæa* (i. 37), drawn the full size of the page (10 in. by 6½); these are the boldest types of the work, printed to face each other; the *Nymphæa* blossom is arranged to show the 4 crossed sepals, stamens, stigmatic disk, and apical papilla; the dead submerged blossom and the sizes of the coming buds, as also the rhizome with its phyllotaxis scars and a lateral vegetative bud (Ar. 141, details lost in reproduction) *. The *Nuphar* again shows the pattern on the stigmatic disk, the leaf-scars of the rhizome with their peculiar adventitious roots, as also the broken submerged leaves, some completely worn away. The idea of getting a complete specimen of such a plant at all at this date expresses the initial difficulty of the problem, and is a lesson to

* According to Arber (p. 172) this figure exactly expresses a Water Lily plant 'buoyed up by the water.' This misses the point of Brunfels' method. Really it is an entire plant dug up, washed and arranged on a table, and drawn as it was with the leaves spaced out flat. A water-lily does not grow like this at all, the leaves are arranged in a quincuncial rosette; the flower is erected.

modern illustrators who collect bits of plants or one flower, and are ignorant of the whole.

These two figures are of the greater interest in that being so completely satisfactory they were copied by Fuchs' men, and very badly copied at that. The appearance of adaptations of these figures in Fuchs (535, 536) is sufficient evidence that the former had Brunfels' work as a guide: while their mode of dealing with them sufficiently displays their weakness as copyists and scientific observers (proof of copying is always given by the reversal of the figure in cutting and printing a second time: *cf.* Ar. 141). The adaptation of *Nymphæa* is badly done; the central detail of the flower is ignored, and made a decorative muddle; the aspect of the plant is wholly changed by the thickening of the petioles, and by losing the sense of the long straight stalk of the flower: the detail of the rhizome is left out. On the other hand, *Nuphar* is deliberately faked till it is almost unrecognizable; the curves are lost, the petioles thickened and all the damaged submerged leaves repaired by transferring those of *Nymphæa*-pattern: a second flower, a failure, is added to complete the picture, though *Nuphar* shoots do not produce two blossoms at the same time. Uncomprehended details of the rhizome and roots are equally scamped: it is obviously more difficult to repeat a misunderstood abstract drawing than to copy concrete examples of the living plant *.

The fine effect of these two bold figures, filling opposite sides of the same opening, shows at once the origin of the idea of Fuchs in taking a still larger page, and so fixing the size of the future herbal. While in Brunfels the figures are mainly "illustrations" to illuminate and decorate the text, which does not explain them—only half of them being printed as whole-page figures, and the others incorporated with the text, often so neatly that the text balances the design,—Fuchs definitely inaugurated the "page-plate" as we term it; and each figure stands as an individual design without reference to anything else †. That subsequent herbalists (Matthiolus, Lobelius, Dodonæus) all descended again to text-figures, must not obscure the fact that Fuchs first clearly saw the advantage of the best drawings of Brunfels, and gave increased significance to his illustrations as distinct from the text. The fact that the production of these plates must have taken some years after the death of Brunfels, and that it is evident that the work of Brunfels was in the hands of Fuchs' men, suggests more definitely that they used this work as a basis on which to *learn* their botanical methods; and that the curious difference in merit of some of their designs indicates their gradual improvement as

* It is interesting to trace the further decadence of these figures in the successive reduction of Fuchs' blocks in translations; cf. French Trans. (1549) cciii., 4½ by 2⅓ in. and (1550) Lyon, p. 374, to 2¼ by 1¼. In the smaller texts (Du Pinet, Leyden, 1561, p. 404; Linocier, Paris, 1620, p. 412) they are replaced by still inferior copies of a picture-block from Matthiolus (Ar. 144). The 4½-in. copies may be seen in Turner (1551), ii. p. 65; but being poor they are replaced in other herbals (Gerard, etc.).

† Only a couple of small figures of Mosses are printed in Fuchs as text-illustrations—*Polytrichum* with gracefully-curved setæ (p. 629).

time went on*. In this way the evolution of the botanical plate at its best may be traced in the pages of Fuchs; this explains the remarkable inequality of the work; a fine drawing being often closely associated in the more or less alphabetical arrangement of the text with an inferior 'mediæval' one. It is, for example, difficult to believe that the same men drew 747 and 751, 463 and 467, 883 and 886, 286 and 289, if we did not know by personal experience how a few years will improve a system of technique. The drawings of Fuchs may be classed as good, indifferent, and very bad; the bad ones of some of the commonest and often least effective forms being their first rather crude attempts at floral work; while in their best efforts, after some years of training, the possibilities of their craftmanship become apparent.

Nothing brings out the value of Brunfels' figures more clearly than their later imitations. Brunfels' plants were mostly small and quite common weeds, in which the greater care was necessary to preserve a resemblance to an easily recognized growth-form; and these would be just the types non-botanical designers would find most difficult to tackle. [Who can mistake the flower Brunfels figures as one he didn't know the name of (ii. 80 '*Herba sylvestris ignoti nominis*'?)—and what was the point of putting it in the book if he hadn't drawn it himself?]

Thus Brunfels' *Viola* shoots (i. 135) are delightfully natural; Fuchs (311) is very feeble in comparison. The Pansy of Brunfels (i. 69) is a good figure of the Corn-field form, with vivid details; Fuchs' (803) is hardly recognizable as a Pansy at all. Brunfels' Hart's Tongue is the earliest line-study of a Fern (a reduced pirated copy Ar. 174), but that of Fuchs is childish beside it. Brunfels' Yellow Flag (ii. 47) is very good for a large plant with a complex flower, and the flower is correctly drawn; that of Fuchs is distinctly poor. Similarly, it is only necessary to compare the Plantains (B. i. 5, F. 39, Ar. 149); Malvas (B. ii. 72, F. 508); *Scilla bifolia* (B. i. 184, F. 838); *Ficaria* (B. i. 215, F. 867); *Delphinium* (B. i. 83, F. 27); *Asarum* (B. i. 71, F. 9, Ar., spoilt, 169: and *Cambridge Flora*, i. 113) to see that Brunfels is well ahead in scientific perception as well as in draughtmanship.

Others are equally interesting as showing, even with the help of fresh specimens, the effort of Fuchs' men to copy Brunfels rather than to copy the plant. Cf. the *Alchemilla* of Brunfels, ii. 53, F. 612; Saxifrage (B. i. 185, F. 747); Groundsel (B. i. 120, F. 612); Sanicle (B. i. 80, F. 671). The Ivy (B. ii. 3 and 4) is obviously the inspiration of Fuchs, 421; yet how much superior is the shaping of the umbel seen from below, in Brunfels. The *Helleborus* (B. i. 30) is a beautiful study, that of Fuchs (274) is very poor, but it shows it is a flagging specimen, and so one of the older figures, before it occurred to them that the plants looked better if kept in water. The

* The same thing is very strikingly noticed in Baxter's amateur production: the first plates (1833 and undated) are extremely poor, only after 2–3 years was the possibility of the simple method worked out: there is thus some hope for the further improvement of the *Cambridge British Flora*.

Strawberry of Brunfels (ii. 35) is again botanically admirable within its limitations, with regard to the dichasial inflorescence, runners, and flowers; but in Fuchs (853) it is particularly badly done; fruits are added to the flowering inflorescence, there are blossoms of two sizes on the same axis; the leaf-arrangement and shoot-construction, recognizably correct in Brunfels, are hopelessly bungled, and the biggest fruit is erected. The case of the *Coltsfoot* is of special interest, because it is again illuminative with regard to the original mode of work. The block of Brunfels (i. 41) is a distinctly fine study of a pulled up summer leafy shoot, with broken rhizome and wilting lower leaves. The same shoot cooked appears in Fuchs (F. 140, Ar. 147), reversed, the drooping leaves touched up, and two inflorescence axes added. Everybody knows how straight these axes stand, and the drooping of the older capitula. The graceful curves, and the insertion of the new shoots out of sight behind the petioles, shows the ingenuity of the fake, as well as its definite disregard of the facts of the case. The intention, however, was undoubtedly good, that of giving different aspects of the plant in a composite figure; and the same applies in a cruder manner to the Strawberry; but Brunfels was the more scientific.

These presumably earlier figures based on Brunfels, and always much inferior, present an earlier aspect of the work. It was succeeded by a long period of indifferent studies representing the slow improvement of the draughtsmen, and probably also of the engraver of this particular class of work. The cutting of the earlier figures is as poor as the draughtmanship, with a thick coarse line (*Asarum*, F. 10); and perhaps half the plates may be included within this epoch.

But once beyond this stage, and beginning to acquire facility in handling leaf-form and spatial arrangement, improvement is very marked; if the illustrations had not got beyond the preceding stage they would have never attracted any attention beyond those of Bock, Matthiolus, or Tabernæmontanus. The new departures undoubtedly express the result of several years' experience on the part of men, originally formal draughtsmen and designers, who had now been put through a course of nature-study, direct from the plant, in the manner of Brunfels; and though still ignorant of scientific "botany," the results were wholly beyond expectation. Many of the older blocks are quite fine designs, and might be done by artists of no botanical knowledge; like many nowadays, in the ordinary course of conventional art-instruction. Thus the Vine (F. 84) may be a good drawing, but it is not a botanist's idea of *Vitis*; nor is the beautiful conventional figure of the Oak Tree (F. 229), which might be used for a book cover: *cf.* also the Hop (164), Plum (403), Pumpkin (701).

The first advance is noted in the improvement of the aspect of the leaves in shape, insertion, angular divergence, and perspective—quite a large number of plants afford fine studies of foliage; the decussate types begin to be well done; in the case of the Teasel, a bijugate system is well-expressed (224), Ar. 176; spiral forms take some doing, and there may be at first a tendency to leave out the leaves on the off-side of the stem: but some of the finest plates show a really remarkable sense of 3-dimensional space-form: *cf.* 56, 57, 72, 129, 142, 190, 213, 289, 299, 331 *Isatis*, 463 Good King Henry, 469, 674, 751, 792, 829, 823.

Other figures are especially characterized by the breadth and dignity of the design as a whole; and these naturally attract the most attention, even if the botanical details be a little vague: but such types are the joy of the book, and give it its value as a work of art. Cf. *Paris* 87, *Clematis* 77, Gentian, with one blossom centred, 200, *Lactuca* 299, Melon 368 (design better than the botany), Cabbage 416, Pea 627 (with a centred pod opened, good enough for a work on Mendel), *Petasites* 644, Ar. 126; Radish 660, Comfrey 695, *Ecballium* 705, Millet 771, Mullein 848, Cowslip 850 (for once beyond Brunfels' i. 96, washed-out plant).

Finally, there remains the new departure of the more definitely scientific diagram, in which a composite structure is built up to express facts drawn from the life of the plant at different seasons—whether of flower and fruit, or summer and winter habit; the whole being fitted into a conventional growth-form, planned to fill the plate-space. The idea lacks the perfect scientific accuracy of Brunfels, and is obviously open to abuse, may be readily misunderstood by the ignorant, and may serve as an excuse for malrepresentation of the facts; but it is a distinctly legitimate method to attempt, and appeals to the designers, though the verdict of succeeding generations has been against it. These figures are clearly due to the direction of Fuchs himself; they give the botanical value of the work, and the method grows from small beginnings—*e. g.*

The early mediæval oak (229) is touched up by adding acorns and their cups as separate items. The Arum (F. 59, Ar. 179) with a dead shrivelled spathe and spadix, suspiciously the reversed one of Brunfels (i. 56), has a fruiting specimen added, and an interior of the bottle-cavity, with remarkably correct detail of ovaries and stigmas, etc. The figures are kept separate; a more crude effort in *Dracunculus* (234) fits the fruits and the spathe on the same stem; and must be so far regarded as a definite failure. The same applies to the Columbine (102) and *Paeonia* (202); though the practice lasted for a long time, and may be noted in the Pæony of Besler (1613), Hort. Eyst. p. vi, 10. Two figures again are given for *Crocus vernus* (441), one with a second *dimerous* flower, and another of a later stage with the leaves shooting, the dead flowers, and fine contractile roots pushing—an admirable set of botanical facts. *Colchicum* (356) is also shown separately in flowers and fruit.

The method is clearly more satisfactory as adapted to conventionalized fruit-trees, in which different branches are set apart for the different effects and the whole grouped as a tree-form: it is questionable whether the shreds and patches of the *Cambridge British Flora* are really any better as affording an adequate presentation to the ignorant of the growth-form of a tree-type. Many examples are particularly neat. *Cf.* especially the Gooseberry, 187; Blackthorn, 404—a beautiful study, with bare branch, flowering branch, and fruiting branch,—only requiring colour to make it vividly accurate. The Hazel (398), with a catkin-bearing twig, Cherry (415), also with three types of branch-system: *Juglans* (379) with catkins added, and nuts; Peach (601), *Ribes* (663), very well-done for inconspicuous flowers, as also *Ervum* (571) with procession of flowers and fruits, and the *Isatis* (415) with flowering and fruiting branches.

It is difficult to believe that the men who produced these figures began with the feeble Herb Robert (206), *Convallaria* (240), Corn Pansy (803), *Scolopendrium* (294), or faked the *Nuphar*, Yellow Iris, and Coltsfoot as plants particularly adapted for bold decorative treatment, yet made such beautiful studies from most insignificant flower-types as Lettuce (229), *Isatis* (331), and Good King Henry (463).

On the other hand, with all their acquired skill in plant-presentation, Fuchs' men do not show any corresponding advance in the observation and reproduction of the more minute botanical details which we look for nowadays, and were present in the original specimens; Brunfels' figures with a wealth of accurate detail, expressed '*summa cum diligentia*,' rather reveal the true germ of scientific enquiry. The draughtsmen of Fuchs are to be credited with their steadfast labour and great output, on a rising scale of excellence, along the lines on which they had been originally trained. Again, the engraving of Wieditz for Brunfels is far superior to anything in the earlier figures of Fuchs; one has an uncomfortable feeling that Speckle would have made a mess of Brunfels' *Pulsatilla* (i. 217) or the *Asarum* (i. 71, F. 10). There is nothing in all Fuchs to compare with the flower of the *Pulsatilla* or that of *Helleborus* (B. i. 30). Brunfels' figures are apparently drawn with a pen, giving fine and deep strokes, with turns and movements intentionally broken, as well as in fine clean lines (*cf.* ii. 52, 53): the earlier figures of Fuchs have a poor thick line; only in some of the early more decorative designs (Cabbage, 416; Oak, 229; Melon, 368) is a heavy line used locally with great effect. The special method evolved in later work tends to the use of a uniformly clear smooth line, in the manner admired by modern process-engravers, and a limiting expression of this type of work in the Comfrey (F. 695) may be at last fairly placed by the side of Weiditz's 75 of Brunfels (A. 48).

The significance of these records is sufficiently obvious; the work of Brunfels and Fuchs covers the whole province of the fundamentals of botanical illustration. To the construction of type-figures and plate-filling with the dignity and restraint attained by the remarkable draughtsmen of Fuchs—and the art of leaving out details too fine to be repeated, as giving a breadth of design to the whole—requires to be added the more faithful scientific observation of Brunfels, and his recognition of the importance of pourtraying the distinct individuality of every plant-organism, in its natural mode of growth, and the consideration of the plant as a whole. The addition of special botanical details, as accurate drawings, or neat combinations in a diagram of established convention, is again exemplified by Fuchs; while the clearness of line-reproduction expressed in the work of Speckle puts to shame modern methods of line process-work, and on a scale quite comparable with that of modern work. The admiration and respect of posterity is earned only by those who utilize to the utmost the resources of their age: and nothing is worth doing which is not of the very best. If the British Flora of the future, passing beyond the horizon of hand-coloured copper-plates, as in Curtis and Sowerby of a hundred years ago, is to come back to cheap process line-blocks, these should be entrusted to those who not only have received an adequate art-training of their generation, and really know something of floral botany, but who have an instinctive appreciation of the bewildering manifestations of plant-life, and can utilize an artistic training without falling into absurd mannerisms or slip-shod ways. It is a pity that copies of Brunfels and Fuchs are not more readily available for the study of those whose ideas of Herbals are founded on the poor borrowed illustrations of Gerard and Parkinson.

ALABASTRA DIVERSA.—Part XXXI.*

By Spencer Le M. Moore, B.Sc., F.L.S.

1. Miscellanea Africana.

(Concluded from p. 219.)

Folia inferiora $\pm 5 \times 1·2$ cm., in sicco saturate grisea; superiora pleraque 2·5–3 cm. $\times$ 4–6 mm. Spicæ usque ad $1·2 \times 1·5$ cm. Flores albi. Bracteæ 4×3–3·5 mm.; bracteolæ 3 mm. long. Calyx 3·5 mm. long., 1·5 mm. lat.; hujus lobi 1 mm. long. Corollæ tubus 6×1 mm.; lobi 2·5 mm. long. Filamenta longiora circa ·5 mm.; antheræ 1 mm. long. Ovarium oblongo-ovoideum, 1 mm. long.; stylus clavellatus, 1·5 mm. long.

This also is near *B. andongensis* Hiern; its tall habit, long, very scabrous 5-nerved lower leaves and comparatively small and narrow upper ones, non-corymbose inflorescence, smaller bracts and bracteoles, shorter calyx not ciliate on the ribs and corolla with tube distinctly longer than the calyx are the chief distinctive marks.

To be referred here is *Gossweiler* No. 1789 found along the wagon-road from Rio Kuanuolo to Kakonda in thickets missed by the bush-fires. It is noted as having pale violet-purple flowers.

Buchnera Kassneri, sp. nov. *Caule* e radice sparsim fibroso stricto subsimplice fere a basi folioso scabrido; *foliis* perpaucis (summis alternis) linearibus acutis uninervibus utrinque margineque scabridis; *spicis* angustis folia longe excedentibus basi breviter interruptis aliter continuis; *bracteis* lineari-lanceolatis acutis margine dorsoque scabridis; *bracteolis* linearibus acutis bracteas semiæquantibus; *calyce* uno latere fisso prominenter 7-nervi puberulo lobis 4–5 inter sese inæqualibus linearibus acutis ciliatis; *corollæ* tubo calycem breviter superante extus glabro lobis linearibus obtusis; *ilamentis* longioribus barbellatis, antheris apiculatis.

Belgian Congo, Kundelungu; *Kassner*, 2788.

Planta fere bispithamea. Folia 3–$4 \times 1·5$–2 cm. Spicæ circa 10 cm. long. Bracteæ circa 10 mm., bracteolæ circa 5 mm. long. Calyx 11·5 mm. long., lobi 1–2·5 mm. long. Corollæ tubus 12·5 mm. long., 1·2 mm. lat., ipso sub limbo contractus; lobi 3–4 mm. long.

* Types in the National Herbarium.

Filamenta longiora 1·25 mm., breviora ·4 mm. long.; antheræ 1·25 mm. long. Ovarium ovoideo-oblongum, 1·5 mm. long.; *stylus* clavatus, superne papillosus, 5 mm. long.

This should be inserted next *B. tuberosa* Skan, which besides tuberous roots has shorter bracteoles and calyx, and corolla-tube nearly double the length of the calyx.

Rhamphicarpa Elliotii, sp. nov. *Caule* sat gracili ramoso quadrangulari uti rami scabriusculo dein glabro; *foliis* sessilibus vel subsessilibus linearibus vel lineari-lanceolatis integris vel dentatis rarius trilobatis (lobo intermedio quam laterales longiori) in sicco nigrescentibus scabriusculis; *floribus* breviter pedicellatis pedicellis uti calyces scabriusculis; *calycis* lobis lanceolatis acutis tubo parum brevioribus; *corollæ* tubo calyce multo longiori supra medium gibboso pilis brevibus glandulosis sparsissime inspersis lobis late obovatis obtusissimis; *antheris* apice obtusis; *stylo* clavato; *capsula* oblique ovata brevissime rostrata glabra latere uno dehiscente.

East Africa, Ukambane; *Scott Elliot*, 6304.

Folia pleraque 5–10 mm. long., 1–2 mm. lat. Calycis tubus 3·5 mm. long.; hujus lobi 2·5–3 mm. long. Corolla verisimiliter punicea; tubus usque 18 mm. long., 2 mm. lat., ipso sub limbo subito usque ad 4 mm. dilatatus; lobi circa 8 × 7 mm. Filamenta barbata, 1–2 mm. long.; antheræ circa 2·5 mm. long. Capsula 7 mm. long., valvis 5 mm. lat. Semina haud visa.

Near *R. veronicæfolia* Vatke: the slender habit, reduced, and in many respects different leaves, and small flowers are its chief peculiarities.

GESNERACEÆ.

Streptocarpus Eylesii, sp. nov. *Folio* majusculo latissime ovato fere suborbiculari apice rotundissimo basi cordato margine denticulato utrobique hirsutulo; *pedunculis* sat elongatis glanduloso-puberulis plurifloris; *pedicellis* quam corollæ brevioribus uti calyx glanduloso-pubescentibus; *calycis* lobis linearibus obtusis; *corollæ* tubo calycem multo excedente inferne subcylindrico basi aliquanto dilatato superne late infundibulari infra medium eleganter curvato extus puberulo, lobis tubo plane brevioribus rotundatis posticis quam antici minoribus; *staminibus* inclusis filamentis supra medium tubi insertis subsparsim glandulosis; *ovario* corollæ tubum vix semiæquante ut stylus brevior glanduloso-pubescente.

Rhodesia, Matopo Hills in wet cavities under shadow of granite rock; *Eyles*, 1097.

Folia 24 × 21 cm., crassiuscula; costæ laterales utrinque circa 14. Pedunculi 4-ni, profecto evoluti (inflorescentia haud exempta) fere 30 cm. long., inflorescentia sola circa 12 × 12 cm., bracteis paucis linearibus glanduloso-pubescentibus ± 8 mm. long. prædita; pedicelli modice 2 cm. long. Flores cærulei. Calycis lobi 7 mm. long. Corollæ tubus 3 cm. long., inferne 3·5–5 mm. lat. sub faucibus 10–12 mm.; lobus anticus (intermedius) 9 × 9 mm., lobi postici 6 × 8 mm. Filamenta 9 mm. long., antheræ 2·5 mm. Ovarium 14 mm. long., 1·5 mm. lat.; stylus 6 mm. long.

Affinity with *S. Dunnii* Hook. f. and *S. Cooperi* Clarke, from which it is easily told by the corollas.

ACANTHACEÆ.

Justicia (§ **Harniera**) **Dinteri**, sp. nov. *Caule* specc. duorum nobis obviorum sesqui-bispithameo ascendente a basi ramoso uti rami tetragono sparsimque pubescente; *foliis* longipetiolatis ovato-lanceolatis vel ovato-oblongis obtusis basi breviter extenuatis tenuiter membranaceis utrinque glabris vel fere glabris lenticellis albis sub lente optime aspectabilibus; *floribus* in axillis congestis sessilibus; *bracteis* calyce brevioribus late obovatis pilosis margineque ciliatis; *bracteolis* minutis; calycis segmentis 5 inter sese fere æqualibus lineari-lanceolatis acutis margine longe ciliatis; *corollæ* tubo a calyce superato fere recto limbo quam tubus paullulum breviore labio postico ovato breviter bidentato antici lobis rotundatis; *antherarum* loc. inf. acute calcarato; *capsula* normali 4-sperma breviter stipitata oblongo-obovata obtusa sursum pubescente capsula abnormali pubescente 1-sperma 4-alata alis subintegris vel plerumque late paucilobatis; *seminibus* minute scrobiculatis.

South-West Africa, Otjitua, under the shade of *Acacia horrida*; *Dinter*, 87.

Planta ex schedis cl. detectoris alt. usque 8 dm. attingens. Foliorum majorum pagina 3–5 cm. long., 12–20 mm. lat., minorum ± 2 cm. $\times$ 8 mm., omnium in sicco læte viridis; illorum petioli 2–3 cm. horum circa 1 cm. long. Bracteæ $\pm 5 \times 4$ mm.; bracteolæ modo 1 mm. long. Calyx 6 mm. long. (sub flore circa 5 mm.). Corolla in toto 5 mm. long.; tubus 3 mm. long., 1·25–1·5 mm. lat.; labium posticum $1{\cdot}75 \times 1$ mm., anticum 2×3 mm., hujus lobus intermedius $1 \times 1{\cdot}2$ mm. Antherarum loc. sup. ·5 mm., loc. inf. ægre 1 mm. long. Ovarium 1·25 mm., stylus 2·75 mm. long. Capsula normalis 5 mm. long., superne 2 mm. lat.; abnormalis 3×2 mm. Capsulæ normalis semina 1 mm. long., abnormalis semen 2 mm., omnia brunnea.

Affinity with *J. heterocarpa* T. And. and *J. leptocarpa* Lindau, differing from both in the broader segments of the calyx which do not run out into very long fine points. Mention should also be made of the larger and broader normal capsules of *J. Dinteri*, and its decidedly different abnormal ones with their broader wings, either simply undulate or provided with a very few broad lobules, instead of many small teeth.

Study in the living plant of the capsular dimorphism of this and its fellow-species of § *Harniera* should yield results of interest.

Dicliptera Batesii, sp. nov. Herbacea, *caule* ascendente pauciramoso tetragono cito omnino glabro; *foliis* petiolatis ovato-lanceolatis acuminatis basi rotundatis vel cuneatis membranaceis glabris, involucris manifeste pedunculatis 1-floris in paniculas racemiformes foliis sæpius breviores digestis, foliis floralibus filiformi-subulatis acuminatis subrigidis; *bracteolis* exterioribus inter se inæqualibus spathulato-oblanceolatis apice acute mucronatis dorso puberulis margine piloso-ciliatis, bracteolis interioribus exteriora subæquantibus vel iis parum brevioribus lineari-lanceolatis longe acuminatis sicut calycis segmenta linearia acuminata pubescentibus; *corolla* ex bracteolis eminente hujus tubo limbo vix æquilongo extus puberulo labio superiori ovato obscure retuso inferiori oblongo tridentato æquilongo, andrœcio breviter stylo longe exserto; *capsula* obovoidea acuta superne sparsim glanduloso-pubescente 4-sperma.

Hab. South Cameroons, Bitye; *Bates*, 608.

Folia pleraque 4–6 × 2–2·8 cm., in sicco fusco-viridia subtus parum pallidiora, cystolithis difficile aspectabilibus prædita; petioli 1–2 cm. long., foliorum oppositorum sæpe inæquilongi. Paniculæ sæpius 2·5–4 cm. long., pilis simplicibus longioribus glandulosis brevibus intermixta obsitæ. Folia floralia ± 6 mm. long. Involucrorum pedunculus vulgo 3–5 mm. long., rarius 8 mm. attingens. Bracteolæ ext. alteræ 10–11 mm. alteræ 13–14 mm. long., interiores summum 11 mm. long. Calyx 7 mm. long. Corollæ tubus 10 mm. long., labia 12 mm. long., superius summum 7·5 mm. lat., inferius 3·5 mm. Ovarium ovoideum, 1·5 mm. long.; stylus fere 2 cm. long., puberulus. Capsula 8·5 mm. long. Semina 1·25 × 2 mm.

Can be told on sight from *D. umbellata* Juss. by the open inflorescences with pedunculate involucres, which organs are longer than those of *D. umbellata*.

VERBENACEÆ

Lippia Gossweileri, sp. nov. Erecta ramosa, *ramis* foliosis pubescentibus; *foliis* oppositis sessilibus oblongis vel oblongo-obovatis obtusis margine denticulatis vel fere integris firme membranaceis supra scabridis subtus pubescentibus; *spicis* longipedunculatis plurifloris obovoideis vel subglobosis; *bracteis* flores excedentibus lanceolatis acutis uti pedunculi pag. utraque pubescentibus; *calycis* albosericei alte bilobi lobis late ovatis apice emarginatis; *corollæ* tubo basin versus attenuato lobis quam tubus plane brevioribus; *staminibus* inclusis; *ovario* ovoideo quam stylus glaber breviore; *stigmate* obliquo.

Angola in open thickets near Munonque; *Gossweiler*, 3349.

Folia ± 2 cm. long. et 7 mm. lat., in sicco grisea. Pedunculi ascendenti-patuli, ± 5 cm. long., spicæ 1–1·5 cm. long., circiter 1 cm. lat. Bracteæ flores profecto evolutos stipantes 1 cm. long. Calyx 1·5 mm. long. Corolla alba; tubus extus puberulus, 3 mm. long., basi ·3 mm. sursum 1 mm. lat.; lobus anticus 1·25 × 2 mm., lobus posticus 1·25 × 1·25, lobi laterales ·5 × ·8. Ovarium ·75 mm., stylus 1 mm., stigma ·7 mm. long. Pyrenæ 1·25 mm. diam.

Easily told from *E. Wilmsii* H. H. W. Pears. by the entire leaves and the bracts; the calyx of the two yields another point of contrast.

Clerodendron lupakense, sp. nov. *Ramis* foliosis molliter pubescentibus deinde glabrescentibus; *foliis* oppositis ovatis vel oblongo-obovatis apice cuspidato-acuminatis ipso obtusis basi interdum aliquantulum obliquis subrotundatis vel obtusis margine undulatis petiolis pubescentibus basi articulatis insidentibus membranaceis supra glabris nitidisque subtus in nervis sparsim pubescentibus; *cymis* brevibus paucifloris supra axillas foliorum diminutorum affixis paniculam thyrsoideam foliaceam efficientibus; *floribus* submediocribus pedicellatis; *calycis* sparsim pubescentis tubo late cylindrico quam lobi deltoidei acuti plane longiore; *corollæ* tubo calycem facile superante basi dilatato inde attenuato ipso sub limbo ampliato glabro lobis inter se subæqualibus suborbicularibus; *staminibus* usque circa 5 mm. exsertis.

Belgian Congo, Lupaka river; *Kassner*, 2458 in part.

Foliorum limbus usque 11 × 6 cm., superiora vero gradatim imminuta; folia floralia ± 3 × 1·5 cm.; folia omnia pag. inf. pallidiora; petioli summum 2·5 cm. long. Inflorescentia tota circa 10 × 4 cm., pubescens. Bracteæ lineares, ± 3 mm. long. Pedicelli 2–3 mm. long. Calyx in toto 8 mm. long., 3 mm. lat.; lobi soli vix 2 mm. long. Corollæ tubus 14 mm. long., basi 2 mm. lat., mox usque 1 mm. subito constrictus, sub limbo 3 mm. lat.; lobi 4 × 4 mm.

Clerodendron consors, sp. nov. *Ramulis foliisque* præcedentis; *floribus* pedicellatis cymosis cymis in paniculam terminalem quam folia breviorem foliis floralibus carentem digestis; *calyce* cylindrico-infundibulari pubescente quam lobi deltoidei acuti longiore; *corollæ* tubo calycem bene excedente attenuato sub limbo dilatato glabro lobis inter se subæqualibus late ovatis obtusissimis; *staminibus* usque 5 mm. exsertis.

Belgian Congo, Lupaka river; *Kassner*, 2458 in part.

Inflorescentia 7·5 × 4 cm. Bracteæ lineares, ± 3 mm. long. Pedicelli summum 4 mm. long. Calyx 7 mm. long., 2 mm. lat.; lobi vix 2 mm. long. Corollæ tubus 15 mm. long., ima basi 1·5 mm. fere usque ad limbum 1 mm., ipso sub limbo 2 mm. lab.; lobi 3 × 3 mm.

The affinity of both the above is with *C. Barteri* Baker, but probably still more close with *C. Bequaerti* de Wild. From this latter both are separated by the not denticulate-runcinate leaves, the longer calyx and corolla, glabrous outside, and with broader lobes. As between themselves the chief points of distinction are the inflorescence, the cymes mixed with floral leaves in the one case and without them in the other, and the longer and broader calyx of *C. lupakense*. To judge from the description in Fedde, Rep. xiii. 144, the inflorescence of *C. Bequaerti* is that of *C. lupakense*.

Clerodendron bingaense, sp. nov. *Ramis* sparsim foliosis pubescentibus; *foliis* parvis petiolatis oppositis ovatis obtusis basi obtusis margine crenato-dentatis tenuiter membranaceis supra glabris subtus in nervis sparsim pubescentibus; *inflorescentia* ei *C. lukapensis* simili foliis floralibus ovato-oblongis oblongisve integris vel fere integris onusta; pedicellis calyce brevioribus pubescentibus; *calycis* pubescentis tubo cylindrico quam lobi deltoidei acuti triplo longiore; *corolla* calycem ter excedente tubo angusto basi apiceque dilatato glabro; *staminibus* usque circa 7 mm. exsertis.

Belgian Congo, Binga, under trees; *Kassner*, 2627.

Folia 3–5 × 2–4 cm., in sicco viridia, dentibus sæpissime 1–1·5 mm.

alt.; petioli 6–10 mm. long., pubescentes. Inflorescentia usque 10×6 cm. Folia floralia ± 2 cm. long. Bracteæ lineares 1–2 mm. long. Calyx 6–7 mm. long., 2 mm. lat.; lobi 2 mm. long. Corolla 18 mm. long., 1 mm. lat., basi 1·5 sub limbo 2·5 mm.; lobi $3{\cdot}5 \times 3$ mm.

Differs from *C. lukapense* chiefly in foliage and corolla.

Clerodendron frutectorum, sp. nov. *Ramis* sat robustis foliosis piloso-pubescentibus; *foliis* amplis longipetiolatis (summis brevipetiolatis) ovatis apice cuspidato-acuminatis ipso acutis basi breviter cordatis 5-nervibusque margine subgrosse dentatis sed dimidio proximali integris nonnunquam omnimodo integris vel fere integris membranaceis utrobique in nervis præsertim pag. inf. pubescentibus supra nitidis; *floribus* magnis ad apicem rami conglobatis foliisque brevipetiolatis etsi amplis stipatis; *bracteis* spathulatis acuminatis pubescentibus quam calyx paullo brevioribus; *calyce* infundibulari pubescente circiter usque medium diviso lobis ovato-lanceolatis breviter acuminatis; *corolla* calycem fere 3-plo excedente tubo attenuato sub limbo satis basi paullo dilatato extus glanduloso-pubescente lobis quam tubus multo brevioribus.

Belgian Congo, Shiwale among bushes; *Kassner*, 2473.

Folia $15\text{–}20 \times 10\text{–}12$ cm., minora vero exstant $8\text{–}10 \times 6\text{–}8$ cm.; petioli 4–9 cm. long., foliorum summorum modo 1 cm. vel etiam minus, omnes pubescentes. Bracteæ 12–15 mm. long. Pedicelli valde abbreviati. Calyx 18 mm. long.; lobi 10 mm. long. Corolla 5 cm. long., 1·25 mm. lat., ima basi ægre 2 mm. sub limbo 4 mm. lat.; limbus nondum pansus late ovoideus, obtusissimus, 9×6 mm.

Affinity with *C. capitatum* Schum. & Thonn., but with quite different leaves and shorter corollas among other features.

Loranthaceæ.

Loranthus (§ Erectilobi) Batesii S. Moore & Sprague, sp. nov. *Ramulis* sat validis teretibus striatis crebro minuteque lenticelliferis glabris; *foliis* amplis petiolatis oppositis vel suboppositis late ovatis obtusis basi cordatis coriaceis glabris costis lateralibus utrinque 3–4 arcuato-ascendentibus procul a margine dichotomis; *floribus* majusculis breviter pedicellatis in fasciculos umbellatos digestis; *bractea* cupuliformi medio haud elevato; *calyce* truncato mox irregulariter rupto ore minute ciliolato; *corolla* basi subsphæroidea cito subito curvata unde attenuata sed mox ampliata sub limbo parum constricta ante anthesin truncato—5-cornuta extus distincte etsi minute puberula lobis erectis; *filamentis* faucium basi insertis superne paullulum angustatis horum dente prominente late subulato; *stylo* superne incrassato sub stigmate attenuato.

Cameroons, Bitye; *Bates*, 675.

Folia usque 17×10 cm., sed sæpe minora, juniora minus cordata interdumque basi solum rotundata; petioli plerumque 1–1·5 cm. long. Pedunculi validi, circa 5 mm. long., pedicelli circa 2 mm. Bractea 2·5 mm. lat. Calyx 2·5 mm. long., ore 5·5 mm. lat. Flores dilute punicei, ex nodis caulis lignosi oriundi. Corolla profecto evoluta fere 6 cm. long., basi 7×5 mm., mox usque 1 mm. constricta, superne 6 mm. faucibus 5 mm. lat.; lobi lineari-oblongi, circa 7 mm. long.

Filamenta 5 mm. long., horum dens ·75 mm.; antheræ fere 2 mm. long. Stylus 5·5 cm. long., hujus pars attenuata 2·5 mm. long.

Besides the erect corolla-lobes this is known from *L. ogowensis* Engl. by the larger obtuse leaves usually more or less cordate at the base, the calyx broader and wider at the mouth and the distinctly puberulous pink corollas.

Zenker's 749 and 1414 referred to *L. ogowensis* in Fl. Trop. Afr. vi. sect 1, 346, are conspecific with this.

Euphorbiaceæ.

Acalypha eriophylloides, sp. nov. Monoica, *caulibus* rhizomate valido erectis simplicibus spithameis dilute flavo-tomentosis; *foliis* sessilibus anguste obovato-oblongis apice mucronatis basi obtusis apicem versus dentatis vel denticulatis pag. sup. appresse hirsutis pag. inf. hirsuto-tomentosis; *stipulis* parvis lineari-lanceolatis pubescentibus; *spicis* axillaribus masculis foliis circiter æquilongis apice bracteis perspicuis sæpe coronatis flore femineo unico ex axillo eodem oriundo ab iis libero; *bractea* ♀ fere usque basin in lacinias 7 inæquilongas lineares longe ciliatas divisa; *sepalis* ♀ oblongis sursum pectinato-ciliatis; *ovario* dense hirsuto; stylis 3 quam ovarium longioribus crebro pectinatis.

Angola, Kuanaval; *Gossweiler*, 3041.

Folia pleraque 2–3 cm. long., 8–10 mm. lat., supra in sicco fusco- subtus dilute grisea, stipulæ 2–3 cm. long. Spicæ evolutæ (incluso pedunculo 5–7 mm. long.) 2·5–3 cm. long. Bracteæ ♂ florum fasciculos stipantes lineari-lanceolatæ, summum 2 mm. long.; bracteæ apicales usque 4–5 mm. long. Bractea ♀ circa 4 mm. lat.; harum laciniæ 2–5 mm. long. Sepala ♀ 1·5 mm. long. Ovarium ægre 3 mm. diam. Styli usque 7 mm. long.

Evidently a close ally of *A. eriophylla* Hutchins., but among other features with differently-shaped leaves, spikes on shorter peduncles, female flower arising separately from the male spike instead of at its base and not invested by the curious large stipules of *A. eriophylla.*

The remains of stems still attached to the rhizome show the effects of fire.

Acalypha Gossweileri, sp. nov. Frutex ultrametralis, crebro ramosus; *ramis* lignosis primo dense pubescentibus mox glabris ultimis solummodo folia pauca gerentibus; *foliis* parvis petiolatis lanceolatis acutis breviterve acuminatis basi obtusis vel levissime cordatis margine dentato-serratis trinervibus membranaceis supra hispidule pilosis subtus arcte pubescentibus; *stipulis* setaceis foliis circiter æquilongis sparsim pilosis; *spicis* axillaribus bisexualibus quam folia brevioribus e bractea unica florem unicum ♀ fovente plane supra basin posita floribusque pluribus ♂ terminalibus approximatis a ♀ satis remotis sistentibus; *bractea* parva foliacea margine integra vel summum undulata extus pilis strigillosis sparsim onusta intus glabra; *sepalis* ♀ 3 lanceolatis ciliatis; *ovario* dense strigoso; *stylis* 3 ovario multe longioribus crebro laciniatis.

Angola, Cazengo, mountains at Grouja de S. Luiz; *Gossweiler*, 5506.

Folia pleraque 2–4 cm. long., 7–10 mm. lat., in sicco griseo-viridia; petioli circa 5 mm. (raro usque 10 mm.) long., arcte pubescentes. Stipulæ circa 5 mm. long Spicæ pubescentes, pleræque 10–15 mm. long.; harum pars inf. (bractea juxta medium fovens) 5–7 mm., pars sup. flores ♂ fulciens 5–8 mm. long. Bractea saltem in sicco grisea, fere 2 mm. long., et 3 mm. lat., nervis pluribus percursa. Sepala ♀ 1 mm. long. Ovarium subglobosum, 1 mm. diam. Styli circa 5 mm. long.

To be inserted next *A. bipartita* Müll. Arg., but quite different in foliage and bracts.

2. Monimiacea Nova Brasiliensis.

Mollinedia (§ Inappendiculata) Cunninghamii, sp. nov. *Ramulis* crebro foliosis fulvo-tomentellis mox glabrescentibus; *foliis* rarius suboppositis nonnunquam sparsis brevipetiolatis apice sæpe breviter cuspidulatis ipso acutis basi obtusis margine dimidio abaxiali plane denticulatis papyraceis supra præsertim in nervis appresse piloso-pubescentibus mox glabrescentibus subtus in nervis tomentellis; *inflorescentiis* foliis brevioribus subsessilibus paucifloris; *pedicellis* quam flores paullo longioribus tomentellis; *floribus* (♀ tantum notis) mediocribus; *perianthio* turbinato extus sericeo quam lobi plane longiore lobis brevibus triangularibus obtusis interioribus exterioribus paullulum dissimilibus; *carpellis* circa 30 appresse villosis.

Hab. Rio Janeiro; *Bowie & Cunningham.*

Folia 6–10 cm. long., 2·5–4 cm. lat., in sicco supra griseo- subtus brunneo-viridia; costæ laterales utrinque 5–6, leviter arcuatæ, ut costulæ reticulumque pagina utraque optime aspectabiles; petioli 4–6 mm. long., tomentelli. Inflorescentiæ 1·5–2·5 cm. long. Dichasiorum singulorum pedunculi 10–15 mm. long., graciles; pedicelli 6–8 mm. long. Perianthium 4 × 5 mm., hujus lobi longit. 1 mm. paullulum excedentes, duo 1 mm. lat., duo 1·25 mm. Carpella compressa, oblonga, 1 mm. long.; stylus incurvus, ·25 mm. long.

Easily distinguished at a glance from *M. Widgrenii* A. DC. and its allies by the relatively small leaves regularly and markedly denticulate in their abaxial half.

THE FLORA OF THE BAGSHOT DISTRICT.

By Horace W. Monckton, V.P.L.S.

I have for a good many years made a practice of noting the plants which I saw growing on various geological formations, and I have attempted to make complete lists of the Flora of certain selected geological areas. The district of the Bagshot Sands on and around Bagshot Heath affords an unusually suitable area for this purpose. It is fairly extensive, being 24 miles from east to west and 11 miles from north to south; its boundary is tolerably regular and there are neither inliers nor outliers of other geological formations. It is true that a considerable portion of the surface is formed of various gravels but the gravel is much the same from the point of view of plant-life as the Bagshot Sand itself; the surface is, in fact, mainly sand and gravel with subordinate beds of clay or sandy clay, and there is an absence of lime in the area.

In 1916 I had a few copies of my list of plants from this district printed for the use of those interested, and a note on the Flora was read to the Linnean Society and published in their *Proceedings* for 1915–16, p. 5 (see Journ. Bot. 1916, 94). I have since added somewhat to my list and, taking the 16th edition of the *London Catalogue*, I have now marked 705 species, 43 varieties, and 8 hybrids as growing on the Bagshot Sand; 15 other species on Alluvium in the district, and 83 species as recorded, but not, I think, established. This makes a total of 854 entries.

As I have said, the Bagshot of this area is mainly a sand formation, and we should expect to find a resemblance in its Flora to that of other similar formations in the south of England, and, in fact, most of our plants do occur on the Eocene of the south coast as well as on the Lower Greensand and Hastings Beds. The resemblance to the Flora of the Lower Greensand is especially marked, but as that formation contains beds of limestone, such as the Bargate Stone, we find some species on it which are absent from our area. The conditions of plant-life are, however, so similar to those in other places that I cannot name any species which is confined to the Bagshot District; still there are some plants which are distinctly characteristic of our area.

Ranunculus Lenormandi F. Schultz is described in Fl. Berks, p. 14, as occurring only on the Bagshot Beds in that county, and I have found it at several places on the Middle Bagshot Beds in both the Berks and Surrey part of our District. It occurs on the Lower Bagshot in a damp field by a small brook about a mile and a half south of Wokingham and Mr. C. E. Britton tells me that it is found on Esher Common, also Lower Bagshot. In Hampshire I found it on the Valley Gravel of the Blackwater at Yately; this gravel is underlain by Bagshot Beds and is in the Bagshot District. The Rev. E. F. Linton describes the species from the Dorset Bagshot Beds (Fl. Bournemouth, p. 27), and it has been recorded from the Hastings Beds and Lower Greensand. In Brewer's *Flora of Surrey*, it is marked for the London Clay, pp. 4, 319, but I believe that to be an exceptional occurrence.

Hypericum Elodes L. is found in abundance in many of the lakes and ponds of the district: I may mention Wellington College and Chobham Common as examples for the Middle Bagshot and Ockham Common for the Lower Bagshot (see also Fl. Berks, pp. xli, 116; Fl. Surrey, p. 47; Fl. Hamps. p. 70). It is common on the Bagshot Beds of Dorset, and has been recorded from the Lower Greensand and Hastings Beds, but is wanting on many geological formations.

Hieracium is more abundant on the Bagshot Sand than on the adjoining formations, and the species have not yet been fully worked out. This applies more especially to the group Vulgata. My specimens have been kindly looked over by the Revs. E. F. Linton and E. S. Marshall. Some from Wellington College are placed near *H. grandidens* Dahlst. or *H. serratifrons* var. *lepistoides* Johan.; one from the same place and one from Finchampstead Ridges are near *H. surrejanum* F. J. Hanb.; one from St. Sebastian near Wokingham is named *H. pinnatifidum* var. *vivarium* Lönnr.; two from Wellington College are described as *H. scanicum* or a form near it; one from Wellington College and one from Broadmoor are assigned to *H. sciaphilum* Uechtr.; and one from Finchampstead to *H. sciaphilum* var. *transiens*. Mr. Linton considers that a number of my specimens from Wellington College belong to an undescribed species, for which he proposes the name *H. euryphyllum*.

There is less difficulty as to the species in the other groups (see Fl. Berks, pp. 312–315), but I may mention that I have found *H. tridentatum* var. *setigerum* Ley at Wellington College and var. *acrifolium* Dahlst. at Gracious Pond Farm, Woking, and on Weybridge Common, Surrey. From the Valley Gravel of the Bagshot District I have *H. rigidum* Hartm. from Sandhurst, Berks, and Walton Common, Surrey, and *H. umbellatum* var. *coronopifolium* Fr. from Sandhurst.

Vaccinium Myrtillus L. is a plant of the Bagshot Sand, Lower Greensand, Hastings Beds, and other sandy formations. In the Bagshot District there are many patches of this plant in what were woods of *Pinus sylvestris*, both on the Bagshot Sand and the Plateau Gravel. Many of these woods have now been cut down, and I am curious to see how the *Vaccinium* will thrive.

Gentiana Pneumonanthe L. is given by Brewer (Fl. Surrey, pp. 150, 332) as occurring only on the Bagshot Sand in that county, and the two localities given in Fl. Berks (p. 342) are probably on the same Formation. It is frequent on the corresponding series in Dorset (Fl. Bournemouth, p. 150). In Townsend's Fl. Hamps. (p. 258) it is recorded from Hook Common; this is near Odiham, and is an interesting example of the transgression of the Bagshot Sand plant on to Plateau Gravel, which rests on London Clay. It is about half a mile S.E. of the nearest Bagshot outlier at Newnham and a mile and a half from the main mass of the Bagshot Sand. Specimens from this locality were given me by the late Miss Cole a few years ago.

Euphrasia is characteristic of the Bagshot Sand; Mr. Dunnis Lumb has been good enough to look over my specimens and determines them as follows:—*E. Rostkoviana* Hayne is the most frequent species; I have examples from Wellington College, the East Berks golf links, Birchen Inhams farm near Wokingham, and from Easthampstead Moor, all in Berks. I also found it on the Valley Gravel at Yately, Hants. *E. brevipila* Burnat & Gremli occurred at Wellington College some years ago. *E. nemorosa* var. *ciliata* is frequent at the same place, and *E. gracilis* Fr. I have from Wellington College and from the Valley Gravel at Cox Hill Green near Chobham, Surrey; Mr. C. E. Britton tells me that it occurs on Ockham Common.

Myrica Gale L. is abundant in many parts of the Bagshot District, and Mr. Hautneville Cope showed me a valley near Bramshill where it was growing in luxuriance. It is frequent on the Bagshot Beds of Dorset and is recorded from Sussex, apparently on Lower Greensand and Hastings Beds (Arnold, Fl. Sussex, p. 101).

Illecebrum verticillatum L. is one of the curiosities of the district. Its occurrence is described by Mr. Druce (Fl. Berks, 416), and it has for a long time appeared in two places; one has now been enclosed in a fowl-yard and the plant will probably vanish thence, but last year it had spread a good deal in the other locality.

Certain plants common on the chalk have transgressed on to the Bagshot Sand; thus I have found *Polygala vulgaris* L. at Wellington College; *Campanula glomerata* L. has flowered at the same place near Crowthorne for several years in succession, and I believe originated through the ground being treated with a chalk dressing. *Legousia hybrida* Delarbr. grows on Birchen Inhams Farm, Wokingham, and in Dorset it is recorded from the Bagshot Beds of Creech clay-pits (Fl. Bournemouth, p. 142).

In the case of some of the plants which occur everywhere interest attaches to some varieties, thus *Taraxacum officinale* var. *erythrospermum* Andrz. is frequent on the football grounds at Wellington College, and occurs at other places in the district. It is recorded from the corresponding formation of Dorset.

Arnoseris pusilla Gaertn., a colonist, is recorded from several places on the Bagshot Sand in Fl. Surrey (p. 124) and the only locality given in Fl. Berks (p. 308) is in the Bagshot district. In Fl. Hamps. it is given from the Bagshot Beds of both North and South Hants. I found it in a field near Brimshot, Surrey, in 1915 and have seen it for several successive years near Yately, Hants. It is recorded from the Lower Greensand and the Blackheath Pebble Beds.

Claytonia perfoliata Don, a native of North America, was recorded as established on Bagshot Sand at Yately, Hants, by the late Rev. C. W. Penny (Journ. Bot. 1873, 206); it is still there in more than one place, but it is around Horsell Birch in Surrey that it flourishes in the greatest abundance on the Bagshot Sand, and near Chobham I have seen it on Valley Gravel. It has been recorded from both Eocene and Purbeck Beds in South Hants and Dorset (Fl. Bournem. p. 55).

Anchusa officinalis L., a native of Central and Southern Europe, was found by Mr. Druce near Finchampstead in 1891 (Fl. Berks, p. 349); I saw it, possibly at the same place, in 1918. Though well within the Bagshot district it was not on the Bagshot Sand, but on an overlying patch of Plateau Gravel.

Juncus tenuis Willd., also a native of the Continent, was found by myself near Wellington College in 1915; it seems to be spreading, for it was growing in more than one place last season.

Sedges are abundant in the Bagshot District. Mr. Druce gives a few characteristic species (Fl. Berks, p. xli) and 29 species are recorded from the Bagshot Sand in the Flora of Surrey. I make the number of species 38, and four others are recorded, but I think only occur on the Alluvium. I myself have found 22 species, most of them on the Middle Bagshot, but I have seen a good many on both Upper and Lower Bagshot and they often extend on to the gravels.

Rhynchospora alba Vahl is found on Chobham Common and near Wellington College, and other localities will be found in the County Floras. It is recorded as common in the Bournemouth District (Headon Beds, Bagshot Series, Gravel) and as occurring on Lower Greensand and Hastings Beds.

Scirpus fluitans L. is found near Wellington College and at other places in our district, and is recorded from Bagshot Beds, Headon Beds, and Gravel of the south coast and also from Blackheath Beds, Lower Greensand, and Hastings Beds.

Carex canescens is recorded from the Surrey, Berks, and Hants parts of the Bagshot district, and I have specimens from Sandhurst. It also is found on the Bagshot Series of the Bournemouth District and on the Lower Greensand at Reigate. I have specimens of a pretty Sedge from Chobham Common and boggy ground near Broadmoor very like *C. flava* var. *lepidocarpa* Syme (E. Bot. t. 1673), which is made a variety of *C. flava* in the *London Catalogue.* Berks (p. 550) gives *C. flava* var. *minor* from Bagshot Sand localities; this is made a variety of *C. Oederi* Retz. in the *London Catalogue.* In Fl. Hamps. (p. 475) two species are given for the Bagshot District—*C. flava* var. *minor* Towns. and *C. Oederi* Retz. Whatever the correct nomenclature may be, I think that I may safely count two species for the district. I may mention that King John's Bog, Odiham, where good *flava genuina* was found (Fl. Hamps.) is off the Bagshot Sand, and is on wet Valley Gravel or Alluvium underlain by London Clay. *C. flava* var. *minor* is recorded from the Bagshot Series of the south coast, the Lower Greensand, Hastings Beds, and also from Andover (Chalk), Keston (Blackheath Beds), below Crayford (Valley Deposits), and Dungeness (Gravel).

Carex binervis Sm. is abundant on our commons, more especially on Middle Bagshot Beds. It is recorded from the corresponding Series of Bournemouth, from the Headon Beds, Lower Greensand, Hastings Beds, and from the Blackheath Beds of Keston, &c.

Carex Pseudo-Cyperus L. is given amongst the plants of the Bagshot Sand in Fl. Berks (p. xli). I have specimens from Ockham Common and the Basingstoke Canal, but though it grows freely enough where it occurs, I should call it a plant of the Alluvium and Valley Gravel which has strayed into our district. It is described as rather rare in Hants, but is more common in marshy places in Kent.

SPHAGNACEÆ.

Sphagnum is found in some abundance in a great number of streams and bogs in the district; the patches are not as a rule large, but there is a considerable variety of species. Some of them are given in Mr. Horrell's paper on the European *Sphagnaceæ*, published in this Journal for 1900, with the localities Brookwood, Pirbright, North Camp, and probably Aldershot, which are situated on Bagshot Sand. I myself have chiefly collected from the Berkshire part of the district; my specimens have been kindly determined by Mr. W. R. Sherrin, and I have added in the following list a few species from Chobham Common, Surrey, communicated by him.

There are many beds of Sphagnum by the streams which rise on the Plateau Gravel of Easthampstead Plain and flow across the moors in Easthampstead parish, which I consequently describe as Easthampstead Moor. The Sphagnum is particularly well developed near the place where these streams pass from the Upper to the Middle Bagshot Beds. In a few places Sphagnum is found on the Lower Bagshot Beds and occasionally on the Valley Gravel, and even on the Plateau Gravel. The following localities given in my list are in Berkshire:—Broadmoor in Crowthorne; Easthampstead Park and Moor in Easthampstead; Finchampstead Wood in Finchampstead; Grebe Pond in Wokingham; Heath Pool in Finchampstead; Long Moor in Barkham; Queensmere in Wokingham; Spout Pond in Finchampstead; Swinley Park in Sunninghill; Wellington College in Crowthorne.

Sphagnum fimbriatum Wils. var. *tenue* Grav. Queensmere; var. *validus* Card. Heath Pool.

S. rubellum Wils. Frequent on the moors; var. *purpurascens* Russ. Easthampstead Moor, Broadmoor; var. *rubescens* Warnst. and var. *versicolor* Warnst. Easthampstead Moor, Wellington College.

S. acutifolium Russ. & Warnst. var. *viride* Warnst. Brookwood, *Sherrin.*

S. plumulosum Roll. var. *viride* Warnst. Brookwood, *Sherrin*; f. *squarrosulum* Warnst. and var. *læte-virens* Warnst. Chobbam Common, *Sherrin*; var. *purpureum* Warnst. and var. *versicolor* Warnst. Easthampstead Moor, Wellington College; var. *flavo-fuscum* Warnst. North Camp, Aldershot, *Sherrin*; var. *ochraceum* Warnst. Brookwood, *Sherrin.*

S. compactum DC. var. *imbricatum* Warnst. Chobham Common, *Sherrin*, Swinley Park, Heath Pool, Finchampstead, *Miss E. Armitage*, Easthampstead Moor; var. *squarrosum* Russ. f. *densum* Card. Brookwood, *Sherrin*; var. *subsquarrosum* Warnst. Brookwood, *Monington*, and *Horrell* (Journ. Bot. 1890, 352); f. *densum* Warnst. Chobham Common, *Sherrin*, Easthampstead Moor.

S. squarrosum Pers. Near Portnall Park, Surrey.

S. teres Angstr. var. *imbricatum* Warnst. f. *robustum* Warnst. Aldershot, *Sherrin.*

S. cuspidatum Mull. Heath Pool, Wellington College.

S. amblyphyllum Russ. Near Kingsmere, Brookwood (*op. cit.* 345); var. *mesophyllum* Warnst. f. *molle* Russ. Chobham Common, near Grebe Pond, *Sherrin*; f. *silvaticum* Russ. Spout Pond, Queensmere.

S. pulchrum Lindb. Easthampstead Moor; var. *virescens* Warnst. Easthampstead Park and Moor. Heath Pool.

S. recurvum Pal de Beauv. var. *majus* Angstr. Near Kingsmere; f. *silvaticum* Russ. Broadmoor, Wellington College. Spout Pond; f. *sphærocephalum* Warnst. Easthampstead Park, near Kingsmere; var. *robustum* Breia. f. *densum* Warnst. Easthampstead Moor.

S. molluscum Bruch. var. *angustifolium* Warnst. Chobham Common, *Sherrin*; var. *vulgatum* Warnst. f. *compactum* Warnst. Chobham Common, *Sherrin*; f. *gracile* Warnst. Chobham Common. *Sherrin.* Easthampstead Moor.

Sphagnum Holtii Warnst. Chobham Common, *Sherrin*, Heath Pool.

S. obesum Warnst. A long trailing form near this species in streams in Finchampstead Wood.

S. subsecundum Nees. Easthampstead Moor; Longmoor. Var. *intermedium* Warnst. Broadmoor.

S. inundatum Russ. One of our frequent species found in many places and on most moors; var. *diversifolium* f. *eurycladum* Warnst. On valley gravel, Darby Green, Hants; var. *lancifolium* Warnst. f. *tenellum* Warnst. Easthampstead Moor; var. *ovalifolium* Warnst. f. *gracile* Warnst. Easthampstead Park; Broadmoor.

S. auriculatum Schimp. var. *canovirescens* Warnst. Easthampstead Moor; Finchampstead Wood; var. *ovatum* Warnst. f. *variegatum* Warnst. Wellington College; f. *pallidoflavum* Warnst. Finchampstead Wood; var. *plumosum* Warnst. Easthampstead Moor.

S. aquatile Warnst. var. *turgidum* Mull. Easthampstead Moor.

S. rufescens Nees & Hornsch. Spout Pond, Broadmoor, Wickham Bushes; var. *magnifolium* Warnst. f. *abbreviatum* Warnst. Chobham Common, *Sherrin*.

S. imbricatum Russ. var. *affine* Warnst. f. *glaucescens* Warnst. subf. *squarrosulum* (*S. turfaceum* W.). Brookwood, *E. C. Horrell*.

S. papillosum Lindb. var. *normale* Warnst. f. *brachycladum* Warnst. Broadmoor Wellington College; f. *confertum* Warnst. Chobham Common, *Sherrin*; f. *squarrosulum* Ingham & Wheldon. Easthampstead Moor in many places; var. *sublæve* Limpr. Finchampstead Wood, Spout Pond, Heath Pool, near Grebe Pond; f. *glaucovirens* Schlieph. Easthampstead Moor; f. *validum* Warnst. Chobham Common, *Sherrin*; Finchampstead Wood.

S. cymbifolium Ehrh. Abundant in most parts of the district; var. *fuscescens* Warnst. Broadmoor; var. *glaucescens* Warnst. Broadmoor; f. *squarrosulum* Pers. Chobham Common, *Sherrin*, Sprout Pond; var. *pallescens* Warnst. Easthampstead Moor, also on the Plateau Gravel, Easthampstead Plain, near Wickham Bushes.

VERBASCUM THAPSIFORME AS A BRITISH PLANT.

By the Rev. E. S. Marshall, M.A., F.L.S.

On July 2nd Mr. W. D. Miller and I spent an hour or two near Holford, v.c. 5 S. Somerset, which is a very rich neighbourhood botanically, and produces a good many scarce *Rubi*. In the lower part of one of the combes we noticed a large-flowered Mullein, which at once struck me as being very like *V. phlomoides* L., a species which I gathered thirty-nine years ago near Marburg, Hessen-Nassau, growing under very similar conditions. I have since traced it for nearly half a mile; it occurs sparingly both in the open and in bushy places, sometimes extending, among bracken, for twenty yards or more up the wooded hillside, facing east. A casual observer might easily pass it by as fine *V. Thapsus*, from which it mainly differs by the larger, flatter corollas, of a brighter yellow, the longer pair of naked filaments, the large, vivid orange anthers, longly decurrent on their filaments, and the stigmas being decurrent, less decidedly capitate.

On consulting text-books, our plants were found to agree in foliage with *thapsiforme* rather than with *phlomoides*; and an examination of the European sets in the National Herbarium proved this to be the case.

In Mr. S. T. Dunn's *Alien Flora*, p. 147, he says:—"Occasionally noticed as a garden escape in England." Whether it has really so occurred I do not know, though I have much doubt. In the present station it has every appearance of a true native, growing in similar situations to those which produce *V. Thapsus*, and often as solitary, considerably isolated individuals. A friend at Bridgwater, who has grown sundry exotic Mulleins, assures me that he did not introduce it; and, personally, I am convinced that it is indigenous. The average height is two to three feet; but one plant was met with—in stony, exposed soil, with smaller flowers—little more than a foot high, whereas the strongest specimen observed reached a height of about six feet (Mr. Edgar Lovett recently saw *V. Thapsus* eight feet high; and I have seen it, naturalised, at least as tall, if not taller, on the Canadian side, below Niagara Falls).

Now arises a question as to its specific rank. Most authorities, such as Bentham, Koch, Rouy, and Nyman, keep it up, rightly regarding *V. cuspidatum* Schrad. as only a variety. In DC. *Prodromus* (x. 226) Bentham aptly remarks:—"Folia *V. Thapsi*, flores *V. phlomoides*." Coste, however, reduces it to a variety of the latter; and Lloyd was of the same opinion. Though by no means a "lumper," I am strongly in favour of this view. The big plant referred to above had an exceptionally large, thick inflorescence, with three branches from near the base, and one or two of the middle leaves were only decurrent halfway down to the leaf below: so it would do just as well for *V. phlomoides*, sensu stricto. I suggest therefore that we should write it "*V. phlomoides* L., var. (or subsp.) *thapsiforme* Coste."

Flowers dried separately are seen to be softly adpressed-pubescent externally.

In the *Student's Handbook* (1870 to 1884), under "Excluded Species," Sir J. D. Hooker wrote:—"*Verbascum thapsiforme* Schrad. Reported by Hudson; not confirmed." This was careless: Hudson (ed. ii. p. 90, 1778) cited *V. thapsoides* L., which Linnæus himself queried as a probable hybrid. *V. Thapsus* was not observed in or near the Holford station.

Schrader's original description is as follows:—"*Verbascum Thapsiforme*, foliis decurrentibus crenulatis tomentosis: superioribus acuminatis, racemo spicato denso, corollæ rotatæ laciniis obovatis rotundatis, antheris duabus oblongis . . .

"Facies *Thapsi*. Caulis sesquipedalis, bipedalis et quandoque altior, erectus, teretiusculus, simplex . . . Calices *Thapsi*. Corollæ magnitudine, forma et colore *Phlomoidis*." H. A. Schrader, *Monographia Generis Verbasci*, p. 21 (1813).

VACCINIUM INTERMEDIUM Ruthe.

By W. Balfour Gourlay, M.B., and G. M. Vevers, M.R.C.S.

This natural hybrid between *Vaccinium Myrtillus* and *V. Vitis-idæa* was discovered in Britain by Robert Garner in Maer Woods, Staffordshire, and was exhibited by him at the meeting of the Linnean Society on March 7, 1872, when "the general opinion elicited by their examination was that they were a luxuriant state of *V. Vitis-idæa*, due to situation, rather than a hybrid" (see Journ. Bot. 1872, 122). It was fully described by Mr. N. E. Brown in Journ. Linn. Soc. xxiv. 125 (1887) as *V. intermedium* Ruthe, from specimens collected by T. G. Bonney in August 1886 on Cannock Chase; in a postscript to the paper, which is accompanied by an excellent plate, these are identified with Garner's specimens exhibited at the Linnean Society. Since then little notice seems to have been taken of the plant, but several rather interesting points and questions arise when one examines its habit and distribution.

In the first place it is locally *very* abundant in the Cannock Chase area of Staffordshire—we have found it in a score of distinct and widely-separate localities. Slight variations in plants from the different localities and their wide separation suggest different acts of hybridization for each locality. The only other place in Britain from which it has been recorded is Caithness. This is rather remarkable, for one would think that there must be many other localities where the parent species grow together and hybridization might take place; none, however, have been recorded, and it seems unlikely that the plant occurs and has been overlooked in such areas, as the upland regions of Britain have been carefully botanized.

The question arises, Can any circumstance at Cannock Chase be specially favourable for the production or spread of the hybrid? The answer to this seems to be: Human interference.

In all but three localities in which the plant was found there was indisputable evidence of man's handiwork. Cannock Chase during the last five years, and for many years before to a lesser degree, has been a military training-area, and many roads, trenches, gun-pits, and drains have been constructed; and it was in such localities that the hybrid was found. Moreover, where the work of man is recent the patch is small and *vice versa*, e. g., patches one yard square were found in conjunction with work obviously done since the beginning of the War, whereas one large patch of an acre in extent had its focus in an artificial bank on which birch-trees of considerable size were growing, proving it to be some twenty years old. Each patch spreads vegetatively by creeping rootstocks. In unmolested areas Bilberry and Cowberry grow intermingled, but in such areas the hybrid is conspicuous by its absence. It would be interesting to know if the Caithness locality gives similar evidence of human interference.

It may be noted that *V. Myrtillus* flowers earlier than *V. Vitis-idæa*, though some overlapping usually occurs. The hybrid resembles the latter in the cylindrical stem and evergreen and rather coriaceous leaf, but favours the former in having awned anthers and in the shape and colour of the ripe berry, which, however, is plum-violet rather than dark blue. The hybrid fruits much less freely than either parent, and its flowers are roughly intermediate in size and shape; it would be of interest to know which is the male and which the female parent. In the paper mentioned above, Mr. Brown states that the discoverer of the plant sent specimens to Darwin, who suggested that the seeds would show infertility. So far as we are aware, no one has since investigated this point: we have collected and distributed a considerable amount of seed for experimental sowing, and hope to make a definite statement at some future date.

SHORT NOTES.

Utricularia. The size of the species of this genus as given in our books is far too small. Syme (Eng. Bot. ed. 3, vii. 126, 1867) gives for *U. vulgaris* "6–18 inches long," and for *U. intermedia* "6 inches." Messrs. Burrell & Clarke (Trans. Norf. & Nor. Nat. Soc. ix. 266, 1911) give *U. vulgaris* as occurring on East Ruston Common "6 feet long" and on Foulden Common with flower-stalks "15 inches long." I have *U. major* 24 inches long gathered by the late George Nicholson at Staines, Middlesex. *U. minor* often occurs in Norfolk 9–10 inches and *U. intermedia* 12–15 inches long.—A. Bennett.

Helosciadium inundatum L. (Koch) f. fluitans (Fr.) Prahl (Krit. Fl. Schlesv.-Holst. ii. 103 (1890); *H. inundatum* var. *fluitans* Fries, Bot. Not. et Mant. iii. 182 (1842), Herb. Norm. 8, n. 18 (1842)—"caule elongato ramoso fluitante, foliis omnibus capillaceo-multifidis." Mr. A. H. Evans sends this from near Holyhead, Anglesea, "growing in water 3 feet deep, and flowering under water." The leaves on the lower part of the stem have the common stalk shortened to about half an inch, thence the leaves are dissected like a Batrachian Ranunculus, and the rest of the stalk is suppressed.—Arthur Bennett.

Juncus pygmæus Rich. In Davey's *Flora of Cornwall* (1909) this interesting Rush is described as occurring in several localities, near together, in the Lizard district; I am not aware that it has been reported elsewhere. In June of this year I found it in considerable quantity in damp places on cliffs about two miles west of St. Ives, Cornwall, in the Land's End District (District 8), perhaps 25 miles from the Lizard locality.—H. Downes.

REVIEW.

Commercial Forestry in Britain, its Decline and Revival. By E. P. Stebbing, Head of the Department of Forestry, University of Edinburgh. With Frontispiece. John Murray. Pp. 186. Price 6*s*. net.

The enormously enhanced cost of book-production is only too evident when a leading firm of publishers has to charge six shillings net for little more than 180 small pages—less than 70,000 words—

printed on inferior paper and somewhat roughly bound. As to the matter of this latest essay by Mr. Stebbing we have no fault to find. It strikes us as being a remarkably sane, temperate, and opportune statement. The writer first states briefly the direct and indirect utility of forests to a nation—how new industries demanding wood, such as paper-pulp and aeroplanes, have arisen, so that, in spite of all substitutes, wood is at least as indispensable as ever; and how forests tend to regulate the water-supply, arrest shifting sand, and so preserve the agricultural value of land. He, then, in 63 pages traces the history of British Forestry from Roman times to 1914, sketching in a most interesting summary the conversion of primeval forest into agricultural land, the demand for oak for the Navy, Evelyn's stimulus to planting and the cessation of this demand with the coming in of teak and steel, and the cheap import of the soft woods from the forests of the Continent and of North America.

The nadir of British Forestry was reached between 1866, when the duties on imported timber were removed, and 1885, when the first Parliamentary Committee on Forestry was appointed. At that period the owners of woodlands "neither knew, nor pretended to know, anything about forestry"—"the estate agent was usually equally ignorant"; the woods "were chiefly regarded from their usefulness in affording sport or amenity": British-grown pit-wood was so badly grown that colliery-owners preferred imported material. Government specifications commonly stipulated for foreign wood, and timber-merchants learnt that they could not obtain any continuous supply of home-grown wood. Mr. Stebbing then narrates with a surprising patience and absence of bitterness the history of seven successive Committees and Commissions, which "resolves itself, if we omit Ireland, into some small encouragement of education, but a total absence of all planting-up of the waste lands of the country." It may fairly be said, moreover, that, until the difficulty of obtaining matches, fire-wood, and paper forced it on public attention, little or no general interest in the matter was evinced.

The second half of the book, dealing with our immediate timber-requirements after the devastation caused by the War and our possible future resources, is, of course, of a more immediate practical interest. A concise summary is given of the available timber-supplies in various countries, with the conclusion, now familiar to us from the author's previous publications, that we must look mainly to Russia. In this, perhaps, he somewhat overlooks the inevitable enhancement of the price of timber that will render possible the exploitation of the less accessible British Columbian supply as readily, perhaps, as that of any from Siberia. Home afforestation, it is cogently argued, "should, in combination with agriculture, greatly ameliorate the social conditions of the people resident in the areas of . . . the poorer classes of soil . . . should lead to the resettlement on these areas . . . of a larger hardy population . . . and . . . result in placing the nation in a position of security in the matter of its timber supplies in the event of war." Incidentally, Mr. Stebbing argues that if we are to have successful coniferous forests in Britain we must get rid of rabbits, black-cock and roe-deer;

and his administrative conclusion is that "by far the greater proportion of land required for afforestation should be acquired by either ordinary leasing or leases on a profit-sharing basis—the State only purchasing areas sufficient to enable it to demonstrate in different parts of the country that commercial forestry could be made to pay."

G. S. Boulger.

BOOK-NOTES, NEWS, ETC.

Mr. T. F. Cheeseman sends us a copy of the account of the Vascular Flora of Macquarie Island which he has contributed to the Scientific Reports (vol. vii. pt. 3) of the Australian Antarctic Expedition of 1911–14. The island, which "lies rather more than 600 miles to the south-west of New Zealand and is approximately 920 miles from Tasmania," was discovered in 1810 by Captain Hasselborough of the ship 'Perseverance,' which had been despatched from Sydney for the purpose of searching for islands inhabited by fur-seals. "These were found to be extremely numerous; it is said that one vessel alone, during the first year of its operations, took away more than 35,000 skins"; as a natural consequence "the species was nearly exterminated: it is now a rare occurrence to see a fur-seal on Macquarie Island." The island, however, was visited for many successive years for the purpose of procuring sea-elephant oil and penguin oil," and the communication which thus existed between New Zealand and the island led to visits from Dr. Scott in 1880 and Mr. A. Hamilton in 1894, both of whom paid attention to its fauna and flora. A subsidiary base in connection with the Australian Antarctic Expedition was established, and large collections were made in all branches of biological science; the botany was investigated by Mr. Harold Hamilton, and this paper is mainly based on his collections. Mr. Cheeseman, however, gives a full account of the work of previous collections, the first of which, consisting of eight species, enumerated in the *Flora Antarctica*, was sent to W. J. Hooker by Charles Fraser about 1810. The number of native species of flowering plants enumerated is 30, of which three—*Deschampsia penicillata* T. Kirk, *Poa Hamiltoni* T. Kirk, and *Triodia macquariensis*, now first described—are endemic; three ferns and a lycopod make up the vascular flora—the other cryptogamy will be described in future volumes of the Reports. The memoir abounds in notes, descriptive and other, upon the species and concludes with an exceedingly interesting and valuable chapter on the "affinities, history, and origin of the flora"—it is in fact in every way a scholarly piece of work. In the index the specific names precede those of the genera—"*acaulis* Ranunculus"—a somewhat novel arrangement; the genera, however, are also indexed.

We have received the first number (July) of *The Journal of the Arnold Arboretum*, edited by Prof. C. S. Sargent, which is designed to take the place of *Garden and Forest*, the last volume of which appeared in 1897. The new Journal, which is to appear quarterly, will contain "notes on trees and shrubs or descriptions of new species and their relationships, letters from correspondents, and notes on the vegetation of countries visited by officers and agents of the

Arboretum." The number before us contains Notes on American Willows of the *Pleonandræ* Group, by Camillo Schneider; a Phytogeographical Sketch of the Ligneous Flora on Korea, by E. H. Wilson; Notes on North American Trees by the editor, in the course of which reasons are shown for the retention of *Populus tacamahacca* Mill. in place of *P. candicans* Ait., and Catesby's specimen in the British Museum Herbarium is accepted as the type of *P. balsamifera* L.; and a paper on "New Species, Varieties and Combinations for the Herbarium and Collections of the Arnold Arboretum" by Alfred Rehder, which is prefaced by some interesting remarks on nomenclature, especially as this relates to horticulture. The paper contains a large number of new combinations, based as these always should be, on a careful study both of plants and synonymy; we note that "*Abies alba* Mill. Dict. ed. 8, no. 1 (1768)" for the adoption of which for *Pinus Picea* L. sufficient reasons seem to be given. We note that Mr. E. H. Wilson, who has returned after an absence of more than two years in Japan, has been appointed Assistant Director of the Arboretum.

The *Journal of the New York Botanical Garden* for June contains an article on "Brackenridge and his Book on Ferns" by Dr. J. H. Barnhart. Although he died in 1893, William D. Brackenridge does not appear in the *Third Supplement to the Biographical Index*, though he had every claim to inclusion, as he was born at Ayr, June 10, 1810, and was in charge of Patrick Neill's grounds at Canonmills, Edinburgh: after this he spent several years on the Continent, part of the time in Poland and the rest under Friedrich Otto at Berlin. He went to America about 1837, and in 1838 was attached as assistant botanist to the U.S. Pacific Exploring Expedition. Dr. Barnhart gives a detailed account of the expedition and of Brackenridge's connection with it. On its return, in 1842, the preparation of the report on the ferns collected was placed in his hands, and, after many delays and difficulties, was issued in 1854–55 as vol. xvi. of the Expedition Series; owing to destruction by fire, copies of the volumes are rare. In 1855 Brackenridge settled near Baltimore, where he became a nurseryman and landscape architect; "he was for some years horticultural editor of the *American Farmer*, but his one book was his only contribution of importance to botanical literature"; he died at Baltimore on Feb. 3, 1893. He is commemorated in the genus *Brackenridgea* A. Gray (Ochnaceæ).

The *Kew Bulletin* (1919, no. 4, published in June) contains a paper by Mr. W. B. Grove on "Species placed by Saccardo in the Genus *Phoma*"; of these a large number are transferred to other genera; there are numerous illustrations and some new species are described. Mr. Rolfe has what is evidently a careful historical account of "The True Mahoganies," of which three species are recognized—*Swietenia Mahagoni* Jacq., *S. humilis* Zucc. and *S. macrophylla* King. The number also contains a paper on the cultivation of New Zealand Flax (*Phormium tenax*) in Co. Kerry, and a note on a collection of about 600 drawings of Indian plants which "appear to have been at one time the property of Claude Martin, who was born at Lyons on Jan. 4, 1731, went to India in 1751, and, as an officer of the English East India Company, served in the Carnatic wars": he died at Lucknow, Sept. 13, 1800. Most of the drawings have been named by William Roxburgh, who, in his *Flora Indica*, described some new species from material sent by Martin, whom he commemorated in *Andropogon Martini*.

The Journal of the Linnean Society (Botany: xliv. no. 299; July 31), contains "A Revision of some Critical Species of *Echium*," by C. C. Lacaita. Under this heading five papers are brought together: 1. Five Critical Species—*E. judæum*, sp. n., *E. australe* Lam.; *E. Coincyanum*, nom. nov., *E. pycnanthum* Pomel, *E. salmanticum* Lag.; 2. The genus in the herbaria of Tournefort, Jussieu, and Lamarck; 3. The *Echia* of Sibthorp's herbarium; 4. The Linnean Species; 5. The *Echia* of Miller's *Gardener's Dictionary*. Mr. Lacaita has made an exhaustive study of the old material, not only in the herbaria mentioned, but in the Sloane Collections and others in the National Herbarium, and his paper is well described by him "as a quarry from which any monographer of the genus may dig material." The other papers in the number are "Plant-Distribution from the Standpoints of an Idealist," by H. B. Guppy, and "On a Malay Form of *Chlorococcum humicola*" (with two plates) by B. Muriel Bristol.

The Essex Naturalist (xix. pt. 1; April 1918–June 1919) contains an exhaustive account by Mr. Miller Christy of "Samuel Dale (1659?–1739) and the Dale Family"; a note by Miss Lister on *Habenaria chlorantha* var. *tricalcarata*; a supplementary report on the Lichens of Epping Forest by Robert Paulson and Percy G. Thompson: and a description by W. G. Clarke of three Essex herbaria, one formed by John Freeman (1784–1864), and two by Joseph Freeman (1813–1907): the herbaria have been presented by Mr. W. H. Freeman (grandson and son) to the Essex Field Club Museum.

The last issue of the *Records of the Botanical Survey of India* (vol. vi. no. 8; Jan. 1919) contains an interesting paper by Mr. C. C. Calder on "The Species of *Oxalis* now wild in India." These are nine in number—*O. Acetosella*, *O. Griffithii*, *O. variabilis* var. *rubra*, *O. Pes-capræ*, *O. corniculata*, *O. pubescens*, *O. tetraphylla*, *O. latifolia*, and *O. corymbosa*, of which the third, fourth, sixth, seventh, eighth, and ninth are completely naturalized introductions; the naturalization of *O. Pes-capræ* is now reported for the first time. Mr. Calder gives interesting details of the distribution of the species, of each of which a plate is given.

In *The Ohio Journal of Science* for April is continued the series of papers dealing with the effect of the great eruption on Mount Katmai in Alaska on plant-life and the remarkable recovery of vegetation around Kodiak "where the new plant covering consisted almost entirely of old perennials which had survived and come up through the ash." In the present instalment Mr. R. F. Griggs records the first stages of the process in the valley of Katmai River: here one of the most notable survivals was *Equisetum arvense*, which "was able to penetrate deposits so thick that nothing else could come through." A series of illustrations from photographs add to the interest of the paper.

HISTORICAL REVIEW OF THE PHÆOPHYCEÆ.

By A. H. Church.

The following notes have been put together as summarizing the progressive discovery of this remarkable race of Marine Algæ in the general history of botany, as also illustrating the gradually increasing interest in what must ever remain one of the most central groups of the vegetable kingdom, in that it alone, in the present world, affords a view of the rise and development, in the sea, of a massive race of autotrophic benthic organism, from the phase of the plankton-flagellate to the culminating expression of plant-forms, which in point of size may bear comparison with the vegetation of the land. These types, again, are undoubtedly the nearest in general organization to the races of marine algæ which left the sea to pass through the vicissitudes of the subaerial transmigration, to emerge as the higher Flora of the Land.

In this respect, it is interesting to note the part played by British algologists, at a time when little interest was attached to the vegetation of the sea; as also to emphasize the essential importance of continued research on this isolated group of plants, rendered peculiarly appropriate to the botanists of this country by the geographical position of the British Isles.

The subject falls naturally into several epochs, as following the general progression of Botanical Science.

I. Theophrastus to the Herbalists (300 b.c.–1623 a.d.).

To the first naturalists of ancient Greece, the common objects of the sea-shore were just the same as they are now, in the same localities, and Theophrastus (300 b.c.) records the plants he saw, and the ones he had heard about from fishermen and sailors. The word *φυκος* ('Phycos') was originally used to cover all marine plants, including such submerged Angiosperms as *Posidonia* and *Zostera*, the litmus-lichen (*Roccella*) growing on the rocks of Crete, and employed from time immemorial as a cosmetic, as also examples of Red, Brown, and Green Sea-weeds proper—*e.g.*, a red 'Sea-Palm,' the 'Oyster-Green' like a crumpled lettuce (*Ulva*), and more particularly the Cystoseiras ('Sea-Oak' and the 'Sea-Fir') and the 'Sea-Vine' (*Sargassum*); the former as miniature trees with thick trunks and branches, the latter with berries like those of the currant-vine. Also he had heard from sailors that at the Pillars of Hercules (Gibraltar) the ocean-tide brought in sea-weeds of marvellous size, 'about a palm-breadth' (drifted *Laminaria saccharina*) and the 'sea-leek,' growing as high as a man's waist (*L. digitata* forms)[1]. Dioscorides (a.d. 77) and Pliny (a.d. 79) have little more to say than record the popular

[1] Theophrastus (circa 300 b.c.), *De Historia Plantarum*, Lib. 4, cap. 7. Hort (London, 1916), English Translation, vol. ii. p. 329.

knowledge of the time; they were only dealing with the same vegetation[1]. By the Romans, in fact, the term *Fucus* was used in its primary sense for the *Roccella*-lichen, as shown by the numerous derivatives in the sense of dyeing, painting, and rouging; further references to sea-vegetation remained dormant for many centuries, until the Renaissance had brought a veneration for the old Greek texts of Theophrastus and Dioscorides. The first new references are those of IMPERATO (Naples, 1599), who in his general 'Natural History' mentions many Mediterranean Sea-weeds, as well as the *Fucus marinus* (*Roccella*), Tamarisk- and *Myrica*-like Cystoseiras. Figures are given for the 'Palma Marina' (Floridean) of Theophrastus, 'Abies Marina' (a *Cystoseira*), and even the '*Fuco giganteo*,' a mythical figure of an oceanic *Laminaria digitata*, too good to be lost, from sailors' tales[2].

First among the Botanical Herbalists, LOBELIUS[3] (Antwerp, 1576) correctly interpreted Theophrastus: The 'Quercus Marinus' is figured recognizably as a *Cystoseira* (an *Abrotanum maris*), and his woodcuts include Sargassums (*Lenticula*) of the Adriatic and Tyrrhenian Seas! as well as the *Fucus Plinianus*, identified as Vraick of the sea-coast, and the Lichen (*Rocella*) of Crete. (The use of the word *Fucus* for the *Roccella*-lichen persisted until the time of Ray, 1686.)

The first really new step was made by DODONÆUS in his *Stirpium Historiæ*, published after his death (Antwerp, 1616[4]). In recording *Ulva*, *Posidonia*, and the *Fucus* of Theophrastus, he mentions that there were some other species as well, and figures very creditably four forms from the Dutch coast: (1) *Fucus vesiculosus*, (2) *Himanthalia*, (3) *Ascophyllum*, (4) *Halidrys*. The first of these is rather ingeniously read into Theophrastus' account of the Sea-Oak (cf. *Cystoseira ericoides*), and other types are referred to the genus *Fucus*, since had not Theophrastus said that there were others beyond the Pillars of Hercules! and from this time *Fucus primus* (*F. vesiculosus*) holds its own as No. I. *Fucus*, or the 'Quercus marina,' as the type for all sea-weeds; and the systematist's custom of beginning the list of sea-weeds with the Fucaceæ may be said to survive until the *Sylloge Algarum* of De Toni (1895).

II. EARLY SYSTEMATISTS (BAUHIN, 1620, TO DILLENIUS, 1724).

Advance beyond this stage was but slow. A few types of plants were isolated, and rather casually named, as by CASPAR BAUHIN[5] (Basle, 1620) who received plants from the beach at Aberdeen; and

[1] Dioscorides (circa 77 A.D.), Lib. 4, cap. 99. Pliny (died A.D. 79), Lib. 13, cap. 25 (vel 48).

[2] Imperato (Naples, 1599), *Dell' Historia Naturale*, pp. 740, 743.

[3] Lobelius (1576), *Stirpium Historia*, pp. 652, 653.

[4] Dodoens (1616), *Stirpium Historiæ Pemptades*, p. 479.

[5] C. Bauhin, *Pinax* (Basle, 1623), pp. 363, 365. *Προδρομος* (Basle, 1671), p. 154 (no figure); *cf. Pinax*, 'Fuci arboribus, fructibus, vel etiam herbis assimilati.'

a few rough blocks were added; *cf.* Johnson's Gerard (1633)[1], and Parkinson's *Theatrum*[2] (1640).

A more imposing technical display was made by Morison[3], the first Professor of Botany at Oxford (in the posthumous vol. iii. 1699), in which copper-plate illustrations are given for the first time, though of varying value, and the text comprises a miscellaneous collection of about 60 plants, including with the sea-weeds *Zostera* and polyzoans. Ray (1686)[4] repeats much the same miscellaneous collection of plants, but without figures, and remarks of little real scientific value. The number of species of *Fucus* grew considerably, the name being extended to all shrubby kinds, as opposed to smaller more mossy forms (*Muscus marina*). Thus Bauhin in his classical *Pinax* (1623) collects together references to 20 forms of shrubby Fuci. Parkinson (1640) knew 12 English plants (including *Ulva* and *Padina*). Tournefort[5] (1700) gives a list of 76 species.

In the third edition of Ray's *Synopsis* (1724) Dillenius includes 57 species as *Fucus*, and these are arranged in artificial classes as they are (1) Branched, (2) Dichotomous, (3) Bilateral, or the converse[6]. Dillenius, Sherardian Professor of Botany at Oxford (1734–1747), also amassed a collection of all the common objects of the sea-shore that looked anything like a plant, including sponges, hydroids, polyzoans, and red and brown algæ. He collected everything he saw on the beach, just as one might do to-day, including about 20 Phæophyceæ out of a total of 60 forms[7]. The value of this work can be indicated by saying that the same sort of thing could be done by any intelligent and uninstructed boy, as a holiday task, in a few days at the sea-side. As an example of shore-observations, the text is chiefly remarkable for the common plants left out. This is no reflection on the industry of Dillenius, whose province was a survey of the whole of the vegetable kingdom, single-handed, but it serves to indicate the highest scientific horizon of the time—at any rate, much had been done since the time of Dodonæus.

III. Influence of the Linnæan System (1735–1813).

From the very chaotic medley of bad descriptions, Linnæus (1753), in the first edition of the *Species Plantarum*[8], reduced the species of *Fucus* to 27 'shrubby' forms; any other sea-weeds being included as *Ulva* (9) and *Conferva* (21); e. g., *Pylaiella littoralis*

[1] Gerard's *Herball*, enlarged and amended by Thomas Johnson (London, 1633), pp. 1567, 1570.

[2] *The Theatre of Plants*, John Parkinson (London, 1640), pp. 1281, 1292.

[3] *Plantarum Historiæ Universalis Oxoniensis*, pars tertia, by Jacobus Bobartius, Oxford, 1699. Morison died in 1683; cf. *An account of the Morisonian Herbarium*, Vines & Druce, Oxford (1914), p. 223. Part iii (1699), xv. cap. 48, p. 645 and last folio of plates, Sect. 15, tt. 8, 9.

[4] Ray, *Historia Plantarum*, London (1704), vol. iii. pp. 9, 10.

[5] Tournefort, Paris (1700), *Institutiones Rei Herbariæ*, p. 565.

[6] Johannis Raii *Synopsis*, editio tertia (Dillenius), London (1724), p. 39.

[7] *The Dillenian Herbaria*, Druce & Vines, Oxford (1907), p. 21.

[8] *Species Plantarum*, edit. i. Holmiæ, 1753, vol. ii. p. 1158.

was a *Conferva*. Linnæus' practical knowledge of even the commoner Atlantic sea-weeds was of the most meagre description, and the mistakes he made are excusable. Thus '*Laminaria digitata*' is left out, and the whole of the Laminarians included under *L. saccharina*, the latter name being borrowed from an allusion to *Alaria*[1]. *Fucus* was again included as the first genus of the group *Algæ*, a subdivision of the Cryptogams (*Systema Naturæ*, 1735). It is true that his 'Cryptogams' also included the tree *Ficus*, and the Algæ, *Lemna*; but these minor slips were soon corrected. The essential point is that the 27 species of the genus *Fucus* were subdivided into 5 sections, much as suggested by Dillenius:—

I. Dichotomi frondescentes,
II. Dichotomi caulescentes,
III. Ramosi foliis distinctis,
IV. Ramosi fronde unita,
V. Fructificationibus non vesicariis,

as 4 groups of Fucoids, and the rest. Characteristic representatives of these groups are:—(1) *Fucus serratus*, (2) *Himanthalia*, (3) *Sargassum*, (4) *Halidrys*, (5) *Laminaria*, *Padina*, and *Chorda*. Out of the 27 forms, 4 in group V were Florideæ. But the old arrangement, retaining the commoner Fucoid plants in the premier position was maintained; and this sequence becomes the guide to subsequent writers, who added new species to the 5 groups. Thus Hudson (1762)[2] increased English forms to *Fucus* 45, *Ulva* 10, *Conferva* 36; Lightfoot[3] (1777) describes *Fucus* 43, *Ulva* 12, *Conferva* 26.

Under the stimulus of the Linnæan System, and the cult of the Herbarium, with greater care in observation and collection, the addition of forms and descriptions proceeded steadily. Increasing interest is shown in sea-weed collecting, apart from the study of flowering plants, and many excellent figures (Lightfoot) enabled the plants to be readily identified; the few drawings of Velley (1795)[4], and a good set by Stackhouse (1795)[5], introducing the use of colour for the first time, and stimulating enquiry as to the nature of the reproductive organs (Velley). A review of British Algæ (Woodward and Goodenough, 1797)[6] comprises accounts of 72 species of sea-weed, all classed as *Fucus*, now becoming a jumble of brown and red forms; and an attempt at a slightly new arrangement is interesting, as affording the general plan subsequently emended and followed by Greville and Harvey.

Meanwhile, considerable progress had been made on the continent. The honour of writing the first book on Marine Algæ alone is due to Gmelin (St. Petersburg, 1768), though the illustrations were rather crude[7]; and a finer volume of coloured plates of 96 sp. was pub-

[1] Sibbald, Edinburgh (1684), *Scotia illustrata*, part ii. p. 26.
[2] Hudson, *Flora Anglica* (London, 1762), p. 466: no figures.
[3] Lightfoot, *Flora Scotica* (London, 1777), vol. ii. p. 902.
[4] Velley (Bath, 1795), *Coloured figures of Marine Plants.*
[5] Stackhouse (Bath, 1795–1801), *Nereis Britannica.*
[6] Goodenough and Woodward, Trans. Linn. Soc. vol. iii. (1795), p. 84.
[7] *Historia Fucorum*, Gmelin, Petropoli (1768).

lished by ESPER (1800)[1]. The latter has no special arrangement, but Gmelin distinguished 7 subgenera (ordo) or 7 orders, as well as *Ulva* and *Tremella*-forms.

The issue of the latter may be said to have stimulated DAWSON TURNER in this country to prepare the 4 great quarto volumes of coloured figures[2], which mark the culmination of the epoch of collectors and naturalists pure and simple. All the forms are called *Fucus*, the figures were chiefly drawn by Hooker, and there is no attempt at any arrangement; but the text is a monument of general information, and still indispensable to British naturalists, as also for the figures of many foreign species collected by BANKS, MENZIES, and ROBERT BROWN, from Australia, the Cape, and California, which are often the most readily available figures and descriptions of still little-known plants.

Reference to the older literature shows how much had been done under the influence of the Linnæan System between 1735 and 1819; scientific method had been introduced into the subject, and naturalists and collectors were stimulated for the first time to increasingly careful and detailed observations. But though attention was paid to such details of spore-arrangement as could be seen with a simple lens of low power, little further advance was possible until better microscopic methods had been invented. The fine hand-coloured plates of Dawson Turner and Hooker set a standard for future work of this kind; but the general attitude of the botanist of the period is perhaps summed up by Martyn (1807),—"Many of them (*Fucus* sp.) make very beautiful specimens for the herbarium, and are often seen disposed on paper so as to form a sort of picture"[3].

IV. INFLUENCE OF THE NATURAL SYSTEM (1789–1851).

Contemporaneous with the work of Turner, new ideas were making their way as a consequence of the increasing acceptance of the Natural System of Classification of Flowering Plants, published by A. L. de Jussieu (Paris, 1789), which was to finally supersede the Linnæan System. Plants being successfully grouped for the first time in Subdivisions and 'Natural Orders' which attempted to map out the more fundamental 'natural affinities' of the plants in question. The application of these ideas to sea-weeds was indicated by LAMOUROUX (1813), who in a striking essay[4] marked out a new scheme, which not only segregated numerous *genera*, but arranged them in distinct *Natural Orders*. The first feature of primary importance was the separation of the Florideæ (II.) from the Fucaceæ (I.) and the Dictyotaceæ (III.); while such admirable names as *Laminaria*, *Desmarestia*, *Chorda*, *Dictyota*, *Padina*, *Asperococcus* were proposed for the new genera. As minor imperfections of this first attempt, it may be noted that the Floridean

[1] *Icones Fucorum*, Esper, Nürnberg (1797), 2 vols., text & plates.

[2] *Fuci*, Dawson Turner (London, 1808–1809, 1811, 1819), 4 vols.: coloured plates and descriptions of 258 species of *Fucus*, both British and foreign.

[3] Martyn (1807) in Miller's *Gardener's Dictionary*.

[4] Lamouroux (Paris, 1813), "Essai sur les Genres de la famille des Thalassiophytes non articulées."

Furcellaria was placed with the Fucaceæ, and *Amansia* with the Dictyotaceæ, while *Asperococcus* was relegated to the Ulvaceæ. The four orders of Algæ included 25 genera, 24 being new, and 9 named after friends of Lamouroux. The creation of *new genera* thus initiated proceeded rapidly, and LYNGBYE (1819) had 49 genera fathered by Stackhouse, Agardh, as well as by Lamouroux and himself, arranged in 6 'orders'[1]; though unfortunately 'brown' and 'red' are still mingled, *Delesseria* coming next to *Fucus*, and *Ulva* to *Laminaria*. Of these 49 genera Lyngbye was responsible for 11.

Similarly, further advance was shown in Sweden by C. AGARDH (1824). The whole of the Algæ are now comprised in 6 orders, with a total of 70 genera[2], with singular prevision, in series from the simplest (Diatoms) to the ones most like land-plants (*Sargassum*). The main series of Green, Red, and Brown Algæ begin to emerge as Ulvaceæ (13 gen.), Florideæ (16 gen.), and Fucoideæ (15 gen.). But the Fucoideæ still retain *Lichina*, *Lemanea*, and *Furcellaria*, and the Ulvaceæ, *Porphyra*; while an order Confervoideæ includes a general mixture of filamentous forms, *Ectocarpus*, *Sphacelaria*, *Mesogloia*, with *Protonema*, *Batrachospermum*, *Thorea*, *Oscillatoria*, *Chara*, *Ceramium*, *Griffithsia*, &c. The larger Algæ are thus beginning to be sorted out; but great confusion still exists in those requiring more microscopic observation, and little appears to be known about them beyond giving them a name.

A short step to the elegant little volume of GREVILLE[3] (1830) shows a slight advance. A preliminary synopsis of Algæ includes 14 orders and 89 genera; but the older arrangement, commencing with *Sargassum* and working down, is followed. *Lichina* is still put among the Fucoids; *Furcellaria* and *Polyides* are again outside the true 'Florideæ'; so that there can be little insight into either the structure or details of reproduction of these types, although they are figured in a colour one would have thought unmistakable. A more remarkable omission is the whole of the 'Confervoid' forms, including Ectocarpoid types, Sphacelarias, &c.; these being still kept separate as in Dillwyn (1809), following the Linnæan System[4].

This class of work culminates in the four volumes of the *Phycologia Britannica* of HARVEY (1846–1851). About 360 coloured plates of British Marine Algæ alone still constitute the standard work of reference on the subject for these shores, and will not be readily superseded. Though these volumes are restricted to British species, the classification expresses the more natural relationships, and all the more obvious errors of the past are put right. Brown Seaweeds (Melanophyceæ) are clearly delimited both from the Rhodophyceæ and the Chlorophyceæ; the first series Melanophyceæ (=Melanospermeæ) alone is subdivided into 6 orders, 35 genera, and 97 species. The system is that of Greville, much emended, and is traced from *Sargassum* down to *Ectocarpus* and *Myriotrichia*; the text is also similar to that of Greville.

[1] Lyngbye (Hafnia, 1819), *Tentamen Hydrophytologiæ Danicæ*.
[2] C. Agardh (Lund, 1824), *Systema Algarum*.
[3] Greville (Edinburgh, 1830), *Algæ Britannicæ* (col. plates).
[4] Dillwyn (London, 1809), *British Confervæ*.

The first half of the Nineteenth Century (1800–1850) may be termed the golden age of the collector and systematist. Enthusiastic amateurs who specialized in alga-collecting were numerous, and the cult of the Herbarium was accumulating the material utilized by systematists, and building the framework of the science. Nowadays one can hardly spare the time and labour for such practices, with a quiet conscience, since ideals of what is most worthy to be done have been considerably raised, and the horizon broadened; but at that time such efforts were still the expression of the highest outlook of the science—at any rate, in this country. The names of many who helped to erect this monumental work are enshrined in generic or specific names :—*e. g.* Ralfs of Penzance (1807–90 : *Ralfsia*), Clouston of Orkney (1800–84 : *Laminaria Cloustoni*), Landsborough of the Sea-Oak fame (1779–1854 : *Landsburgia*), Miss Cutler of Sidmouth (†1866 : *Cutleria*), Miss Gifford of Minehead (1823?–91 : *Giffordia*) : others are commemorated in genera of Florideæ, as Mrs. Griffiths of Torquay (1768–1858 : *Griffithsia*, the accepted doyenne of British lady algologists), Mrs. Gatty (1809–73 : *Gattya*), Mrs. Gulson (fl. 1855 : *Gulsonia*), Miss Ball (†1872 : *Ballia*), Miss Hutchins of Bantry (1785–1815 : *Hutchinsia*, now sunk in *Polysiphonia*), and Pollexsen of Orkney (1813–99 : *Pollexfenia*). It is also interesting to include Mrs. Wyatt of Torquay (fl. 1833 : *Wyattia*), who with the assistance of Mrs. Griffiths compiled the *Algæ Damnoniensis* (4 vols. exsiccata, 234 specimens) to which Harvey's *Manual* (1841) was largely indebted[1]. This algological branch of Botany has been now seen, as it were, to grow up : passing through the stage of 'general information,' characteristic of the more or less educated classes of Greek, Renaissance, or modern times, to the Nature-Study phase of the school-boy and the age of Dillenius, on to the adult naturalist and collector, with refined methods for collecting, naming, and determining species and varieties, but not seeming capable of getting much further. The generation which produced the *Phycologia Britannica* and allied works[2] left few successors; and this work so far again marks the close of an epoch. Henceforward the study of Algæ requires a more special botanical training than was possible for the collector and amateur, though the function of these is still by no means exhausted, and there is room for many at the present day.

A more complete system was drawn up by the younger AGARDH (1848), inclusive of all known algæ[3] : the Phæophyceæ alone extend to 7 families and a total of 70 genera, arranged in series from *Ectocarpus* to *Sargassum*; and this arrangement constitutes the basis of modern classifications, to be emended with improved outlook, as expressed by further knowledge of reproductive processes and life-histories.

Meanwhile, another phase of the subject was beginning to make

[1] Greville (1830), *loc. cit.* p. vi; Harvey; *Phyc. Brit.* (1851), Preface, p. iv.

[2] Cf. *Phycologia australica* Harvey (1858); *Nereis Bor. Amer.* Harvey (1851). *Makers of British Botany*, Oliver (1913): 'Harvey,' p. 204.

[3] J. G. Agardh (Lund, 1848), *Species Genera et Ordines Fucoidearum.*

itself felt. Though the *Phycologia Generalis* of KUETZING (Leipzig, 1843) shows no advance as systematic work, since Kuetzing had peculiar ideas of his own with regard to classification, and a great turn for making new genera out of old ones, which did not convince Schleiden [1], it is always interesting to turn to this remarkable pioneer volume, which may be said to introduce the atmosphere of the elementary laboratory practice of the present day into the subject, based on the methods of section-cutting and the use of reagents. The Florideæ are termed *Heterocarpeæ*, and other algæ *Isocarpeæ*; the latter being curiously divided as Gymnospermous and Angiospermous: the lower Phæosporeæ are still mixed up, *Mesogloia* being near *Batrachospermum*, and *Ectocarpus* next to *Draparnaldia*. But the volume gives special attention to anatomical and physiological considerations, while a large number of careful anatomical drawings and figures of the reproductive organs put the available material in quite a new light. Many of these illustrations have done duty in text-books to recent times [2]. Though not perfect to modern eyes, they are quite different from anything attempted previously—at a time too when cell-theory was still vague, and even 'protoplasm' had not been established by Von Mohl. Kuetzing also seems to have been the first to introduce the objectionable practice of printing the details of 'brown,' 'green,' or 'red' algæ in respectively coloured inks [3].

V. MODERN BOTANY.

"In the years immediately before and after 1840, a new life began to stir in all parts of botanical research, in anatomy, physiology and morphology" (Sachs) [4]. The important additions to the botanical outlook associated with the names of Schleiden, Von Mohl, Naegeli, Hofmeister, and many others constitute the stimulus which prepared the way for conceptions of phylogeny and descent implied by the observations of Darwin and his associates; and the aggregation of these standpoints has made modern botany a subject altogether beyond the dreams of the older school of naturalists. The application of these views to Sea-weeds again came from the other side of the English Channel, and the researches of BORNET and THURET on Antherozoids and sexual fertilization in Brown and Red Algæ mark the starting-point of new lines of progress. The actual fertilization of *Fucus* was observed by Thuret at Cherbourg (1854), though the significance of the sexual organs had been fairly known since 1845, and the theory of sexuality was rendered clear in both Brown and Red Algæ [5]. Work on the French shores has been followed up by JANCZEWSKI (Antibes), GUIGNARD (Cherbourg), CROUAN (Brest),

[1] F. T. Kuetzing (Leipzig, 1843), *Phycologia Generalis* oder Anatomie, Physiologie und Systemkunde der Tange. Schleiden (Eng. Trans. Lankester (1849), p. 146) knew so little of the sea as to regard all algæ as polymorphic expressions of one type of plant.

[2] Hauck (1885), Oltmanns (1904).

[3] *Cf.* Zanardini, *Icon. Phycolog. Adriatica* (1860); Okamura, Tokyo (1902).

[4] Sachs' *History of Botany*, Eng. Trans. p. 182.

[5] Bornet and Thuret (1878) collected papers in *Études Phylocologiques*.

and Sauvageau (Gulf of Gascony), while the establishment of the Marine Station at Naples by Anton Dohrn (1878) has enabled inland continental observers to work under favourable circumstances on the shores of the Mediterranean (Berthold, Reinke, Falkenberg, Oltmanns). The writings of these and many such observers are still the working literature of the subject. The latest official review of the group Phæophyceæ is that of Kjellman [1] (1891), the most complete systematic text (in Latin) that of De Toni (1895) [2], and the most complete text-book that of Oltmanns [3] (1904–5).

General morphological and structural problems have been most successfully dealt with from a modern standpoint by Reinke [4] and Oltmanns [5], while Kuckuck [6] (Helgoland) has set the highest standard of draughtmanship for cells and tissue-details; Sauvageau [7] (Guéthary) has shown what can be done with simple line-work. Good figures of weeds in a natural condition, free from the conventions of herbarium material are given by Okamura (Tokyo) [8].

The opening years of the present century have seen advance in new directions; as on the ecological side,—the account of the Algal Flora of the Færoes by Börgesen [9] constituting a model for floristic work, which has been followed by Cotton [10] for Clare Island in British seas; while on a more restricted formation Miss Baker [11] has stated the algal problems of the Salt-marsh. A distinctly new standpoint has been introduced in the discussion of cytological problems of the organization of the nucleus in karyogamy and meiosis (Strasburger, 1897; Farmer and Williams, 1898; Williams, 1904). In this department Yamanouchi [12] has set a standard of technique and comprehensive detailed observation for application to all life-cycles, which may be equalled but scarcely surpassed, as expressing the limit of modern microscopic methods.

The footnote references are only intended to afford a guide to the best methods of work in the group at the present time—the first desideratum for British seas being undoubtedly a comprehensive account of the British plants, with figures and full structural and ecological details, to replace the *Phycologia Britannica* of Harvey.

---

[1] Kjellman (1891), Phæophyceæ, in Engler & Prantl's *Pflanzenfamilien.*

[2] De Toni (1895), *Sylloge Fucoidearum.*

[3] Oltmanns (Jena, 1904), *Morphologie und Biologie der Algen.*

[4] Reinke (Kiel), cf. *Altas Deutscher Meeresalgen* (1889).

[5] Oltmanns (1889), *Bibliotheca Botanica*, iii. p. 78.

[6] Kuckuck (Helgoland), cf. *Wissenschaftliche Meeresuntersuchungen*, 1898.

[7] Sauvageau, J. de Bot. 1892, 96; 1902, Sphacelarias, Myrionemas.

[8] Okamura (Tokyo), *Icones of Japanese Algæ*, 1907 et seq.

[9] *Botany of the Faeroes* (Warming, 1908); *Marine Algæ*, Börgesen (1903), p. 403, 1908, p. 683.

[10] Cotton (1912), *Clare Island Survey.* Proc. Roy. Irish Acad. xxxi., Marine Algæ, p. 94.

[11] Baker and Blandford, *Brown Sea-weeds of the Salt-Marsh.* Journ. Linn. Soc. p. 325 (1916).

[12] Yamanouchi (Bot. Gazette, Chicago), *Fucus* (1909), *Cutleria* (1912), *Zanardinia* (1913). J. L. Williams, *Dictyota* (1904), Annals of Bot. p. 183. Strasburger, Fertilization of *Fucus* (1897). Prings. Jahrb. xxv. p. 372.

CAREX MONTANA L.

By H. Stuart Thompson, F.L.S.

On August 10th I cycled to Charterhouse-on-Mendip, partly to explore an interesting seventy-acre plot of rough pasture and heather recently bought by a friend interested in botany and geology. This enclosure is primarily a rabbit-warren, with a remarkable chasm or miniature canyon of curious irregularity, and bedecked with ferns, running some 200 yards through the carboniferous limestone on the side nearest the Mendip Sanatorium.

As noticed in 1915, when I began mapping the distribution of *Carex montana* on the Mendip plateau, this sedge is very abundant in this and neighbouring walled enclosures, and on the roadside between Charterhouse and the head of Cheddar Gorge. In May and June the pale green of its narrow grass-like leaves can be seen from afar; but in a fine August the colour is a rich yellow-green, so that it forms a distinct feature in the landscape and can be seen a quarter of a mile off, especially when against a belt of heather. The object of this note is to draw the attention of field-botanists to the colour of the foliage of the sedge, because it may possibly be found not only elsewhere on the Mendip Hills but in other English counties, *e. g.* Wilts and Dorset, from which I believe it is not yet reported.

In Somerset *C. montana* was unknown until the late E. F. Linton found it, when botanizing in July 1890 with the late R. P. Murray, on a roadside bank close to Charterhouse Church (Journ. Bot. xxviii. p. 350). In 1908 it was seen by Mr. F. Samson in another place in the neighbourhood; and in 1916 and 1917 I observed that it was "abundant over scores of acres and appeared in spots several miles apart" (Report of Watson Bot. Exch. Club for 1917, p. 79). This year, on August 10th, I saw it in several patches much nearer Priddy, nearly three miles from where Mr. Pugsley had seen it by the Roman road west of Charterhouse. Two years ago I noticed it in small quantity on approaching from the tableland the extreme head of Cheddar Gorge. All these localities are at an altitude of from 700 to 800 ft., and roughly within the old mining area.

When once known in the field *C. montana* can easily be detected in July or August hundreds of yards off, when riding on a bicycle, so brilliant is the yellow-green of its foliage. The leaves of *Brachypodium sylvaticum* are of a very similar colour when growing in the open moorland or rough pasture, as that grass sometimes does on Mendip and elsewhere, but they are much broader. It was the leaves only (of the sedge) which Mr. Linton first detected in July 1890, but "careful search led to the discovery of a few withering spikes . . . . and on one of these a single fruit remained." That discovery was of a plant new to Watson's Peninsular Province (no. 1); for in his *Compendium of the Cybele Britannica* (1870) it was recorded from Provinces 2–5 only, and in "Lat. 51–52 or 53: Sussex, Gloucester, Monmouth, Hereford, Worcestershire." Its present census number in Lond. Cat. ed. 10 (1908) is eleven, for it has also been found in Devon, Hants, and other counties.

Those unacquainted with this sedge, who may look for it after the seeds have fallen at Midsummer, may detect it by its bright, narrow, very slender, and pointed leaves, 4–8 inches long, or rarely longer; and make sure of the species by its thick shaggy branched rhizome to which the fibrous roots are attached. The basal sheaths of the leaves are often reddish purple, as in *C. depauperata*, a very rare and quite different species, which holds its ground in one spot a few miles from Charterhouse, N. Somerset. In early spring before the flowers are out and when the young leaves of *C. montana* are quite short, and surrounded by last year's dead ones, botanists should search for the erect flowering spikes, which are black before the anthers appear at the end of April. The stems soon elongate and finally droop in graceful curves, so that the flowers are often hidden in the mass of leaves. At the end of April 1917 I saw at Charterhouse on Mendip hundreds of these little black spikes, two or three inches high, appearing immediately after the snow melted after that bitter winter.

I am of the opinion that *Carex montana* had been overlooked on Mendip until 1890 chiefly because its flowers and fruits disappear soon after Midsummer, and because many plants have no flowers. Perhaps for similar reasons I actually do not remember having collected it on the Continent, where so widely spread; though until I went to Charterhouse in 1915 my knowledge of the plant was limited to having seen it growing only on shady banks in Wyre Forest and in a Sussex woodland.

Since the above was written, I find the following interesting note on this plant by that careful observer the late T. R. Archer Briggs in his *Flora of Plymouth* (1880) p. 351:—"One of the earliest *Carices* to flower. By the third week in June I have found the seeds all shed and the spikes withered; but the large patches formed by its tufts of light green leaves and its thick shaggy rhizome serve, when flowers and seeds are gone, to distinguish it from its associates, *C. pilulifera* and *C. præcox*." First record for Devon: Briggs, in Journ. Bot. (1873), 172.

RUBIACEÆ BATESIANÆ.—I.

By H. F. Wernham, D.Sc., F.L.S.

In this Journal for 1916 (pp. 226–231) I published descriptions of several new Gamopetalæ collected by Mr. G. L. Bates in the Yaunde district of Southern Cameroons, most of them from the neighbourhood of Bitye, Ebolowa. Mr. Bates, who has already obtained a deserved reputation for the excellence and interest of his collections, has recently sent to the National Herbarium about 250 specimens from the same district; over 16 per cent. of these are *Rubiaceæ*, among which are so many novelties as to claim a separate record; the interest of the remainder, from the rarity and excellence of the material, is hardly less than that of the new species. Notes by Mr. Bates, which I quote in inverted commas, accompany most of the specimens: the following is an extract from his letter of Jan. 30, announcing their despatch:

". . . . Nearly all plants here [Bitye] are woody, and fully half of them, I should think, have weak climbing stems. These latter I have called, all, 'vines' . . . . I use still the Bulu word *ékôtôk*; and if you want to substitute English you will have to say 'mixed growth on abandoned ground' . . . . The natives here never keep the land under cultivation long—or properly, never under *cultivation* at all—and after clearing, and planting for a few seasons, they leave the wild growth to spring up again. This new growth is partly from roots and stumps left in the ground and large trees left standing at the time of clearing, and partly from seeds of certain quick-growing trees, vines and weeds characteristic of such land, and never found in the forest . . . . *Ékôtôk* goes gradually back to the forest; these quick-growing plants disappear, and true forest-growth takes their place; 'old *ékôtôk*' is that which is turning to forest again . . . . Here, where there is no winter, there is no regular time of flowering of each species; still, I am sure that a long and careful course of observation would show some kind of regularity in seasons, but it would be hard to work out."

I proceed to enumerate the Rubiaceæ in systematic order, describing such as appear to be new. The consideration of certain critical forms is reserved for a subsequent paper.

Sarcocephalus esculentus Afzelius ex Sabine in Trans. Hort. Soc. Lond. v. 442. t. 18 (1824). Haviland, in Journ. Linn. Soc. xxxiii. 25 (1897).

No. 1206. "A large tree, stem 100 ft. to branches, about 18 ins. in diameter, at top of a tall stump. Forest. Fruits said to be eaten by natives: known as *akôndâk*."

This species is confined to the tropics of the African continent, wherein it has a wide distribution—laterally, at least, for it has not been recorded from south of the equator. It appears most abundantly about the Niger-basin; but it ranges from Senegambia in the north and west to Abyssinia in the east. According to Dr. Masters, it has pink flowers and an edible fruit, of the size of a peach; it is the "peach" or "fig" of Sierra Leone, where it is known as *amelliky*. In Liberia it is called *doy* (see Flor. Trop. Afr. iii. 39).

Mussænda bityensis, sp. nov.

Frutex scandens, ramulis ferrugineis pulverulento-pubescentibus tardius breviter irregulariter strigillosis. *Folia* venis primariis lateralibus utrinque 9–11. *Calycis* lobi pro rata breves latiuscule lanceolati acutissime acuminati, eorum uno petaloideam in laminam candidam sæpius producto. *Corollæ* extus insuper densiuscule strigoso-sericeæ basin versus glabratæ limbus pro rata angustissimus. *Ovarium* in anthesi tumidum notabile magnum oblongo-ovoideum.

No. 1202. "Climbing shrub or vine; forest. Corolla yellow; conspicuous white leaf adnate to calyx."

Allied to *M. obtusa* Krause, from which it is readily distinguished by its climbing habit and the remarkable size of the ovary, even in young buds. The *leaves* present no notable features; they are elliptical, 10–12 cm. × 5–6·5 cm., scarcely acuminate at the apex, which is, however, so sharply acute as to be almost mucronate; between the main veins the surface is almost glabrous, on both sides, except for a few short stiff adpressed hairs; the veins are strigose; leaf-base obtuse; the *petiole* with indumentum like that of the neighbouring branchlets, is usually less than 1 cm. long. *Stipules* triangular, 6–7 mm. × 3–4 mm. at base, divided to about one-third of their length into two sharply acute lanceolate-subulate lobes. *Flowers* sessile in heads, 6 to 9 in each, on peduncles 1·5–2 cm. long, arising at the end of branchlets 4 to 6 together in a corymbose arrangement. *Ovary* 7–8 mm. long, 4–5 mm. broad; small *calyx*-lobes no longer than 3 mm.; petaloid lobe comparatively small—about 5 cm. × 2·8 cm.—with acuminate base narrowing into a very slender stalk about 1·5 cm. long. *Corolla*-tube scarcely inflated above, and comparatively broad throughout, at most about 2·5 cm. long; limb not more than 8 mm. in diameter.

Mussænda leptantha, sp. nov.

Frutex ramulis ± dense ferrugineo-tomentosis, desuper substrigosis pilis nec manifeste tamen deflexis. *Folia* venis primariis utrinque ca. 9 lateralibus. *Calycis* lobi pro rata brevissimi anguste lanceolati acuminate acutissimi necnon apice subsetacei tamen dentoidei, uno quoque in flore (exterioribus tantum) petaloideam in laminam magnam producto late ellipticam basi cuneatam in petiolum gracillimum angustatam longiusculum. *Corollæ* tubus angustissimus superiore longitudinis in dimidio paullo oblonge inflatus, extus sericeus, infra glabratus subfilamentosus, limbo angustissimo.

No. 1212. Allied, like the preceding, to *M. obtusa*, from which it differs chiefly in the characters of the corolla; the limb, for example, is little more than half the diameter of that in Krause's species. The *leaves* and *stipules* are practically indistinguishable from those of *M. bityensis*. A striking difference is seen in the *ovary* and *calyx*; in the mature flower the former is very small and narrow, the whole length from ovary-base to the tips of the calyx-lobes not exceeding 4 mm. The *corolla*-tube is about 3 cm. long, and no more than 2 mm. wide at most; the limb is only 6–8 mm. in diameter.

Sabicea cameroonensis Wernham in Monogr. Sab. 35 (1914).

Nos. 1170! 1382! "Small vine, *ékôtôk*." Previously collected by Bates (1113!) in a similar habitat; otherwise, only by Mildbraed in the Molundu district, upon whose specimen I based the description of this species. A photograph of the type (Herb. Berol.) is in the National Herbarium.

Sabicea Amomi, sp. nov.

Frutex volubilis ramulis gracilibus, ultimis dense griseo-sericeis tardius sparse strigoso-tomentosis. *Folia* membranacea late elliptica vix acuminata subacuta basi subito acuto-acuminata in *petiolum* gracillimum longiusculum desinentia, utrinque præcipue infra in venis obscuriuscule strigillosa; *venæ* laterales primariæ utrinque ca. 8; *stipulæ* triangulares apice rotundatæ mox reflexæ persistentes. *Inflorescentia* pro rata pauciflora laxiuscula axillaris subumbellata, *pedunculo* manifesto apice bracteis duobus lanceolatis acutis glabratis onusto. *Pedicelli* graciles, plerumque conspicui. *Calycis* lobi inter breviores, attenuati tamen, lineari-lanceolati acuti pro rata elongati subglabri, *ovarium* densissime griseo-strigosum duplo excedentes. *Corolla* inter minores tubularis insuper extus strigosa infra glabrata.

No. 1411. "Climbing in *Amomum*-thicket by stream, forest. Corolla dark-greenish-purple."

Allied to *S. venosa*, and distinct in the venation of the leaves, the few-flowered, lax inflorescence with manifest bracts, and the relatively long calyx-lobes. *Leaves* $\pm$ 8 cm. × 4 cm., with stalk from 1 cm. to more than 3 cm. long; *stipules* about 5 mm. or longer, and 4 mm. broad at base. *Peduncle* $\pm$ 6 mm.; bracts 5 mm. × 1·2 mm.; pedicels up to about 3 mm. *Calyx*-lobes as much as 5 mm. long; *ovary* little more than 1 mm. in depth. *Corolla* about 1 cm. long; the lobes, short and narrow, apparently remain erect.

Bertiera (§ Capitatæ) **bityensis**, sp. nov.

Frutex ramulis junioribus dense griseo-sericeo-tomentosis; *flores* denso in capitulo sessili terminali dispositi; *calycis* ubique densissime sericei limbus subinteger v. obscure necnon brevissime lobatus. *Fructus* (maturum non vidi) verisimiliter inter minores necnon sessilis.

(See key to species in my Monogr. in Journ. Bot. l. 117 (1912).)

No. 1289. "Shrub, forest." Externally this species resembles *B. globiceps* K. Schum.; but it may be distinguished readily by the form and lobing of the calyx.

The thickness of a branch 3 dm. from the apex is but 3 mm. The mature *leaves* are pergamaceous, about 17 cm. long and 5·5 cm. broad, with *petiole* rarely longer than 6 mm.; the leaf-surface is glabrous above, except for the sparsely strigose midrib; the underside is rather densely silky upon the main veins, and sparsely silky between them. The membranous *stipules* are lengthily oblong, as much as 1·5 cm. long, but not more than 4 mm. broad, not noticeably acuminate, but with acute apex, and strigose dorsal midrib so prominent as to be almost carinate, the blade of the stipule being glabrate. *Capitulum* 3–4 cm. in diameter. *Calyx* barely 5 mm. long. The tube of the *corolla* consists of a lower subcylindrical portion, 5–6 mm. long, and an upper subglobular part 4 mm. long and 4 mm. in diameter; lobes lanceolate, acuminate, with very acute apex, 2·5–3 mm. long. *Anthers* linear 3·5–3·8 mm. long.

Tarenna bipindensis Wernham in Cat. Talb. Nig. Pl. 130. *Chomelia bipindensis* K. Schum. in Engl. Bot. Jahrb. xxxiii. 339 (1903).

No. 1380. "Vine on undergrowth, forest. Corolla sap-green."

Tarenna flavo-fusca S. Moore in Journ. Linn. Soc. xxxvii. 302 (1906). *Chomelia flavo-fusca* K. Schum. *loc. cit. supra.*

No. 1243. "Climbing high, forest. Corolla outside dark-green and reddish; inside pale-yellow." The same species was collected by *Gossweiler* as far south as Cazengo, in Angola.

RANDIA MICRANTHA K. Schum. in Engl. Bot. Jahrb. xxiii. 438 (1897).

No. 1216. Small tree, forest. Large white stigma "conspicuous." The type was collected by Pogge in the Kasai (Congo) district. There are several previous records from the Cameroons; and a variety occurs so far south as Angola.

RANDIA CLADANTHA K. Schum. in Engl. Bot. Jahrb. xxviii. 62 (1901).

No. 1270. (No note.) One of the "Amaralioid" species (v. Journ. Bot. lv. 7 (1917)); it has been recorded only from Nigeria and the Cameroons.

RANDIA STREPTOCAULON K. Schum. in Engl. Bot. Jahrb. xxiii. 440 (1897); Wernham in Journ. Bot. lv. 8 (1917), incl. syn.

No. 1267. "Vine, forest. Corolla cream-coloured, with carmine sprinklings, shading at tips and inside." Another "Amaralioid" species.

RANDIA OCTOMERA Hiern in Flor. Trop. Afr. iii. 98. *R. octomeria* (sic) Benth. et Hook. fil. Gen. Pl. ii. 89. *Gardenia octomera* Hook. Bot. Mag. t. 5410 (1863).

No. 1403. "Small shrub, stem 4 ft. long; forest, corolla green."

This species was described and figured by Sir W. J. Hooker (*loc. cit.*) from a plant gathered by Gustav Mann in the island of Fernando Po. It affords a good example of the difficulty in separating the genera *Randia* and *Gardenia*—a difficulty recognized by the author just quoted in his description (*loc. cit.*). Hitherto the species has been recorded subsequently from Nigeria only, so that the present record represents an interesting eastward extension of the distribution.

Randia (§ EUCLINIA) **megalostigma**, sp. nov.

Arbor (?) ramulis validiusculis cortice rugosulo mox indutis manifeste striato. *Folia* magna crassiuscule pergamacea, obovato-lanceolata apice vix acuminata obtusa vix tantum acuta, basi subtruncata v. nonnunquam subcordata, subsessilia v. *petiolo* valido brevissimo, utrinque glaberrima; *venæ* primariæ utrinque 6–7 prominulæ laterales; *stipulæ* brevem in vaginam connatæ tubularem latere quoque breviter inter petiolos apiculatam diutius persistentem. *Flores* magni 1–2 in axillis subsessiles. *Calyx* coriaceus maturus campanulato-infundibularis, dentibus angustissimis oblongis brevibus vix acutis onustus, breviorem in *ovarium* angustum leniter desinens infra sensim in *pedicellum* brevissimum angustatum, *bracteolis* 2–3 brevibus late triangularibus onustum subcoreaceis plus minus distantibus. *Corollæ* brevissime necnon dense ferrugineo-tomentosæ tubus e basi longe cylindricus, insuper leniter infundibulariter dilatatus, lobi ovati acuminati acuti patentes demum deflexi. *Stigma* bilobum magnum carnosum ramulis obtusissimis.

Nos. 1171, 1275.

Allied to *R. maculata*, as is indicated by the similarity of the flowers, this species is easily distinguished by the size and shape of the *leaves*; the latter measure 18–25 cm. × 8–12 cm., the greatest width being in the upper third of the blade; *petiole* barely 3 or 4 mm. long; tube of *stipules* 3–4 mm. deep. *Calyx* and *ovary* form a funnel rather more than 1·5 cm. long, and about 1·3 cm. wide at the mouth, which is surmounted by the distant and very short teeth. The *corolla*-tube has a total length of about 20 cm.; at its base the width is 8–9 mm.; at 17 cm. upwards from the base the width is nearly 2 cm.; at the mouth, just beneath the base of the lobes, the width is over 5 cm.; lobes 3·5 cm. long and over 2 cm. broad. The narrowly-linear *anthers* are nearly 3 cm. long. Lobes of *stigma* 1·7 cm. long and 6–7 mm. broad.

Morelia senegalensis A. Rich ex DC. Prod. iv. 617, et in Mém. Soc. Hist. Nat. Par. v. 232 (1834). *Randia sp.* Benth. & Hook. fil. Gen. Pl. ii. 89.

No. 1210. "Tall weak-stemmed shrub; forest. Flowers white." Bates collected the same species in 1917 (no. 1046), noting it as "a shrub or very small tree, 15 ft. Flowers white, with agreeable perfume."

This species has a wide and continuous distribution in the African tropics, where it is endemic, from Senegambia in the north and west to Angola in the south and Uganda in the east.

Gardenia spathicalyx K. Schum. ex Wernham in Cat. Talb. Nig. Pl. 131 (1913).

No. 1356. No note accompanies this specimen. Collected originally by Zenker and Staudt in the Yaunde district; several excellent specimens were discovered later by the Talbots in Nigeria. The flowers are large—six inches or longer—and densely hairy on the outside; the calyx is split along its whole length on one side, and is divided into 5 long linear lobes on the other.

Allied to this, but readily distinguishable, is the following:—

Gardenia Vogelii Hook. fil. ex Hook. l. c. viii. 782–3 (1848); Hiern in Flor. Trop. Afr. iii. 103 (1877).

No. 1281. "Small shrub, forest. Corolla white, but tube greenish."

This species was based upon a plant found by Vogel in the Ibu district of Nigeria. Specimens have been discovered subsequently as far south as the Congo, and eastward in Djur-land and Niam-niam.

Gardenia abbeokutæ Hiern in Flor. Trop. Afr. iii. 104.

No. 1365. "Climbing high on trees in *ékôtôk* that had lately been forest. Flowers yellow."

This species has been found westward in Nigeria, and as far as Gola, in Liberia.

Amaralia palustris, sp. nov.

Frutex scandens, ramulis in juventute dense griseo-sericeis mox cortice striato-rugosulo indutis glabrato validiusculis. *Folia* inter minora tenuiter pergamacea, glabrata anguste elliptica v. nonnunquam oblanceolata late acuminata acuta, basi truncata v. subcordata, *petiolo* brevissimo crassiusculo; *venæ* primariæ utrinque 6–8 laterales; *stipulæ* oblongæ obtusæ basi demum laxe cohærentes. *Flores* in axillis subsessiles solitarii inter maximos. *Calycis* magni lobi ovato-lanceolati apice subobtusi extus glabrati, tubus brevissimus necnon hypocrateriformi—campanulatus extus minute et brevissime sparse sericeus. *Corolla* magna campanulata lobis latis brevissimis apice rotundatis. *Ovarium* obconicum griseo-sericeum læve.

No. 1209. "Climbing shrub; swamp. Corolla purplish-red, darkest inside."

Allied apparently to *A. Millenii*, this species is characterized by the narrow leaves, with truncate or subcordate base, the colour and size of the flowers, and the habitat. *Leaves* 9–12 cm. × 3–5 cm., with stalk barely 8 mm. at longest; *stipules* about 1 cm. long at the time of fall. The *calyx*-tube forms a shallow basin about 3 mm. in depth, and nearly 1·5 cm. in diameter just below the lobes, which are 1·5 cm. long by 8 mm. wide. *Corolla*-tube 3·5 cm. deep, and over 2·5 cm. wide at the mouth; lobes about 1 cm. long and the same in width at the middle. *Ovary* nearly 1 cm. long.

Amaralia ekotokicola, sp. nov.

Frutex scandens ramulis longe gracilibus striatis pulverulento-sericeis. *Folia* majuscula pergamacea glabrata late elliptica apice vix acuminata necnon subacuta basi sæpius subcordata in juventute nonnunquam subacuta, *petiolo* validiusculo brevissimo asperulo; *venæ* primariæ laterales utrinque ca. 8; *stipulæ* oblongæ apice obtusæ dorso vena centrali strigosa prominula onustæ basi brevissimam in vaginam cohærentes tardiuscule caducæ. *Flores* majusculi in axillis solitarii subsessiles v. breviter pedicellati, basi quisque bracteolarum involucello membranaceo circumdatus infundibulari conspicuo. *Calyx* inter maximos lobis late oblongis nec acuminatis minutiuscule mucronatis. *Corolla* campanulata insuper subcylindrica majuscula lobis brevibus latissimis fere semicircularibus. *Ovarium* parvum manifeste necnon crebre striato-canaliculatum.

No. 1379. "Vine, old ékôtôk. Corolla white with purple speckling and shading inside turning yellowish-brown before falling."

Allied to *A. Millenii* from which it may be distinguished by the characters of leaf and petiole. *Leaves* 11–14 cm. × 6·3–8 cm., the stalk not longer than 1·5 cm.; *stipules* barely 1·5 cm. long, 5 mm. broad. The bracteolar involucel, which encloses the short pedicel, does not exceed 5 or 6 mm. in depth. *Ovary* 5–7 mm. long, widened gradually from the base to 4–6 mm. at the well-marked junction with the tube of the *calyx*; the latter is but 5 mm. deep, and nearly 1·5 cm. in diameter at the base of the lobes, which are 1·3 cm. long and 8 mm. broad. *Corolla*-tube about 4 cm. long, 1 cm. in diameter at the base, and over 2 cm. wide above; lobes 8–9 mm. wide at the base, 9 mm. long.

CANTHIUM THONNINGII Benth. in Hook. Nig. Flor. 410; *Phallaria spinosa* Schum. & Thonn. Beskr. Guin. Pl. 113 (1828).

No. 1334. "Reclining or trailing shrub. Corolla yellowish-green, stigma white."

This species has apparently not been recorded from any locality east of Nigeria.

Vangueria umbellulata Hiern in Flor. Trop. Afr. iii. 150.

Nos. 1179, 1337. "Shrub 6 or 8 feet high, with many slender horizontal branches; forest. Corolla yellowish-green, stigma dark."

This species was described from a plant preserved in the National Herbarium, collected by W. Brass, at the end of the eighteenth century, in the Cape Coast neighbourhood. Welwitsch collected specimens (nos. 5348, 5349) undoubtedly referable to the same species; so that its discovery in the Cameroons provides an interesting distributional link.

Pavetta permodesta Wernham in Journ. Bot. liv. 227 (1916).

Nos. 1203, 1318. "Small shrub, cut off at ground; forest. Flowers white." I based the description of this species upon a previous Bates-number, 716, collected in the same locality.

Morinda Batesii, sp. nov.

Arbor majuscula ramulis pro rata gracilibus glabris insigniter quadrangularibus. *Folia* inter majora papyracea glabra, elliptica apice vix acuminata subacuta, basi cuneata *petiolo* brevissimo; *venæ* laterales primariæ utrinque ca. 7; *stipulæ* late triangulares parvæ. *Capitula* parva pedunculis gracilibus in axillis binis. *Flores* inter minores, *corollæ* tubo gracili necnon breviusculo, lobis lanceolatis subacutis.

No. 1185. "Tree over 75 ft. high, stump over 2 ft. in diam.; called *atyen* (acheng); forest. Corolla pale-green, the lobes white on upper surface."

The nearest affinity is with *M. geminata* DC. (see Hutchinson, in Kew Bull, 1916, p. 8) from which our species is distinct especially in the slender branches and peduncles, and the much smaller corolla. It is moreover quite a large tree—a good deal more than twice the size of *M. geminata*. *Leaves* $\pm$ 17 cm. $\times$ 8 cm., with stalk not longer than 8 mm.; *stipules* 5 mm. long, and about the same in width at base. *Peduncle* 3–6 cm., or longer at maturity. *Corolla*-tube up to 1·7 cm. long, but not much over 1 cm. wide even at the mouth; lobes 6 mm. long, 1·3 mm. broad.

Psychotria latistipula Benth. in Hook. Nig. Flor. 420.

No. 1407. "Small shrub." This species was discovered originally in the island of Fernando Po. Mr. Bates has found it previously in the Batanga district (no. 227) and in Bitye (nos. 624, 914).

Cephaëlis peduncularis Salisb. Parad. t. 99 (1808); Hiern in Flor. Trop. Afr. iii. 223.

No. 1359! "Much-branching shrub, head-high, or higher; forest. Flowers and bracts white."

Widely distributed over western tropical Africa, from Senegambia in the north to Angola in the south; collected also by Bagshawe in Uganda (no. 1356! in Hb. Mus. Brit.).

Cephaëlis hexamera Wernham, nom. nov. *Uragoga hexamera* K. Schum. in Engl. Bot. Jahrb. xxviii. 104 (1901).

No. 1398. "Small half-woody plant, one foot high; forest."

The species was founded upon a plant collected by Dinklage (no. 1800) in the Bipinde district. A good specimen was discovered by the Talbots in the Oban district of Nigeria.

(To be concluded.)

GEORGE STEPHEN WEST, M.A., D.Sc., F.L.S.

(1876–1919.)

George West was born at Bradford on April 20th, 1876. The father, William West (1848–1914), of whom a notice appears in this Journal for the latter year (p. 161), had first-hand knowledge of British flowering plants and cryptogams, and his two sons helped him much: the elder, William, died in 1901 at the early age of twenty-six (see Journ. Bot. 1901, 353). George began early to specialize in the Algæ, especially the Desmids. After passing through the Bradford Technical College and the Royal College of Science, London, he completed his education at St. John's College, Cambridge, where he was elected Hutchinson Research Student, and appointed demonstrator in biology to the University. Afterwards for several years he filled the post of lecturer in natural history at the Royal Agricultural College, Cirencester, and was then appointed (1906) lecturer in botany at the University of Birmingham, under the late Prof. Hillhouse, whom he commemorated in that gigantic sulphur-bacterium *Hillhousia mirabilis.* On the retirement of Hillhouse in 1909 he succeeded to his chair, and in 1916 became Mason Professor. West was an excellent teacher and lecturer, much liked by his pupils, and extremely successful in training them in the habit of scientific research. He greatly enlarged and improved his department; the herbarium is almost entirely his creation. Among his post-graduate students may be mentioned Dr. Muriel Bristol and Dr. Nellie Carter, whose respective researches have thrown much light on the algæ of the soil and on the forms of the chloroplasts of Desmids.

West was the leading expert of this country on Freshwater Algæ: he could recognise at sight almost every British Desmid. His four beautifully illustrated volumes on British Desmidiaceæ in the Ray Society's publications are well known; it is hoped to publish a fifth volume based upon his notes. The investigations of father and son in the Desmids of the whole world made it clear that that group is peculiarly fitted to throw light on the problems of plant distribution and the evolution of species, owing to the fact that they can seldom survive desiccation even for a few hours.

George West's chief publications on Algæ generally were his Treatise on British Freshwater Algæ (1904, long out of print) and the volume (1916) upon the Myxophyceæ, Peridinieæ, Bacillarieæ, and Chlorophyceæ—the first of the series of Cambridge Botanical Handbooks,—of which some account will be found in this Journal for 1917 (p. 83). Besides these and numerous articles in this and other botanical journals, etc., on Algæ from all parts of the world—the series of "Algological Notes," begun in this Journal for 1911 and continued at intervals, may be mentioned—West was contemplating the preparation of a new work on British Freshwater Algæ (excluding Diatoms and Desmids), in which he intended to describe and figure every known species: the value of such a volume can be appreciated by all who are acquainted with his skill and accuracy in drawing, and it is hoped that some part of it may be in a condition fit for publication. The whole of his drawings of Algæ are bequeathed to the British Museum; his algological library and specimens are left to the University of Birmingham.

There still remains to be mentioned his projected Algal Flora of the Midlands; of this only a comparatively few preliminary lists are prepared, but it is hoped to publish these shortly. It is scarcely possible to imagine, apart from calcareous districts, a more unpromising area in this country for algæ than that round Birmingham, yet West and his zealous helpers showed that even this could yield riches, including such a rarity as a new *Roya* in conjugation, probably the first that has ever been found in Britain in that condition. He proved again that, when a competent botanist settles down in a new locality, it begins at once to yield a previously unsuspected wealth of material.

West died at Edgbaston on August 7th after a brief illness. The cause was a severe attack of double pneumonia, aggravated by the weakness due to his indifferent health during the last few years, for he never recovered completely from the influenza trouble of four years ago. He leaves a widow and two young sons, and his premature decease at the early age of forty-three deprives British natural science of one of its most promising adherents. The loss of his kindly encouragement and help to the eager band which he had gathered round him leaves a gap which will be difficult to fill.

W. B. G.

SHORT NOTES.

Vaccinium intermedium Ruthe (p. 259). One locality for this plant in Caithness is a gorge of the Achorn Burn, a tributary of the Dunbeath Water on the east coast: this is locally a deep shady chasm in the rocks, but the higher parts of the walls are exposed to sunlight" (C. B. Crampton, *Vegetation of Caithness* etc., p. 94: 1911). One plant only was found, with the parents and *Arctostaphylos Uva-ursi*. Here there can hardly have been human interference. The other locality, whence I have a specimen collected by Mr. Sutherland, is Scarmclett Braes near Watten near a large lake; the only evidence of human interference in the neighbourhood is the existence of two "picts' houses." The North Lancashire locality (Coniston Old Man, 2000 ft.), communicated to me by Mr. Pearsall (whose son, in company with Mr. Adamson, found it there in 1914), and the Staffordshire habitat, Norton Bog, 1898 (Bagnall, Fl. Staff. p. 40), seem equally remote from human influence. Mr. Garner informed me that the first finder of the plant in Staffordshire was a surgeon, Mr. D. Ball. In *Science Gossip* for 1872 (p. 248) Mr. Garner figured and described it as "a Curious British Plant"; he there says "The Maer and Camp Hills were planted by Mr. Wedgewood, the eminent potter." In Robson's book of Botanical Labels (1874) the plant stands as *V. Myrtillus* var. *hybridum* Garner.—Arthur Bennett.

[Mr. Vevers writes that the "large patch of an acre in extent" mentioned on p. 259 would be more correctly stated as half an acre. He adds: "I had the opportunity of going to Maer Wood where the plant was originally discovered; we found four patches of the hybrid, including one very extensive and old patch which might well be the original one discovered in 1870. My friend Capt. Gourlay has since found it in a new Staffordshire locality—Whitley Common."—Ed. Journ. Bot.]

Simethis planifolia Gren. & Godr. A small quantity of the 'Branksome Lily' still exists in the old locality; but I saw no more than four or five plants, when at Bournemouth in June of this year. Mr. Rogers tells me that it crops up every now and then in grassy waste by the side of roads; so that, though building and dumping operations have sadly restricted the area of its occurrence, there is a good hope of its not entirely disappearing from the neighbourhood.

H. J. Riddelsdell.

Mimulus moschatus L. Reference has been made from time to time in the horticultural journals and in our own pages to the general scentlessness of this plant. A note in *The Garden* for Sept. 6 states that a fine plant was seen at Feltham, Middlesex, which was very strongly scented; it came from a small nurseryman in the neighbourhood, who at the time said it was not scented, but it certainly became so. From this it would seem that the scent appears and disappears in the same plant.—Ed. Journ. Bot.

× Potamogeton dualus Hagström (*P. panormitanus* Biv. × *pusillus* L.). Dr. Hagström in his *Critical Researches in Potamogeton* (p. 103) describes the above hybrid, and mentions specimens from "Ponds near York (1881) Bennett, and Shropshire (1886) Beckwith." These I have looked up; both specimens were sent by me and are now in the Stockholm herbarium. I also find specimens of *P. panormitanus* Biv., from Ireland as "*P. pusillus* L. var. *tenuissimus* Koch. Off Harbour Island, Lough Neagh, Co. Antrim. 10 Aug. 1909, C. H. Waddell." It is probably fairly distributed in this county, but all specimens need examination as to whether they are this or *pusillus*.—Arthur Bennett.

Sex-terms for Plants. I was much surprised to read Mr. Church's criticism of the use by Mr. Chamberlain of the term "female" in relation to a tree (p. 230), and still more at his suggestion to substitute for it the word "fruiting." It seems to me that "female" is quite a satisfactory term: it is a good plain strong English word, and, *pace* Mr. Church, an unambiguous one having but a single meaning, therefore surely an ideal scientific term. The term "fruiting," on the other hand, is open to grave objection. It can of course be correctly used to denote the stage of development of a plant to contrast, say, with "flowering," and it can also be correctly used in contrast to "sterile"; but as an antonym of "male," for which I gather Mr. Church proposes to use it, I should have thought it impossible. Just now long words with Greek roots are, one realizes, much in fashion, ; but really Mr. Church's suggestion of the use of two prefixes, which merely mean "large" and "small," for purposes of sex-differentiation seems preposterous, and to my thinking the sooner such misleading terms are "scrapped," to use Mr. Church's expression, the better in the interests of accuracy. Your contributor would appear to have some objection to the recognition of sex in plants, but I may be pardoned for suggesting that the use of ambiguous verbiage will not do away with the fact.—James Groves.

Pollination of Viscum album. Following some experiments on the fertilization of Mistletoe by Dom Ethelbert Horne, as recorded by him at length in this Journal for 1916 (p. 292), and again in a shorter note in the volume for 1918 (p. 331), and guided by some advice from him about protecting the blooms for trial, four flowering twigs of a female plant were enclosed in fine hexagonal cotton net with a 1 mm. mesh. The net was kept clear of the blooms by a framework of thin split cane; two little hoops of this were tied across each other at the top, the ends being then brought down to the stem, where they and the net covering, now of balloon shape, were securely tied. There is no male plant in the garden, but twigs of pollen bloom were obtained from a distance and hung up in the female bush. The uncovered part of the bush, especially on the sunny side, became loaded with berries. Of the four enclosed twigs, two have one berry each, the other two none. It may be surmised that some of the pollen may have been caught and retained by the fine net, or all of it in the case of the flowers where no fertilisation was effected. In any case, this experiment, agreeing with former trials by Dom Ethelbert, would support his view that fertilisation is not necessarily due to the agency of insects, for none of the bees and flies, claimed by the naturalists Koelreuter, Kirschner, and Loew to be conveyors of the pollen, could possibly pass through the small meshed net.

Gertrude Jekyll.

Galium erectum in Somerset. When Murray's *Flora of Somerset* was published in 1896 there was only one undoubted record for this plant in the county of Somerset, and that was from a wall near Templecombe—a strange habitat. Since then it has been found in several localities in N. and S. Somerset (see Marshall's *Supplement*). On June 7th this year, in walking up to Sidcot School from Winscombe Station, by the old and much frequented foot-path through the fields, I noticed in the top enclosure, close to the main road to Bristol, numerous patches of *Galium erectum* in the short mowing grass. The plant was variable in form, colour, and stature. Some were very short, and others somewhat like the upland Mendip form of *G. Mollugo*, the type of which grows in a lane adjoining and on the main road. Further search showed that *G. erectum* was distributed in patches over the greater part of the field. On enquiry

I learned that this pasture had been browsed by sheep for "at least 40 years" since it had been ploughed; and it was never mown until this year. This doubtless explains why the plant had never been noticed, or at least recorded, from a place within 200 yards of the Sidcot School premises and through which generations of young naturalists and not a few older botanists must have passed. Already by June 15th the flowers had largely disappeared (it is well known to blossom at least three weeks earlier than *Mollugo*); and on August 1st I could not find a trace of even the leaves. The short grass had been mown a fortnight earlier, and a horse was now in possession. Such plants as *Cnicus acaulis*, however, threw a further light on the cultural history of that pasture. Apparently certain Bedstraws are appreciated by stock, especially in dry weather. The day after my discovery I was surprised to find patches of good *G. erectum* in grass left to be mown on both sides of the private drive to Newcomb, Sidcot, a quarter of a mile on the other side of the School. This drive was made some 12 years ago, and was cut out of a pasture grazed by cows. I regard the Sidcot locality and that on a Lias pasture near Washford in the west of the county as the most satisfactory stations for *Galium erectum* in the whole of the Bristol and Somerset area.—H. S. Thompson.

Hypericum humifusum (pp. 195, 225). The notes on the distribution of this plant lead me to record that on 9th Sept. I saw it in great quantity in a gravelly field on a hillside in the neighbourhood of Newton Abbot, S. Devon. The abundant flowers gave quite a tinge of colour to the upper part of this field, which was at the edge of a dense wood, and bracken-bordered. The form was a somewhat diminutive one, which might be accounted for by the position, exposed to strong sunlight, and by the very dry season.—C. E. Larter.

REVIEWS.

Lectures on Sex and Heredity, delivered in Glasgow, 1917–18, by F. O. Bower, J. Graham Kerr, and W. E. Agar. Macmillan & Co., London, 1919; 16mo, pp. vi + 119. Price 5*s*.

A clear understanding of the mechanism of reproduction is admittedly of primary necessity to biologists and economists of every grade, and this pleasant little production epitomizes much of modern views. The word "sex" is still commonly used to cover two distinct sets of phenomena: (1) *syngamy*, the fusion of two gamete nuclei to give a new individual—a phenomenon of fundamental importance as leading to consequent meiosis with its differentiation of inheritance and new possibilities of racial variation, with nothing "male" or "female" about it, the latter terms being merely human conventions, as applied to phenomena of (2) *heterogamy* and the differentiation of sexual characters—as a set of factors concerned solely with the secondary, post-syngamic, nutrition of the zygote, and its further consequences as expressed in "maleness" and "femaleness."

Such phenomena in the botanical kingdom range from the simplest isogamy, and even complete absence of nucleogamy, to advanced heterogamy with manifold secondary differentiations, as also the ultimate complete supersession of heterogamy in the fusing units; though the complexities of somatic differentiation may continue effective. Among animals a very uniform and almost monotonous scheme of heterogamy obtains, from the lowest Metazoa to the highest, and the subject is hence considered from a broader standpoint in Botany.

Professor Bower gives a simple account, stripped of all unnecessary technicalities, of the general facts of plant-reproduction, tracing the progress of sexual differentiation through the vegetable kingdom, from the water to the land, including the elaborated mechanism for post-sexual nutrition within the seeds of higher land-plants. It is edifying to note that Professor Bower in this connection (p. 50) tilts against Tennyson for writing "How [*sic*] careless of the single life," because the poet was not thinking of something entirely different which had appealed to the botanist, in reference to the infinite care taken by the organism (not "Nature") to protect what he calls the "germ"; ignoring the fact to which Tennyson was alluding—*i. e.* that, notwithstanding every such precaution, the seed is ultimately exposed to the caprices of "Nature," and it is in the stage of the resting seed, rather than in germination, that the most appalling wastage of the race has to be endured.

The account of sexual reproduction from the animal side is put so very briefly and concisely, that one does it the compliment of wanting more. The comparison of the human ovum with the gametes of a seaweed (p. 5) affords an interesting reminder that the highest organisms, having passed through the Reptilian epoch, have come back to a state practically identical with that of an alga; the comparison would have been more effective if the oosphere of *Himanthalia* or *Sargassum* had been figured instead of *Fucus*. Hence zoology passes on to more intimate phenomena of nuclear syngamy, and the possible mechanism of heredity. The Weismannic conception of germ-plasm, so foreign to a botanist, is utilized to bar out the inheritance of acquired characters, to the discomfiture of many educationalists and sociologists who hope for immediate results. Mendelism is introduced in the person of the Blue Andalusian fowl, and pleasing facts are recorded as to the inheritance of insanity and brachydactyly. An implied delicate compliment to the presumed intellectuality of the teaching profession is expressed by its position at the head of the table of falling birth-rates; though it might be argued that a man who expects to make a living by teaching others is *ipso facto* "unfit." One cannot expect much more in only about a hundred small pages, but a short list of references to the more reliable literature of the subject might have been added.

A. H. C.

The Building of an Autotrophic Flagellate. By A. H. Church. Botanical Memoirs No. 1. Oxford University Press. 1919. 27 pp. Price 2*s*.

In a score of crisply written chapters, closely packed with facts and deductions, Dr. A. H. Church gives us a reasoned argument descriptive of the origin and development of the simple self-supporting plankton-cell in sea-water. He insists that it is in the vast, constant, ionized ocean that the first hazy rudiments of life began to be (problems for the physicist and chemist to unravel); that carbohydrates were formed and increased in complexity, thanks to the peculiar linking properties of the carbon-atom, and led on to colloid-formation; that nitrogen was pressed into service and was added to the mobile composition of the plasma; and that, when means had been evolved for utilising solar energy, an autotrophic organisation had come into existence capable of producing an ever increasing output of carbohydrate and proteid, and of carrying on life indefinitely. The subject thus became a botanical problem. Owing to the scarcity of nitrogen compounds in the sea, the manufacture of carbohydrates was necessarily far in excess of the proteid synthesis, and consequently there were great quantities of carbohydrate waste to be got rid of, either in a soluble form, or by storage, or preferably as an insoluble polysaccharide deposit on the periphery of the plant—thereby originating a mucilaginous or cellulose wall. Thus "chemical linkage" and "physical growth by adsorption" progressed. The plasma prospered in the daylight, but by night it had to live upon its own reserves; in this way katabolism was initiated and a certain independence attained—an independence which conduced to the possibility of animal life. The delicate plasma necessarily assumed a spherical form by reason of surface tension. Surface tension and metabolic activity would be associated with contractility. Further, a "differentiation" of the plasma "into at least three regions may be postulated": (1) the surface or plasmatic film; (2) an illuminated metabolic zone—the chloroplasm; (3) a central region—the nucleoplasm—living at the expense of the outer zones and free to assume the control of the organism. As the spherical plankton-cell tends to sink vertically, which would be fatal, a tremendous advantage would be gained if the organism could contrive to rise up by growth towards the lessening light. Thus polarity is assumed to have become established—with the subsequent development of a flagellum, however rudimentary, which served primarily as an "anterior tractor-mechanism" and subsequently became exploited in many cases as a food-gatherer. A great advance was achieved when binary fission superseded the mere fragmentation due to sea-action, such fission being presumed to originate in the deep-seated nucleoplasm where starvation would first be felt. The author, in discussing failure and death, argues that "under pressure of approaching dissolution new departures . . . new racial improvements . . . may be . . . expected to occur," namely, the evolution of sexuality, of the holozoic animal, of benthic plants and animals. The later chapters treat of holozoic nutrition, the origin of sexual fusion, the differentiation of flagella, the formation of the cell-wall.

Step by step the author works out his case, showing how inevitably phase has followed phase in the scheme of evolution—a scheme which was "settled once for all time in the initiation of minute forms of ultra-microscopic life, as the necessary outcome of the physical and chemical organization of the aqueous phase of the sea itself." Dr. Church's pamphlet is written in a condensed style not easy to digest at the first reading, but it is severely logical and presents a fascinating study of the origin and progression of plant life and all that it involves, which will be welcomed and enjoyed by all students of biology.

A. G.

A Monograph of the Genus Alaria. By Professor K. YENDO (Journal of the College of Science, Imperial University of Tokyo, vol. xliii. 1919: 145 pages, 19 plates).

THIS is a valuable addition to our knowledge of the Brown Algæ. In addition to submitting the species to a critical revision and reducing them to 15—some 32 have been described since Greville established the genus in 1830,—the author discusses in his introduction several matters of great interest in relation to the anatomy, morphology, habit, and life-history of *Alaria* and its allies among the Laminariaceæ. The shape of the lamina is untrustworthy as a systematic character for its width varies with the environment; so also does its thickness and toughness; and the rapidity of growth of the frond is astounding; in three or four months the frond of such a colossal plant as the N. Pacific *A. fistulosa* may attain a length of as much as 60–80 feet or even more. This species is remarkable for its hollow midrib septated at irregular intervals, which serves as a float for the lamina. A close study of the development of the sporophylls has led the author to divide the species into two groups, *Holosoria* and *Metasoria*. In the former the sporophylls are thick and coriaceous from the first and become covered with sori. In the latter, to which our one British species belongs, the sporophylls are membranaceous at first; and this part remains sterile and more or less gets worn away, while a new and thicker growth arises below it and becomes soriferous. The meaning of the cryptostomata has been much discussed. Prof. Yendo sums up our knowledge of these structures in the different families of Brown Algæ and concludes that in the Laminariaceæ the hair-tufts can safely be regarded as a sort of absorptive organ. The presence of mucilage glands in the various species of *Alaria* is described; but mucilage canals are absent. Occasionally monstrosities occur such as duplication of the lamina or ramification of the stipes, &c.

In treating of the development and life-history of *Alaria*, Prof. Yendo discusses two questions about which there has been much disagreement, namely, whether *Alaria* is perennial, and whether it sheds its lamina annually. His own observations lead him to the conclusion that the plant is biennial. Germinating in the late autumn, the plants grow to a great length by the following October, the lamina then becoming worn away almost to the base; quite early in the following year the lamina starts growing again from the base rapidly, soon shedding the remnant of last year's blade, and quickly attaining its greatest length becomes soriferous and is washed away from its substratum before the end of October. There is, he says, little difference in the life-histories of *Alaria* and *Laminaria* on the coast of Japan. In a diagrammatic table he figures the comparative life histories of these two biennial genera and of the two annual genera *Costaria* and *Undaria*. The species of *Alaria* being all inhabitants of the northern colder seas, the author thinks it may be assumed that the genus had its origin in the Northern Circumpolar Sea and migrated into the Pacific and Atlantic Oceans along the Arctic currents. The species prefer to live on steep rocky exposed coasts, and are rarely found in quiet waters. A synoptical key to the species is provided, based mainly on the sporophylls; and the 15 species are all described, figured, and critically discussed at some length. As to their economic value, they are but little used as food, the Laminarias with which they grow being preferred as better in taste, consistency, &c.

A. G.

The Genus Fumaria.

The *Journal of the Linnean Society* (Botany, xliv. no. 298) dated May 16, is mainly occupied by Mr. Pugsley's "Revision of the Genera *Fumaria* and *Rupicapnos*," concerning which a note appeared in this Journal for 1917 (p. 165). Those who are acquainted with the author's paper on "The Genus *Fumaria* in Britain," issued as a Supplement to this Journal for 1912 and subsequently separately (which is here followed in the treatment of the British species), will need no assurance that this monograph is characterized by the thoroughness which distinguishes all Mr. Pugsley's work: it is indeed a model of completeness, for the author's treatment is not limited to mere descriptions; to each of these are appended notes which not only add materially to the interest of the paper but show a careful and detailed study of living specimens, which is not always evident in monographs. The amount of material examined is very large, and is drawn not only from British but from foreign herbaria, as well as from living material.

The descriptive portion is prefaced by sections on the classification of the genera and their distribution, with a consideration of their habitats; an excellent "list of works cited" shows that the author has fully investigated the literature of the subject. He gives his reasons for following Pomel in the retention of *Rupicapnos* as a genus distinct from *Fumaria*, thus differing from Cosson and other authors who have merged it in *Fumaria*. The latter name he restricts to the annual species forming the section *Sphærocapnos* DC., the perennial plants comprised in the section *Petrocapnos* Coss. & Dur. being referred to *Rupicapnos*.

The genus *Fumaria* is divided, as by Haussknecht in *Flora* (1873) and by Mr. Pugsley in his paper on the genus already referred to, into two sections—*Grandiflora* and *Parviflora*, the former containing 27 and the latter 19 species. Of these a considerable number are new: *F. Ballii* (founded on the plant described by Ball in this Journal for 1877 (p. 297) as *F. agraria* subsp. *tenuisecta*), *F. dubia*, *F. berberica*, *F. coccinea* (R. T. Lowe MSS.), *F. australis*, *F. Schramii*, *F. indica* (a plant referred in Indian floras to *F. parviflora* or *F. Vaillantii*): *F. Martinii* Clavaud supersedes *F. paradoxa* Pugsley, for which it is an earlier name; *F. micrantha* forma *dubia* of the author's former paper is raised to the rank of a variety. A large number of varieties, several of them new, of many of the species are also dealt with. Under *Rupicapnos* 20 species are given, all of which, with one exception, are North African. These are placed in four generic sections which have not been previously established. Here also are several new species—*R. prætermissa*, *R. sublævis*, *R. Cossonii*, *R. decipiens*, *R. oranensis*; *R. africana* is based on Lamarck's *Fumaria africana*, a name which has been variously applied—Pomel's *R. africana*, for reasons adduced, is regarded as a still-born name, and *R. Pomeliana* is substituted for the Algerian plant intended by Pomel.

A concise clavis of the species is inserted in each genus; a feature of the descriptions is the rigid adherence throughout to a system of italicised contrasting characters following that adopted in the author's previous papers on *Fumaria* (already referred to) and *Narcissus* (issued as a Supplement to this Journal for 1915). Plates from drawings by the author are furnished of five African species of *Fumaria* and of four species of *Rupicapnos.*

The Flower and the Bee: Plant-Life and Pollination. By John H. Lovell. Illustrated from Photographs by the Author. London: Constable. 8vo, cloth, pp. xvii, 286. Price 10*s.* 6*d.* net.

In this handsome and—considering the times—cheap volume, Mr. John Lovell gives us the result of many years' observation of the life-relations of flowers and insects—for his book is not confined to bee-visitors, as its title would suggest. He has, he tells us, "approached the science of flower ecology from three different points of view"—those of the botanist, entomologist, and apiarist—believing that the study of only one phase of the subject must lead to partial and imperfect conclusions. His "experience has convinced him of the efficacy of natural selection in the evolution of flowers, of the advantages of cross-fertilisation, and of the inheritance of acquired characters," and he dismisses somewhat summarily the "new and bizarre suppositions" which have been advanced against the older biological theories.

After an introductory chapter on "Flowers and Humanity," Mr. Lovell gives a brief account of the work of Sprengel, the Muellers, and Darwin, whose attention was directed to Sprengel's book by Robert Brown, "an eccentric English botanist of great learning." There follows a chapter dealing with wind-fertilisation, and several devoted to the work of bees, who, "as pollinators of flowers far surpass all other insects in importance. In their adaptations for collecting pollen and nectar: in diligence and in mental attributes, bees stand easily in the first rank"—it was in order to become familiar with the economy of the honey-bee that the author became a practical bee-keeper. The chapter headed "Bumble-Bee Flowers" begins with the statement that "The English nation owes its power and wealth largely to bumble-bees," thus introducing the well-known case of the correlation of bees and clover which led to the introduction of bumble-bees to New Zealand. Another chapter tells of "Bees which visit only one kind of flower"; one species is on this account popularly known as the pickerel-weed bee, its visits being confined to *Pontederia cordata* of which pickerel-weed is the popular name. Flowers visited by butterflies are commonly red, and it is curious that the butterflies themselves are often of the same hue; the relations of the hawk-moths and flies with blossoms are also discussed; "conspicuous flowers pollinated by insects which do not secrete nectar are called pollen-flowers," and to them a chapter is devoted. There is an interesting table of the colours of North-American flowers, from which it appears that "the green, white, and yellow flowers number 3001, or three-fourths of the entire number, while the red, purple, and blue amount to only 1019": of these 2972 are pollinated by insects or self-pollinated, while those pollinated by wind, including a few pollinated by water, number 1048. The last chapter on "Bees and Fruit-growing" is of practical value, containing as it does useful as well as interesting information.

A word must be said as to the numerous illustrations, from photographs taken by the author: mostly of natural size, they stand out from the black background with startling distinctness. The book has an excellent index; the style is here and there a little flamboyant, but this will not lessen its attractiveness for the general reader, on whose behalf technical terms have as far as possible been avoided.

BOOK-NOTES, NEWS, ETC.

THE death is announced at St. Ola, Orkney, on Aug. 20, at the age of sixty-six, of MAGNUS SPENCE, Fellow of the Educational Institute of Scotland, for many years headmaster at Deerness. He was born in the parish of Birsay, 1 Jan. 1853, and was an able representative of the large class of devotees of the natural sciences who keep the lower lights burning in outlying districts, and whose value is to be estimated not so much in their actual output of publications, as in the stimulus and example they afford to their colleagues and succeeding generations of pupils. In addition to his educational duties Spence's interests lay in the direction of the botany, meteorology, and geology of his district. Although over age for retirement he continued school-work during the pressure of the War, and as Keeper of the Orkney Meteorological Observatory at Deerness he was responsible during the whole period for Government records. His published work included a *Flora Orcadensis* (1914) which was noticed in this Journal for that year (p. 222), a list of the local flora implying many years of careful work and observation; but he is perhaps better known to recent readers of the Journal for his contributions to the algology of Orkney (Journ. Bot., 1918, 281, 337). Although Spence only took to marine algæ in later years his work showed interest in economic and ecological problems, and it was hoped that in retirement he might have been spared to continue the work of Pollexsen (as the name usually written "Pollexfen" should be spelt) and Clouston, and establish the marine flora of Orkney, at the more northern limit of the British area, on a sound basis.

MR. R. S. ADAMSON and Miss Alison Crabtree publish in the *Memoirs of the Manchester Literary and Philosophical Society* (vol. 63, pt. 1) a very full and interesting account of "The Herbarium of John Dalton" (1764–1843) which was acquired by the Society in 1866 from the Manchester Public Library in whose possession it had been since before 1864. "It seems to have been almost entirely overlooked, and had unfortunately been allowed to become exceedingly dirty and to some extent damaged by insects and damp": from the evidence adduced it would seem to be identical with the collection which was in 1856 "in the possession of a Mr. T. P. Heywood of the Isle of Man." A complete enumeration of the contents of the herbarium is given, the introduction to which must be consulted for its full description, and for an account of Dalton himself, with references to the botanists with whom he was associated and who contributed largely to the collection. Of the eleven volumes in which the herbarium is contained, the first is dated 1790, the plants in the seventh and eighth (part) were collected by Dalton in 1797: the latest entry in the volumes is 1829. The authors of the paper say: "There does not seem any evidence at all that Dalton made two collections," and this, so far as regards the Manchester and Isle of Man herbaria, is doubtless correct. But the *Report of the Yorkshire Philosophical Society for* 1897 (p. xv) contains a note transcribed from a memorandum in Dalton's hand in his copy of Galpine's *Compendium*: "June 21st, 1827. Gave my Herbarium and Coleopterous insects to the Philosophical Society of York": this herbarium (see Report for 1893, p. 36) contained "2,500 specimens of British Phanerogams" and is now in the Yorkshire Museum. Dalton's plants figure largely in the somewhat extravagantly printed "Catalogue of British Plants in the Herbarium" of the Society, the publishing of which was begun in the Report for 1894 and was concluded in that for 1917.

A NEW edition (the fourth) of the *Guide to the British Mycetozoa exhibited in the Department of Botany* has been "printed by order of the Trustees of the British Museum" at the very reasonable cost of a shilling. The following prefatory note by Dr. Rendle explains the considerable changes which have been made in this issue:—"The present edition has been carefully revised by Miss Gulielma Lister. The publication of a new edition of the *Monograph of the Mycetozoa*, in 1911, in which the nomenclature was brought into conformity with the International Rules, has necessitated some alterations in the names of genera and species in the present edition of the Guide. An important advance in our knowledge of the life-history of the Mycetozoa, to which reference is made in the Introduction, is the discovery that the swarm-cells fuse in pairs and that the resulting zygote forms the plasmodium. Notes have been added to the Introduction on methods of cultivation of the plasmodium and the swarm-cells; and on the collecting, preserving, and mounting of specimens. The number of species recorded as British has been increased since the date of the last edition, from 146 to 180; this increase indicates the value of local work carried out by individual observers. An innovation in the text is the noting under each species of the time of year when the sporangia may usually be found in Britain; and also the derivation and meaning of the generic and specific names."

Professor Augustine Henry has published in the *Proceedings of the Royal Irish Academy* (vol. xxxv. section B, no. 2), a very interesting and exhaustive paper (which is issued separately by Messrs. Hodges & Figgis, Dublin, price 1*s.*) on "The History of the London Plane" (*Platanus acerifolia* Willd.). The chief point of interest lies in the fact that whereas in the *Trees of Great Britain* (iii. 620: 1908) the author saw "no grounds for assenting to Schneider's view that this is a possible hybrid between *occidentalis* and *orientalis*," and gave what seemed to be good reasons for his conclusions; his further investigations, however, which are the subject of the present paper, led to a reconsideration of the point, and Prof. Henry now considers that "the evidence establishes beyond doubt that the London Plane is of hybrid origin," the parents being the species already named. The evidence is duly set forth, "the best proof of the hybrid nature of *P. acerifolia* being that it does not come true from seed." Six other hybrid forms are enumerated and fully described, two of them being new, and a synopsis of the six species recognised is given. The paper is illustrated by six plates by Miss Margaret G. Flood, five of them figuring the trees described and one showing the achenes.

The *Annals of Botany* for July contains papers on "The Floras of the Outlying Islands of New Zealand and their Distribution," by J. C. Willis; "Studies on the Chloroplasts of Desmids," by N. Carter (2 plates); "Infection by *Colletotrichum Lindemuthianum*," by P. K. Dey (1 plate); "Variation in *Hevea brasiliensis*," by S. Whitby; "The Cytology and Life-history of *Nemalion multifidum*," by R. E. Cleland (3 plates); "The Compound Interest Law and Plant Growth," by V. H. Blackman; "The 'Brown Rot' Diseases of Fruit Trees, with special reference to the biologic forms of *Monilia cinerea*," by H. Wormald (2 plates).

Notes from the Botanical School of Trinity College, Dublin (vol. iii. no. 1; June), contains two papers, both "reprinted by permission from the *Proceedings of the Royal Dublin Society*": there is doubtless some good reason for this, but the reprinting (in the same city) suggests that Dublin is more fortunate than London in its paper supply. Dr. H. H. Dixon writes on the recognition by their microscopic characters of the various woods which are known in commerce as Mahogany, and Margaret G. Flood on the exudation of water by *Colocasia antiquorum*; both papers are accompanied by plates.

Nos. 52–53 of *Notes from the Royal Botanic Gardens, Edinburgh*, are entirely occupied by descriptions, by Prof. Balfour, of new species of *Rhododendron*, of which all but five were discovered by Mr. George Forrest during his botanical exploration of Yunnan and the bordering area of S.E. Tibet in 1917–18. "They are only a portion of the novelties in Forrest's collection; a description of others will fill many subsequent pages of these Notes."

The July issue of *Mycologia* (vol. xi. no. 4) contains an interesting account of "the Mycological Work of Moses Ashley Curtis" (1808–1872) by C. L. Shear and Neil E. Stevens, in the course of which his "joint work with Berkeley" is summarised.

The Presidential Address of Sir Daniel Morris to the Botanical Section of the British Association at its recent meeting at Bournemouth included a useful summary of recent botanical research in this country, but was mainly devoted to a very interesting and comprehensive review of "the many efforts that have been made, and are still being made, to promote the interests not only of the home land but of the Empire as a whole." The work of the Imperial Department of Agriculture in the West Indies in connection with the sugar-cane is summarized; there is an account of the investigations into wheat-breeding on Mendelian lines carried on by Biffen at Cambridge and in India by the Howards, which "clearly demonstrates the value of thorough acquaintance with pure botany as a qualification for grappling with questions of economic importance"; cotton and its diseases come under consideration, as does rubber and its diseases. The account of the development of the cacao industry on the Gold Coast, which Sir Daniel regards as "probably the most remarkable instance on record of the successful combination of science and enterprise in the Tropics," may be quoted: "Thirty years ago no cacao of any kind was produced on the Coast. Owing, however, to the foresight of the then Governor (Sir William Brandford Griffith), who sought the powerful aid of Kew, cacao growing was started in a small way among the negro peasantry, with eventually extraordinary results. After selecting the locality for the experiments, seeds and plants were obtained through Kew, and a trained man was placed in charge. The first exports in 1891 amounted to a value of £4 only. So rapid was the development of the industry that ten years later the exports reached a value of £43,000. By this time both the people and the Government had begun to realise the possibilities of the situation, and systematic steps were taken to organise under scientific control a staff of travelling agricultural instructors to advise and assist the cultivators in dealing with fungoid and insect pests and improve the quality of the produce. In 1911 the exports had increased nearly fourfold, and reached a total value of £1,613,000, while in 1916, what may possibly be regarded as the maximum exports, were of the value of £3,847,720."

At the recent meeting of the Botany Committee of the Devonshire Association, Mr. Hiern resigned the post of Hon. Secretary, which he has occupied since the formation of the Committee eleven years ago. He has been succeeded by Miss C. E. Larter.

We learn with interest that the University of Leeds has conferred the degree of Doctor of Science on our veteran botanist Mr. John Gilbert Baker, F.R.S.

Mr. W. R. Sherrin, A.L.S., has been appointed Curator of the South London Botanical Institute.

We greatly regret to announce the death of Prof. J. W. H. Trail, of Aberdeen, of whom a notice will appear in due course.

The address of the Rev. E. S. Marshall, who is leaving West Monkton, is "Offa's Dyke," Tidenham, near Chepstow.

HISTORICAL REVIEW OF THE FLORIDEÆ.—I.

By A. H. Church, D.Sc.

To the algologists of the last century, as soon as the vegetation of the tide-range began to be familiar, and Red Algæ were differentiated from the larger Fuci, the Florideæ proved at once an attractive and wholly mysterious race of organism, the types of which in their kaleidoscopic variety of form, the transient charm of their rosy coloration, so different from the predominant green of land-vegetation, and their delicate texture and ramification, have been very generally accepted as representing the culminating race of marine algæ. Yet many are stout strong plants, attaining to a bushy mass 3–6 ft. in length, and the residual types of the tide-range may present no special attraction either in colour or form, though valued from an economic standpoint and utilised as food by man and cattle.

The observations of Bornet and Thuret on the nature of their reproductive processes, so distinct from the general flagellated mechanism of other algal phyla, added to the wonder of the group; and the more the types have been investigated the more mysterious have appeared their special attributes: only within the last few years has the general scheme of the Life-cycle been rendered clear, and its relation to that of other algal phyla made intelligible. All these features appear the more remarkable as this strange algal race, living in the sea—by no means relegated to deep water as is popularly supposed, but side by side with other residual phyla of 'green' and 'brown' algæ,—still holds its own in more quiet environment as a race of marine phytobenthon which has passed to the limit of marine possibility in its reproductive processes. In so doing it throws a curious light on the history of the early sea, as also on the possibility of the landward migration of comparable algal forms to constitute the flora of the land—whether as higher types of autotrophic vegetation, or as reduced and heterotrophic fungi.

In the collection and elucidation of the multitudinous forms so far included in this isolated group, the pioneer algologists of this country have done perhaps more than those of any other in establishing the foundations of the subject; though in more recent years the more critical work has been done elsewhere, as laboratory technique replaces shore-collection and the cult of the sea-weed album. Once it is understood that the best plants in optimum growth can be only obtained by dredging in the sub-littoral zone, and that the highest laboratory technique is required to bring out the most essential details, the plants are largely relegated to the cytological expert. But much remains to be done in other directions of structure and anatomy, the physiology of metabolism, œcological relations, and above all in culture, which is within the scope of the most elementary laboratory practice; and a wide field still remains open to the algologists of this country, as also to those of British colonies with even finer subtropical representatives of the group.

The history of the Florideæ in its earlier phases is bound up with that of other marine plants[1], and followed a similar course from the time of Theophrastus (circa 300 B.C.) to the works of the herbalists (Lobelius, 1576; Dodonæus, 1616) and the collectors of the XVIIth Century (Kaspar Bauhin, Προδρομος, 1622; Dillenius, in *Ray's Synopsis*, 1724), and to the writings of the Linnæan school of the latter part of the XVIIIth Century, as represented by the descriptions and coloured illustrations of Stackhouse (1795–1801) and Dawson Turner (1808–1819).

In Theophrastus the most definite reference to a Floridean is that of the "Sea-Palm." The text[2] gives a good idea of the difficulty of an early naturalist in wrestling with the morphology of a seaweed; and the Sea-Palm (*Palma marina*) became a stock article with early writers. It is interesting to note that the text describes the plant as φοῖνιξ, although the Greeks do not seem to have distinguished the pinnate *Phœnix* from the palmate bushy *Chamærops*; as also to make it quite clear that there was no allusion to a lobed seaweed like the palm of a hand: the midrib is described, and the torn appearance of the laminæ which gave the pinnate character to the fronds; the latter evidently grew in tufts of leaf-like members, which were not irregularly lobed and crumpled. The plant has been generally identified with the bright red *Callophyllis laciniata*, but this is certainly a mistake[3]. An older view may be compared in Imperato's figure[4] of the *Palma marina*, which is nothing like the *Callophyllis*, but may have been inspired by a *Dasya*. The plant in the text obviously would be *Delesseria sanguinea*, with its bushy tuft of torn red leaves, up to 10 inches long, and strongly-marked mid-rib; but *D. sanguinea* is not described for the Mediterranean, and there is nothing in the Ægean nearer than *D. Hypoglossum*, an insignificant species[5].

While larger forms of Red Algæ were included as *Fucus*, the colour of many of them being by no means distinctive; the majority, being smaller types, came under the heading of *Muscus marinus*; and

[1] *Historical Review of the Phæophyceæ*, Journ. Bot. 1919, p. 265.

[2] "A deep sea plant, but with a very short stem, and the branches which spring from it are almost straight, and these under water are not set all round the stem, like the twigs which grow from the branches, but extend quite flat in one direction, and are uniform, though occasionally they are irregular. The character of the branches or outgrowths to some extent resembles the leaves of thistle-like spinous plants, such as the sow-thistles and the like, except that they are straight, and not bent over like these, and have their leaves eaten away by the brine: in the fact that the central stalk at least runs through the whole, they resemble these, and so does the general appearance. The colour both of the branches and of the stalks, and of the plant as a whole is a deep red or scarlet."—Theophrastus, Eng. Trans. Hort. (1916) p. 337.

[3] Hort (*loc. cit.*). On the other hand there is little in the text to show that it did grow in the Eastern Mediterranean; it is the last on the list of sea-plant wonders, and the account may well be based on the tales of sailors who had pulled their boats up on the tide-range beyond the Pillars of Hercules among Laminarians waist-high (p. 331). The only other choice is a feeble description of a bilateral *Dasya*.

[4] Imperato (Naples, 1599). *Dell' Historia Naturale*, p. 740.

[5] Danish Oceanographical Exped. 'Thor' (Copenhagen, 1918) no. 5.

an old block woodcut with this title in Lobelius (1576)[1] does duty as late as the time of Parkinson (1640)[2], ultimately appearing as the 'Red Coralline' of the tide-pools, though originally intended for a softer moss-type, probably *Ceramium rubrum.* A figure of *Corallina* in Gerard (1597)[3] is probably the oldest recognizable figure of a Floridean type.

A few Florideæ are thus included by Dillenius[4] in the *Historia Muscorum* (1741) as *Conferva.* Linnæus[5], in the first edition of the *Species Plantarum* (1753) has only a poor show[6]. In later times the larger British species are described by Dawson Turner in the Icones et Hist. Fucorum (1808–1819): the smaller ones in Dillwyn's *British Confervæ* (1809); *cf.* also Esper (1797)[7] and Stackhouse (1795–1801) *Nereis Britannica.* The convention of *Fucus* and *Conferva* died hard; the definition of the latter had been given by Linnæus as *Alga capillaris,* and according to Dillwyn[8] it included Polysiphonias, Ceramiums, and even *Dasya coccinea*; yet Goodenough and Woodward[9] (1795) included as *Fuci* such plants as *Polysiphonia byssoides, Bostrychia,* and *Bonnemaisonia.*

The history of the Florideæ as a class begins with the separation of the group under this special name by LAMOUROUX (1813)[10]; the eleven genera—*Claudea, Delesseria, Chondrus, Gelidium, Laurencia, Hypnea, Acanthophora, Dumontia, Gigartina, Plocamium,* and *Champia,* are localized under the heading Florideæ, although the colour-guide was still a little vague; *Furcellaria* was left with the Fucaceæ from its dark colour, and *Amansia,* as presenting a 'network' surface, with the Dictyotaceæ. Lyngbye[11] added genera, as *Lomentaria* and *Callithamnion,* but had the genera all mixed up on a system of his own; the Florideæ not being separated from Brown Algæ: the idea did not make way at once; the colour-guide was treacherous. C. Agardh[12], it is true, retains the order 'Florideæ'

[1] Lobelius (Antwerp, 1576), *Stirpium Historia*, p. 648.

[2] Parkinson (London, 1640), *Theatrum Botanicum*, p. 1296.

[3] Gerard (London, 1597), *Herball*, p. 1379, *Corallina anglica.*

[4] Dillenius (Oxford, 1741), *Historia Muscorum*, 48 forms of *Conferva*, of which 10 may be Floridean, p. 32, including *Lemanea* and *Batrachospermum.*

[5] Linnæus (Holmiæ, 1753), *Species Plantarum*, pp. 1162, 1166.

[6] *Fucus* (*Rhodymenia*) *palmatus*, *F.* (*Phyllophora*) *rubens*, *F.* (*Furcellaria*) *fastigiatus*, and *Conferva corallinoides*, *C. catenata*, *C. polymorpha*: as marine forms not including *Lemanea* and *Batrachospermum* taken from Dillenius.

[7] Esper (Nürnberg, 1797), *Icones Fucorum.*

[8] Dillwyn (1809), *British Confervæ*, nos. 58, 44, 36.

[9] Goodenough and Woodward (1797), Linn. Trans. iii. p. 84, nos. 72, 70.

[10] Lamouroux (Paris, 1813), *Essai sur les Genres de la Famille des Thalassiophytes*, p. 75. In this paper Lamouroux introduced the custom, since much abused, of naming genera after his botanical friends. The idea of so commemorating botanists of repute had been initiated in scientific botany by Father Plumier (*Nova plantarum Americanum Genera*, Paris, 1703), who in his need for new names for numerous North American genera, so utilized the names of about 60 'Patres Botanici,' from Theophrastus (Eresius) to Ray and Dillenius; practically the whole of which are still retained. The science has grown up with the elegant Gallicized forms as *Claudea*, *Champia*, *Amansia*, *Dumontia*, *Delesseria*, *Laurencia*, and future generations may assimilate *Proto-Kuetzingia*, *Schmitziella*, and *Heterojanczewskia.*

[11] Lyngbye (Copenhagen, 1819), *Tentamen Hydrophytologiæ Danicæ.*

[12] C. Agardh (Lund, 1824), *Systema Algarum.*

with sixteen genera—*Liagora*, *Polyides*, *Digenea*, *Ptilota*, *Thaumasia*, *Rhodomela*, *Chondria*, *Dasia*, *Sphærococcus*, *Thamnophora*, *Grateloupia*, *Halymenia*, *Bonnemaisonia*, *Amansia*, *Delesseria*, *Oneillia*; but *Ceramium*, *Griffithsia*, *Champia*, *Chætospora*, *Hutchinsia*, *Rhytiphlœa*, are sandwiched between *Chara* and *Ectocarpus*!, *Lemanea* is placed with the Fucoids, and *Batrachospermum* with *Mesogloia*. Curiously enough, Greville[1], as late as 1830, still keeps the tradition of the dichotomous *Polyides* and *Furcellaria* as near *Dictyota dichotoma*, and beyond the pale of the true Florideæ, notwithstanding the brightness of the crimson coloration of his plate[2].

The accumulation of genera and species, and the marking out of the main series by differentiation of somatic organization, was the work of the collectors and systematists, more particularly of the first half of the XIXth Century; *cf.* Lightfoot (1777), Hudson (1768), Goodenough and Woodward (1795), Velley (1795), Stackhouse (1795), Dawson Turner (1808), Dillwyn and Hooker (1809); *cf.* Literature in *Historical Sketch of the Phæophyceæ*, loc. cit. p. 268, as also Brodie, Borrer, Lilly Wigg, Templeton, Drummond, Carmichael, Boswarva, Dickie, many of whose names remain allocated to species of the Florideæ, and others still more familiar in generic guise:—Pollexsen (*Pollexfenia*), Ralfs (*Ralfsia*), Hore (*Horea*), Landsborough (*Landsburgia*), Mrs. Gulson (*Gulsonia*), Mrs. Gatty (*Gattya*), Miss Gifford (*Giffordia*), Miss Cutler (*Cutleria*), Miss Hutchins (*Hutchinsia*) with Mrs. Griffiths (*Griffithsia*) and her friend Mrs. Wyatt, jointly responsible for the *Algæ Damnoniensis* (Torquay, 1840) 4 vols., as an exsiccata of 234 specimens checked by Mrs. Griffths.

In more recent times this work has been amplified for British coasts by Buffham († 1896; *Buffhamia*, Holmes (*Holmesia*) and more particularly by E. A. L. Batters († 1907; *Battersia*), whose list of British Marine Algæ (Journ. Bot., Supp. 1902) remains the standard authority, and Trail († 1919; *Trailiella*).

For this country the work culminates in the two volumes of the *Phycologia Britannica* of Harvey (1845–1851) containing descriptions and coloured plates of 182 species, arranged in 52 genera and 7 orders. As works of the same epoch may be included:—*Species, Genera et Ordines Floridearum* of J. Agardh (Lund, 1851–1876), *Iconographica Phycologia Adriatica* of Zanardini (Venice, 1860), and *Phycologia Mediterranea* of Ardissone (1883).

To the collectors of the early part of the Nineteenth Century is largely due the rapid growth in the study of algæ which marks the difference between the works of Harvey (1851), *Phycologia Britannica*, *Nereis Bor. Amer.* (1851), *Phycolog. Australica* (1858–63), and the volumes of Stackhouse and Dawson Turner. Outside the range of the Flowering Plants and Ferns, no other group of the vegetable kingdom has been so popularized as the Florideæ, in this

[1] Greville (Edinburgh, 1830), *Algæ Britannicæ*.

[2] For the older restriction of the order 'Florideæ,' *cf.* Harvey (1841) *Manual of British Algæ*; *Porphyra* remains associated with *Ulva* in the Phyc. Brit. (92), as also *Bangia* (96), and *Erythrotrichia* (322).

country. The facility with which really astonishing pictures, with a beauty of line and colouring, beyond ordinary draughtmanship, were to be produced, in an age when mechanical productions of artistic value were so defective, led to the establishing of the cult of the sea-weed album, and the formation of such a volume came to be regarded as a polite accomplishment eminently suitable for ladies of taste and leisure. Many of these books survive to the present day, when sea-weed mounting is almost a lost art, G. Brebner († 1905) being one of the last exponents ; and it is still interesting to appreciate the skilled manipulation of a fine specimen. It is curious to note how the British Florideæ lend themselves to such pictorial display, being usually of a most convenient size; the larger Brown Algæ were allowed to complete the collection, rather in the form of 'juvenile phases'; *i. e.* Laminarians less than a foot in length.

Kuetzing (1843) in his *Phycologia Generalis* alone exhibits a more extended outlook of more modern botany, by the incorporation of many detailed anatomical and physiological considerations, together with a large number of drawings made from careful sections, some of which have done duty in text-books to the present day. Similar work for the world at large, as continued to the present time, has extended the list to over 3000 species, which are found enumerated by De Toni [1] (1897–1905), of which about 300 are listed for the British Coast by Batters (1902) [2].

Beyond what may be termed the book-keeping of the subject, the great advances that have been made in our knowledge of the life-history of these plants, are due to the work of relatively few observers; certain papers stand out prominently as indicating epochs in the progress of the science, as again expressive of new mental attitudes and view-points in dealing with the plants, these being more or less reflected into the subject from the general advance in other fields of botanical research.

I. Of these epochs the first is that indicated by the observations of Bornet and Thuret [3] on the French coast of the Channel and at Biarritz, in connection with the question, more particularly, of sexual reproduction, and following the lines of similar work on the Brown Seaweeds : the significance of sexuality, and the nature of the reproductive organs, being established for about a dozen genera, including such forms as *Nemalion*, *Helminthora*, *Callithamnion corymbosum*, *Lejolisia*, *Dudresnaya*. Much of the work spread over twenty years was collected in the classical volume of the *Études Phycologiques*, with beautiful aquatint plates from drawings by Riocreux, which as faithful representations of the living plant-tissues, as actually seen fresh under the microscope, without distortion or conventional representation, have never been surpassed.

[1] De Toni (Patavii, 1897–1905), *Sylloge Algarum*, vol. iv. *Florideæ*, pp. 1870.

[2] Batters (1902), Supp. Journ. Bot.

[3] Bornet and Thuret (1867), Ann. Sci. Nat. p. 137, " Recherches sur le fécondation des Floridées" ; *Notes Algologiques* (1876–1880) ; *Études Phycologiques* (1878).

II. A second epoch, based on the researches of Schmitz[1] (1883), was devoted more particularly to the detailed examination of the problems connected with the development of the cystocarp, the nature of the cell-fusions, and what was, perhaps, really of more consequence—the regrouping of the families and genera in accordance with the nature of the reproductive phenomena in the Life-Cycle, rather than by somatic organization and the external morphology of the adult structures alone, as in the artificial systems of J. Agardh and Harvey.

Although what Schmitz regarded as the essential point of his work—the sexual nature of the cytoplasmic fusion with auxiliary cells, as expressive of a mysterious phenomenon of 'double-fertilization,'—has not stood the test of time, as it did not that of the "tradition" of his day, the 1883 paper contains a neat exposition of the theory of the Florideæ as a whole, which gives it a text-book value. The more detailed systematic scheme of Schmitz, left unfinished at his death, is found in the section of the *Pflanzenfamilien* of Engler and Prantl (Schmitz and Hauptfleisch, 1896), and is the basis of the modern presentation of the group. There can be no doubt that the Florideæ acquired a special vogue of mystery in virtue of Schmitz's claims of the significance of auxiliary cells in 'double fertilization'; but with further knowledge of sexual mechanism, deduced from observation of other branches of the vegetable kingdom, at hand, such assumptions are seen to be wholly unauthorized, and the entire edifice of classification erected on it is left without sure foundation. However, the series and orders of Schmitz have now become established and incorporated in botanical literature[2], largely through the agency of the valuable volumes of De Toni, and there is little to be gained by altering them until there may be satisfactory grounds for recasting the entire subject[3]. On the other hand the attempted phylogenetic arrangement of Schmitz (1889–1897) marks so definite an advance on preceding systems, that all nomenclature may be conveniently checked at the latter date.

III. In a paper which also attains classical rank Oltmanns[4] succeeded in demonstrating in a perfectly convincing manner the exact significance of these secondary fusions with auxiliary cells, and traced the mutual relations of the nuclei in the process; details are described for five well-defined leading types, as *Dudresnaya pur-*

[1] Schmitz (Berlin, 1883), *Untersuchungen über die Befruchtung der Florideen*: an English translation is more readily accessible, *cf.* Dallas (1884) Ann. & Mag. of Nat. Hist. p. 1.

Friedrich Schmitz, of Greifswald, died 1895, will always be known as the greatest investigator of the Florideæ, during the latter half of the nineteenth century. He served through the Franco-Prussian war, and was first attracted to sea-weeds while on duty on the coast of Normandy. Most of his material was obtained from Naples, and only those who have a tide-range to forage on can appreciate the handicap of working entirely with preserved material, or on specimens collected by other people. (Carruthers, 1895, Journ. of Bot. p. 115.)

[2] Svedelius (1911), Engler and Prantl, Appendix. *Florideæ.*

[3] The present condition of the classification of Flowering Plants on the lines of the Eichler-Engler–Prantl system affords a direct analogy.

[4] Oltmanns (Naples, 1898), Bot. Zeit. p. 99. "Zur Entwicklungsgeschichte der Florideen," *Morphologie und Biologie der Algen*, 1904, p. 689.

purifera and *D. coccinea*, *Gloiosiphonia*, *Dasya*, and *Callithamnion*, the peculiar nuclear phenomena, as also cytoplasmic fusion, being solely the expressions of an attempt to obtain food-supplies for the parasitic generation. This has placed the question of the nutrition of the carposporophyte on a rational basis, and older views on the sexual significance of cytoplasmic fusions, unavoidably obscure so long as the essential nuclear phenomena were little known, even in the case of higher plants, have been relegated to their proper place.

IV. In more recent times the attention paid since 1894 to the cytological details of diploid phases as associated with the familiar alternation of generations in the life-history of land-plants, and as constituting a causal factor for the differentiation of gametophyte and sporophyte, has led to a more thorough investigation of the reproductive organization of the Florideæ. In a paper on *Polysiphonia violacea*, SHIGEO YAMANOUCHI [1] (Chicago, 1906), the cytological relation of the different individuals of the trimorphic sequence involved in the life-cycle was clearly established as a model for similar work on other forms, as the necessity for the use of the microtome and the best methods of modern technique was successfully vindicated. So long as algologists could make out nine-tenths of the facts by simple section-cutting, or 'squeezing-out' methods, the use of the microtome was avoided; and though the importance of nuclear phenomena may have been exaggerated, these latter are an essential part of the story, and cannot be omitted. However much can be done even better without it; in dealing with the general anatomy and most of the reproductive processes, more particularly as presented in fresh material, the microtome remains as the last appeal in all cytoplasmic research.

Even more recently the Florideæ maintain their value as contributing to the solution of much debated problems of reproductive mechanism common to higher organism. The demonstration by SVEDELIUS [2] of the fact that in such forms as *Scinaia* (as also by Kylin [3] and Cleland for *Nemalion*) the cytological alternation of haploid and diploid nuclear phases need not necessarily run conformably with the morphological alternation of gametophyte and sporophyte individuals, bids fair to remove the curious obsession of botanists (dating to Strasburger [4], 1894) that such cytological mechanism of the nucleus can ever be a satisfactory causal factor in the differentia-

[1] Yamanouchi (Chicago, 1906), Bot. Gazette, p. 425, "The Life-History of *Polysiphonia violacea*."

[2] Svedelius (1915), *Nova Acta*, Upsala, iv. p. 1.

[3] Kylin (1916), *Berichte*, xxxiv. p. 257: Cleland (1919), Ann. Bot. p. 323.

[4] Strasburger (1894) may be said to have initiated the idea that since the gametophyte of land plants is *haploid* in its chromosome number, and the sporophyte is *diploid*, therefore any haploid stage must be a gametophyte, and any diploid generation a sporophyte: a curious *non sequitur* which has been very generally accepted.

There cannot be more than two cytological phases, haploid or diploid, but there may be more than two morphologically differentiated stages in a life-cycle; *e. g.* the Florideæ have three, hence commonly manipulated to make two, in order to suit a preconceived academic scheme.

tion of a complex life-cycle, thus squeezed into an academic two-phase scheme [1].

V. Also within the present generation, the Florideæ share in the new outlook on the science which has been opened up under the heading of Œcology [2] (Warming, 1896). This special line of investigation is designed to replace the rule-of-thumb methods of the older school of naturalists, and to analyze and tabulate the enormous amount of 'general information' acquired subconsciously by the older 'collector,' which largely constituted the charm of out-door investigations.

The difficulties of the problems presented by the Florideæ are enormous, and can be only overcome by long-continued and careful work; the main field of research being invisible to the human eye, submarine, beyond the reach of either direct observation or experiment, and only to be explored by dredging and the use of deep-sea instruments—often on dangerous rocky ground—at all seasons of the year. The vegetation of the tide-range inevitably receives at first an exaggerated amount of attention: all such vegetation is of a depauperated character, and by no means representative of the main strength of the inventive genius of the group. The same applies with even greater force to the reduced and hardy relics characteristic of the more extreme positions in zones above the high-tide mark, the case of dark caves, the vegetation of the salt-marsh, brackish water, and extension into freshwater streams and ditches. Owing to their more ready accessibility, and their association with more interesting types of land-vegetation, these depauperated wastrels of the sea are in danger of being given a degree of prominence out of all proportion to their essential value, either morphologically or phylogenetically. The true vegetation of the sea is in the sea, and may be said to begin at low-tide level.

BARBAREA RIVULARIS IN BRITAIN.

By A. B. Jackson, A.L.S., and A. J. Wilmott, F.L.S.

At first sight it would appear from Mr. Marshall's account of this plant (*ante*, p. 211), that we have an addition to our British species of *Barbarea*, but in reality it is nothing of the kind. Mr. Marshall seems to have forgotten the paper on *Barbarea vulgaris* (Journ. Bot. 1916, 202), in which *B. rivularis* Martr. Don. has been fully dealt with and shown to be merely a synonym of *B. vulgaris* var. *silvestris* Fr. It is a form not uncommon in Britain, and we have now seen it from at least a dozen vice-counties as well as from Ireland. The British examples are not of the short-

[1] Yamanouchi (1906), *loc. cit.* p. 433: Bower (1919), *The Living Plant*, p. 482: *cf.* Cleland (1919), Annals Bot. p. 347 for the prevailing dogma—"the cystocarp of *Nemalion* is not sporophytic in character, and there is no cytological alternation of generations."

[2] Warming (1909), *Ecology of Plants*, Eng. edit. p. 170. Börgesen (1903), *Botany of the Færoes*, p. 339; (1908) p. 683. Cotton (1912), "Clare Island Survey," Proc. Roy. Irish Acad. 31.

fruited form regarded by Rouy and Foucaud as the type, for which they cite Billot exs. 3011 (as *B. stricta*). These exsiccata have the siliques in some cases not more than 12 mm. long, so it will be seen that in plants with siliques "double as long" these need not be longer than those of typical *B. vulgaris*. The British plants of var. *silvestris* have the fruits of normal length, and Mr. Miller's plant from Cossington which Mr. Marshall has kindly sent us is in no way different. We cannot find, however, that Martrin-Donos states that his *B. rivularis was* the short-fruited form, while Carion says of his *B. vulgaris* var. *longisiliquosa* that it differs *from type*, with which it grows intermingled, by its "siliques très longues, très nombreuses et rapprochees de l'axe." The specimen Mr. Marshall refers to the var. *longisiliquosa* has siliques scarcely, if at all, longer than in those which he considers may be type, and all are of the same length as in typical *B. vulgaris*, neither shorter nor longer. We have not yet seen in this country any specimens of the var. *silvestris* with siliques of other than typical length, and it was because of this fact that the matter was not more fully detailed in the paper mentioned above. We regard it as unsafe to accept without verification the accounts given in Rouy and Foucaud, although they are often very valuable.

The strict-fruited form of *B. vulgaris* has often been confused with the true *B. stricta*, even by such well-known authorities as Babington and Newbould, but no one who has seen true *B. stricta* in the living state would be likely to confuse the two. Mr. Marshall, misled no doubt by the inadequate description of *B. stricta* given by Rouy and Foucaud, contends that our British *B. stricta* is only *B. rivularis*. Unfortunately he has overlooked the important contribution to our knowledge of *B. stricta* by Messrs. Sprague and Hutchinson (Journ. Bot. 1908, 106), where the diagnosis of the two plants are so clearly set out as to leave no doubt as to their distinction. Mr. Marshall says that the Cossington specimens show a complete agreement with examples of *B. stricta* in his herbarium from Clifton Ings (not Thirsk) and Upton on Severn, both of which had been confirmed by us and one by Murbeck. A careful comparison of these specimens shows the resemblance to be merely superficial. The colour and shape of the petals do not in the least suggest *B. stricta*: they are obovate, bright yellow with a whitish claw, while those of the specimens of *B. stricta* have the petals much narrower in outline and of a different shade of yellow (more lemon yellow) all over. What is more important still, the flower-buds are distinctly hairy in the same specimens, while those of the Cossington plant are *quite* glabrous. We have measured the length of the styles in ten fruits of each of the gatherings in question, and the averages are :—Cossington 2·4 mm., Upton 1·8 mm., Clifton Ings 1·6 mm. Moreover, those of the first taper and are less than ·3 mm. broad, while those of the *B. stricta* are stout and truncate, ·4 and ·5 mm. broad respectively. These measurements correspond to a very real difference in appearance.

We consider the question of the shape and size of the lateral lobes of the leaves to be of subsidiary importance and unreliable for diagnosis, for in some specimens we have seen of typical *B. vulgaris* the lateral lobes have remained small and undeveloped.

We think it just possible that Mr. Marshall is right in considering that the figure given by Syme for *B. stricta* is really *B. rivularis*, i. e., *B. vulgaris* var. *silvestris*. The matter was not mentioned in the previous paper because we could not decide that there was sufficient on the plate to determine which of the two it was better placed under, and we are still undecided. There is little in the text to show that Syme either knew or was able to discriminate between the two plants. Both grow in Yorkshire, which Syme especially mentions, and he may have confused them as so many others have done.

NOTES ON BEDFORDSHIRE PLANTS.

By J. E. Little, M.A.

The Flora of Bedfordshire has during the present century received attention in three publications. The Victoria County History of Beds (i. pp. 37–67; Constable, 1904) deals with the Botany of the county generally in articles by J. Hamson and G. C. Druce, assisted by James Saunders and E. M. Holmes. In 1906 Mr. J. Hamson published *An Account of the Flora of Bedfordshire* (Beds Times Publishing Co., Bedford), and Mr. James Saunders gathered together various contributions which he had previously made in *The Field Flowers of Bedfordshire* (W. F. Bunker, Luton, 1911).

The following paper presents a selection of records supplementary to the last-mentioned. Mr. W. Hillhouse, in the *Transactions of the Beds Natural History Society* (F. Thompson & Son, High St., Bedford), proposed in his paper "On the Surface Geology and Physical Geography of Beds" (pp. 83–91) that the county should be subdivided according to its main geological features into two districts, a northern (chiefly clay) and a southern (chiefly cretaceous), the former being cut up into four, and the latter into three subdistricts, and each of the sub-districts being again parcelled into seven portions. Thus in fact forty-nine divisions were proposed, a number wholly unworkable on any extended scale, and undesirable for so small a county. The Victoria County History, passing over this proposal of Mr. Hillhouse, takes the river-basins as its starting-point, and makes the following divisions:—1. Nene; 2. East Ouse; 3. West Ouse; 4. Ivel; 5. Cam; 6. Ouzel; 7. Lea. Of these basins the areas draining into the Nene and the Cam are so small that for practical purposes they may be merged with their neighbours, Nene with West Ouse, and Cam with Ivel. This leaves five divisions, possibly in the estimation of some a number still too large. The records subjoined all fall under Mr. Hillhouse's Southern and under Mr. Druce's Ivel Division. Some parts of the Ivel Basin are more easily accessible from Hitchin than from either Luton or Bedford. The Rev. Chas. Abbot in his *Flora Bedfordiensis* (1798) mentions for this district a number of plants in the neighbourhood of Potton which recent search has failed to re-discover—at least, no recent record of any of them appears to exist, although it is possible that some are still to be found. Abbot's list for the Potton neighbourhood includes :—

†*Dianthus deltoides* L. *Montia fontana* L. *Hypericum humifusum* L.; *H. pulchrum* L.; *H. elodes* L. *Geranium sanguineum* L. *Trifolium ochroleucon* Huds.; *T. scabrum* L. *Galium uliginosum* L. *Solidago virgaurea* L. *Jasione montana* L. †*Vaccinium Oxycoccos* L. †*Erica Tetralix* L. *Hottonia palustris* L. *Vinca minor* L. †*Utricularia minor* L. †*Malaxis paludosa* Sw. (as *Ophrys paludosa*). *Juncus bulbosus* L. †*Rhynchospora alba* Vahl. (as *Schœnus albus*). *Carex divulsa* Stokes; *C. leporina* L. *C. rostrata* Stokes.

Those marked † are noted by Mr. Saunders as probably extinct. Any confirmation of Abbot's observations in this district would be a welcome contribution to the Flora of the county. A few plants are noted as "common" by Abbot, which do not appear to be now common in the Ivel district:—

Lathyrus silvestris, *Pimpinella major*, *Serratula tinctoria*, *Cnicus eriophorus*.

The following plants are noted as "rare" by Abbot:—

Arabis Thaliana, *Ilex Aquifolium*, **Trifolium hybridum*, *Sium erectum*, *Linaria minor*, **L. Cymbalaria*, *Alnus rotundifolia*.

These may all be said now to have a much more extended distribution.

Mr. R. Morse's record of *Seseli Libanotis* possibly adds another county for its distribution, and confirms Mr. Saunders's expectation that it might be found. Although not strictly relevant to the subject of the present paper, I may here say that in 1912 I brought home from Arbury Banks, Herts, a well-known station for *Seseli*, seed gathered from fine plants three to four feet high, and scattered them on an isolated balk in the middle of arable land near Little Almshoe, St. Ippolyts, Herts. Until last year I had not visited the spot to see if this experiment in naturalization (some, I fear, will say an undesirable one) had succeeded; I found fifteen flourishing plants, tall like their ancestors, and very different from those of the sheep-depastured down on which Mr. Morse found them in Beds, where they have a hard struggle to exist at all.

The following list was drawn up at the end of 1918: so far as Beds efforts are concerned, the present year has been a blank to me botanically, as I have not had time to make any expeditions. The only exception was a fortnight in West Norfolk in July which I spent with a cousin at Wallington, near Downham Market. He kindly motored me about, and I spent my time over a number of small "fens" which lay within a distance of 15 miles on the west side of the county. They differ both from the deep fens of the great level, and from the broads, and are more properly small bogs in depressions between slightly higher ground, in the drainage basins of the Wissey and the Nar. I spent my time chiefly over sedges, but partly also over the distribution of forms of Marsh Orchis. In two, Foulden Common and Marham Fen, *O. incarnata* was predominant. In Beechamwell Fen, Caldecote Fen, Oxborough Fen, Shouldham, *O. prætermissa* Druce prevailed. In most of the latter a few plants with spotted leaves occurred, though I could not appreciate any other difference to warrant the suggestion of hybridism with *O. Fuchsii* Druce. Actually I only found the latter in Shingham Fen with *O. prætermissa.* Accustomed as we are here to regard *Habenaria Conopsea* as a plant of the downs, it was curious to find it coming right down into the bog at Caldecote with *Aquilegia vulgaris* :—

Ranunculus circinatus Sibth. The Lake, Southill Park, 1913. *Watson Exchange Club Report*, 1913, 428.—*R. heterophyllus* Weber. Pond near the moats of Ickwell Bury, 1912. Det. *E. S. Marshall.*—*R. hederaceus* L. Biggleswade Common, 1913; Warren Farm, Sandy, 1914.

Papaver Lecoqii Lamotte. Arlesey, 1914.

Fumaria officinalis L. var. *Wirtgeni* Hausskn. and *F. parviflora* Lamk. var. *acuminata* Clavaud. Barton Hills, 1918. Confirmed by H. W. Pugsley.

Radicula palustris Mœnch. R. Ivel at Biggleswade, 1913.—*R. amphibia* Druce. Arlesey, 1911; Clifton, 1912; Shefford.

Draba lanceolata Neilr. (*Erophila stenocarpa* Jord.). Sandy Heath, 1914. W. E. C. R. 1914, 484. Maulden, 1914.—*D. præcox* Stev. Lower Stondon, 1913; near Greenfield Mile, 1914, W. E. C. R. 1914, 484.

Barbarea vulgaris Ait. var. *campestris* Fr. Shillington Bury.

Cardamine flexuosa With. Shefford, 1913.

Erysimum cheiranthoides L. Arlesey, Henlow, 1912; Shefford, 1914.

**Brassica juncea* Hook. fil. & Thoms. Between Edworth and Langford, 1914, with **Lepidium ruderale* L.

Diplotaxis muralis DC. Southill, 1912; Maulden, 1914.

Thlaspi arvense L. Shillington, 1909.

Teesdalea nudicaulis Br. Sandy to Potton, 1911; Southill Park, 1913; Rowney Warren, 1911; Maulden, 1914.

**Bunias orientalis* L. Arlesey, 1910. Det. A. Thellung.

Viola Riviniana Reichb. var. *pseudo-mirabilis* Coste. Rowney Warren, 1911, det. *E. S. Gregory.*—*V. Riviniana* var. *diversa*, E. S. Gregory. Clophill, 1914. W. E. C. R. 1914, 485.

Cerastium semidecandrum L. Rowney Warren and Sandy, 1911; Southill Park, 1912: Maulden, 1914.

Stellaria aquatica Scop. Shefford and Clifton, 1912.—*S. palustris* Retz. (forma *glauca*). Shefford, 1913.

Spergula arvensis L. Sandy, 1911; Maulden and New Rowney Farm, 1914.—*S. sativa* Bœnn. Biggleswade, 1913; Rowney Warren, 1912.

Claytonia perfoliata Donn. Old Warden, *R. Morse*, 1915.

Geranium pyrenaicum Burm. fil. Rowney Warren, 1912; Pegsdon, 1913.

Erodium pimpinellifolium Sibth. Portobello Farm, Sutton, 1913. W. E. C. R. 1913, 436. "Allied to *E. commixtum* Jord." E. G. Baker. But neither in these plants, nor in those I grew in 1914 from the seed did the beaks exceed 25 mm. in length, J. E. L.

Melilotus arvensis Wallr. Wilbury Hill and Arlesey, 1914.

M. indica All. Between Edworth and Langford, 1914.

Trifolium ochroleucon Huds. Wilbury Hill, 1915, *H. C. Littlebury.*—*T. fragiferum* L. Arlesey, 1914; Henlow, 1911; Stondon (*R. Long*); Barton, 1918.

Astragalus glycyphyllus L. Between Shefford and Southill, 1911; Holwell, 1913.

Vicia lathyroides L. Maulden, 1914. *Botanical Exchange Club Report*, 1914, 137.

Lathyrus silvestris L. Between Shefford and Southill, 1911, var. *platyphyllus* Retz. Standalone Farm, Potton Hill, 1911.

Rubus idæus L. Rowney Warren; Sandy.

Potentilla Anserina L. (a) *concolor*, Southill; Gravenhurst; Edworth, 1914: (b) *discolor*. Sandy Warren, 1913.

Rosa tomentosa Sm. (aggr.). S. of Shefford, 1911.

Pyrus Aria Ehrh. Sandy, 1911.—*P. aucuparia* Ehrh. Rowney Warren, 1911; Sandy, 1912; Southill, 1913.—*P. communis* L. Near Sheerhatch Wood, 1912.—*P. Malus* L. (a) *acerba* DC. Rowney Warren, 1911: (b) *mitis* Wallr. Southill, 1912; Ickwell; Sandy, 1911.

Ribes rubrum L. Southill, 1913. ? *var. *sativum*.

Myriophyllum spicatum L. The Lake, Southill Park, 1912.

Epilobium angustifolium L. Swamp N. of Biggleswade Common, 1913; Southill Park, 1914.—*E. tetragonum* Curt. Arlesey; Warden Abbey, 1912.

Conium maculatum L. Sandy, 1911; Clifton, 1912; Warren Farm, Sandy, 1913.

**Carum Petroselinum* Benth. & Hook. fil. Southill, 1912.—*C. segetum* Benth. & Hook. fil. Shefford, 1913.—*C. Bulbocastanum* Koch. Pegsdon, 1913; Barton, 1917.

Pimpinella major Huds. Between Shefford and Southill, 1913. Kempson's Park, 1914; between Holwell and Lower Stondon, 1913.

Seseli Libanotis Koch. Five miles from Hitchin, in Beds, 1913, *R. Morse.* W. E. C. R. 1914, 497.

Silaus flavescens Bernh. Between Shefford and Southill, 1911.

Heracleum Sphondylium L. var. *angustifolium* Huds. Extreme forms near Southill Station, 1913. Barton, 1918.

Galium Cruciata Scop. Clophill, 1914.—*G. palustre* var. *elongatum* (Presl). Warden Abbey, 1913, det. C. E. Moss; Biggleswade, 1913.—*G. tricorne* Stokes. Holwell, 1913.

Valeriana officinalis L. Rowney Warren, 1911.—*V. sambucifolia* Mikan. Biggleswade Common, 1912; Holwell, 1913.

Erigeron acris L. Arlesey, 1912; Pegsdon, 1913; Henlow, 1913.—**E. canadensis* L. Sandy, 1911; Arlesey, 1910; Maulden, 1918.

Filago apiculata G. E. Sm. Maulden, 1918, with *F. minima* Fr.

Gnaphalium silvaticum L. Sandy Heath, 1911.

Bidens cernua L. Biggleswade Common, 1913.

Anthemis arvensis L. Pegsdon, 9113; near Holwell, 1913.

Tanacetum vulgare L. Shefford, 1911; Clifton, 1912; New Rowney Farm, 1912; Biggleswade Common, 1913.

Artemisia Absinthium L. Midland Railway, Southill, 1912; L. N. W. Railway, Sandy. A casual?

Petasites ovatus Hill. Clophile, 1913; Arlesey, 1913; Cadwell.

Arctium intermedium Lange (*A. vulgare*, A. H. Evans). Pegsdon, 1912.

Centaurea Scabiosa L. (*floribus albis*). Pegsdon, 1914.—**C. Calcitrapa* L. Wilbury Hill, 1913, with **C. solstitialis* L., B. E. C. R. 1913, p. 476.

Carduus crispus L. var. *acanthoides* (L.). Southill, 1913, det. *C. E. Salmon.*

Cnicus eriophorus Roth. Between Shefford and Southill, 1913.

Crepis capillaris Wallr. var. *diffusa* (DC.). Galley Hill, Sutton, 1913; *C. taraxacifolia*, Thuill. Arlesey, 1911; Cadwell, 1910.

Hieracium umbellatum L. var. *coronopifolium* Fr. Maulden, 1918.

Hypochœris glabra L. (type). Sandy and Potton, 1913.—*H. maculata* L. Beds border, five miles from Hitchin. B. E. C. R. 1913, 480.

Leontodon nudicaulis Banks var. *lasiolænus* Druce. Barton Hills, 1918.

Campanula latifolia L. Rowney Warren, 1911.

Primula veris × vulgaris. Stanfordbury Farm, Shefford, 1912.

**Vinca major* L. Clifton, 1912; Arlesey, 1912; Southill Park, 1912; Clophill, 1914.

**Symphytum peregrinum* Ledeb. Maulden, 1918.

Myosotis versicolor Sm. Flower first white, then blue. Southill, 1912. Var. *dubia* Arrond? See W. E. C. R. 1914, 503.

Lithospermum officinale L. Sheerhatch Wood, 1912.

Echium vulgare L. Pegsdon, 1913; between Ravensburgh and Barton, 1917.

Atropa Belladonna L. Eastwood's Brickworks, Arlesey, 1911. Casual?

Verbascum nigrum L. A form with cream-white flowers, between Shefford and Southill, with the type, on greensand and marl. Confirmed by G. C. Druce, 1914.

Veronica aquatica Bernh. (Segr.). Biggleswade, 1913; Warden Abbey, 1913.

Euphrasia nemorosa H. Mart. Pegsdon, Barton, 1918.

Bartsia Odontites Huds. var. *serotina* (Dum.). Pegsdon, 1913. B. E. C. R. 1913, 487.

Orobanche major L. Rowney Warren, 1912, L. Little.—*O. minor* Sm. In clover, Holwell, 1913.

Thymus ovatus Mill, subvar. *subcitratus* A. B. Jackson (inflorescence elongate). Pegsdon, 1913.

Calamintha montana Lam. Between Cadwell Bridge Farm and Wilbury Hill, 1913.

Salvia Verbenaca L. Southill, 1913; Henlow, 1914.—**S. verticillata* L. Arlesey. 1912.

Nepeta Cataria L. Southill, 1913.

Scutellaria galericulata L. Swamp between Biggleswade Common and Sandy Warren, 1913; Shefford, 1914.

Lamium hybridum Vill. Southill, 1912; Clophill, 1914.

Chenopodium hybridum L. Sandy, 1911. B. E. C. R. 1911, 116.—*C. rubrum* L. Southill Park, 1914.

Polygonum lapathifolium L. South of Sandy Warren, 1913.

Rumex limosus Thuill. Pond at Warden Abbey, 1913. Confirmed by *C. E. Moss.*

Mercurialis annua L. Southill, ♀ only, 1914.

Parietaria ramiflora Mœnch. Potton Churchyard (long unbranched stems), 1911.

**Castanea sativa* Mill. Sandy, 1911; Rowney Warren, 1911; Clophill, 1914.

Populus. See Journ. Bot. 1916, 253.

Ceratophyllum demersum L. Lake in Southill Park, 1912.

Cephalanthera grandiflora Gray. Pegsdon, 1909; Barton, 1910.

Orchis prætermissa Druce. Below Cadwell Bridge.—*O. ustulata* L. Pegsdon.

Ophrys apifera Huds. Arlesey Brick Co's pit (gault), 1910.—*O. muscifera* Huds. Barton Leet Wood, 1910: Pegsdon, 1909.

Habenaria virescens Druce. Sheerhatch Wood, 1912; Southill, 1913.

Allium vineale L. var. *compactum* (Thuill.). Arlesey; Clifton, 1912; Stanfordbury, Shefford, 1913.

Juncus subnodulosus Schrank. Southill, 1912.

Sparganinm simplex Huds. Biggleswade Common, 1913 (with branches 5–6 cm. long, bearing both ♀ and ♂ heads). "Your specimens have essentially the habit and growth of *simplex*, but the branched spikes I have never seen before." A. Bennett in litt., 20 Feb., 1914.

Typha latifolia L. var. *media* Syme. Arlesey Brick Co.'s Pit, 1911, with type and *T. angustifolia* L.

Potamogeton perfoliatus L. Shefford, 1911; det. *A. Bennett.*—*P. pusillus* L. var. *tenuissimus* Koch f. *angustifolius* Fischer; det. *A. Bennett.* Lake at Southill Park, 1913, W. E. C. R. 1913, 461. I have not been able to procure it in fruit. Mr. C. E. Salmon says "the leaf apex reminds one of *P. rutilus.*"—*P. pectinatus* L. Lake at Southill Park, 1913.

Zannichellia palustris L. var. *brachystemon* (Gay). Arlesey Brick Co.'s Pit, 1910.

Carex Pairei F. Schultz. Rowney Warren, 1914.—*C. pilulifera* L. Sandy Warren; Rowney Warren, 1911.

**Anthoxanthium aristatum* Boiss. Everton, 1911, B. E. C. R. 1911, 137.

Phleum pratense L. var. *nodosum* (L.). Galley Hill, Potton, 1913; Sandy, 1909.

Agrostis canina L. var. *mutica* Doell. Sandy, 1913.

Deschampsia flexuosa Trin. Sandy; Sutton; Rowney Warren. 1911.

Avena pratensis L. Barton, 1910; Pegsdon, 1913.

Catabrosa aquatica Beauv. Biggleswade, 1913.

Poa compressa L. Shefford, 1911.

Festuca bromoides L. Sandy, 1911. Var. *Broteri* (Boiss. &

Reut.). Border of Cambs and Beds, Everton, 1911; det. G. C. Druce.

Brachypodium pinnatum Beauv. var. *pubescens* Gray. Sheerhatch Wood, 1912.

Lastrea aristata Rendle & Britten. Keeper's Warren, Southill, 1913.

NOTES ON JAMAICA PLANTS.

By William Fawcett, B.Sc., and A. B. Rendle, F.R.S.

(Continued from Journ. Bot. 1919, p. 68.)

EUPHORBIACEÆ.—II.

Mettenia Griseb.

Examination of the male flower of *M. globosa* Griseb. (*Croton globosum* Sw. Prodr. 100 & Fl. Ind. Occ. 1181) confirms the opinion of Bentham and Hooker (Gen. Pl. iii. 324) that this genus when better known would have to be united with Thwaites's genus *Chætocarpus.*

The male flower of *M. globosa* has an irregularly 5-partite densely puberulous calyx, and 6 to 7 stamens inserted at different levels on a central column which is prolonged above into a rudimentary pistil. The anther-cells are attached separately to the connective which is produced slightly beyond. There is an inconspicuous 4-lobed disk below the stamens.

As Bentham and Hooker suggest, there are two West Indian species, one Jamaican originally described by Swartz (*Croton globosum*), the other an undescribed Cuban species known only from a fruiting specimen collected by Wright (no. 1973). Examination of the material available has convinced us that the Cuban plant represents a distinct species, as shown by the following comparison :—

Chætocarpus globosus, comb. nov.

Young twigs puberulous. Leaves roundish-ovate to roundish-elliptical, rounded or very obtuse at both ends. Capsule 11–12 mm. l.; columella winged. Native of Jamaica.

C. cubensis, sp. nov.

Young twigs glabrous. Leaves elliptical with cuneate base. Capsule 8–9 mm. l.; columella not winged.

Frutex vel *arbor* (?) ramulis glabris. *Folia* 3–4·5 cm. l., elliptica aut anguste elliptica, apice rotundata vel obtusissima, basi cuneata, glabra; petiolus 2–3 mm. l. *Capsulæ* 8–9 mm. l.; columella non alata. *Semina* atra, hilo magno albo. Type in Herb. Mus. Brit. and in Herb. Kew.

Hab. Cuba, *Wright* 1973!

Dendrocousinsia Millspaugh.

This genus was described in Field Columb. Mus. Bot. ii. 1913, 374, from specimens collected in Jamaica by Mr. William Harris and Dr. N. L. Britton. The author remarks that it is "near *Sebastiania*," but does not indicate how it differs from that genus. Dr. Millspaugh describes the calyx-lobes in both male and female flowers as "each subtended internally by a minute bract with a glandularly fringed margin." We do not understand this use of the term "bract," and prefer to regard this inconspicuous glandular fringe of hairs as representing a disk. This might be regarded as a distinction from *Sebastiania*; other differences are: the distinct subequal calyx-segments, the leaves sometimes opposite or whorled, and the solitary male flower in the axil of each bract.

The genus, however, appears to be more nearly allied to the Old World genus *Excœcaria*, and to differ from this, as conceived by Bentham and Hooker, merely in the indication of a disk, and the presence of a caruncle. The material available of two of the species is incomplete: of *D. fasciculata* we know only the female flower; of *D. alpina* only male flowers.

DENDROCOUSINSIA Millsp. *Flores* dioici, apetali. *Discus* e fimbriis glandulosis minutis. *Fl.* ♂ : *Calycis* segmenta 3, parva, distincta, subæqualia, membranacea. *Stamina* 3; filamentis liberis; antherarum loculi distincti, paralleli, contigui, longitudinaliter dehiscentes. Ovarii rudimentum 0. *Fl.* ♀ : *Calyx* 3-partitus v. 3-lobus. *Ovarium* 3-loculare; styli 3, liberi v. basi brevissime connati, patentes v. revoluti; ovula in loculis solitaria. *Capsula* tridyma, in coccos 2-valves a columella persistente dissiliens. *Semina* oblonga, levia, strophiolata.

Arbores parvi *fruticesve*. *Folia* alterna, opposita, vel verticillata, breviter petiolata vel sessilia, integra aut denticulata, coriacea v. papyracea, pennivenia. *Spicæ* nunc terminales nunc terminales atque axillares, solitariæ aut fasciculatæ. *Flores* sub quaque bractea solitarii, ♂ sessiles, ♀ sessiles vel subsessiles. *Bracteæ* brevissimæ, sub flore utrinque glanduliferæ.

D. SPICATA Millsp. *Folia* petiolata, elliptica, utrinque rotundata vel emarginata, margine conspicuo revoluto, 3·5–8 cm. l. *Spicæ* ♂ et ♀ terminales, ♂ ad 10 cm. l., subcrassæ, ♀ 2–3·5 cm. l. *Glandulæ* suburceolatæ lateribus crassis carnosis.

Hab. On limestone rocks, Peckham, Clarendon, 2500 ft., *Harris*, 10,980, 10,981, 11,204, 12,777!

D. FASCICULATA Millsp. *Folia* sessilia, ovata, interdum elliptica vel oblonga, utrinque obtusa, 3–9 cm. l. *Flores* ♀ ad apices ramulorum fasciculati, foliis tribus involucrati. *Glandulæ* 1–3-ramosæ.

Hab. Dolphin Head, 1800 ft. *Harris*, 10,266!

D. alpina, sp. nov. *Folia* petiolata, ovata, interdum elliptica, utrinque obtusa, 2·5–3·5 cm. l. *Spicæ* ♂ terminales atque axillares ad nodos vetustiores foliis delapsis. *Glandulæ* ut in *D. spicata*, aut interdum obsoletæ.

Arbor 18 ped. alta, glabra. *Folia* ovata vel elliptica, utrinque obtusa, 2·5–3·5 cm. l., margine in sicco subrevoluto parce denticulata, eglandulosa, papyracea-coriacea, supra reticulato-venosa, infra costa prominenti nervis venisque obscuris; petioli circa 4 mm. l.; stipulæ rotundato-deltoideæ c. 1 mm. l. *Spicæ* ♂ terminales atque axillares ad nodos vetustiores foliis delapsis, bracteas c. 20 gerentes; ♀ non visæ. *Bracteæ* rotundato-ovatæ, denticulatæ. *Glandulæ* carnosæ, interdum obsoletæ. *Flores* ♂ : *Sepala* rotundato-rhomboideo-ovata, margine irregulari denticulata. *Bracteæ* et *sepala* coccinea.

Hab. John Crow Peak, Blue Mts., 6000 ft. *Harris*, 12,906!

We have received this specimen from the Jamaican Herbarium under the name of *Gymnanthes alpina* Britton, and refer it to *Dendrocousinsia,* owing to the structure of the male flowers.

Acalypha L.

Acalypha virgata L. var. pubescens, var. nov. Ramuli, petioli, nervique dense pubescentes. *Folia* utrinque sparse pubescentia; petioli 2–8·5 cm. l. *Spicæ* femineæ usque ad 8 cm. l. *Bracteæ* femineæ hispidulæ.

Hab. Claverty Cottage, Blue Mts., J. P. 1421, *Hart*!

WATSON BOTANICAL EXCHANGE CLUB REPORT.

The *Thirty-fourth Annual Report of the Watson Botanical Exchange Club for* 1917–1918 contains as usual much interesting material contributed by our leading British botanists There are valuable notes on critical genera and species: Mr. Groves's on *Ranunculus* (*Batrachium*), Mr. Moyle Rogers's and Mr. Riddelsdell's on *Rubus*, Major Wolley-Dod's on *Rosa*, Mr. Barton's on *Salicornia,* and Mr. Pugsley's on *Orchis* may be mentioned as examples of the former and Mr. Salmon's on *Arabis hirsuta*, Mr. Little's on *Prunus insititia*, Mr. Marshall's on *Pyrus Pyraster*, Mr. White's on *Prunella laciniata*, and Messrs. Little and Jackson's on *Alnus glutinosa* of the latter. Space will not allow us to quote these at length, but a few points may be noted. Mr. Groves makes useful suggestions: thus of *Ranunculus fluitans* var. *cambricus*, sent by Mr. Griffiths from the original Anglesey locality, he writes: "This curious plant has always been a puzzle, and it would be of great interest to ascertain if its peculiarities are due to ecological factors by cultivating it under different conditions, especially in running water. If the Batrachian *Ranunculi* could be grown on an extensive scale I believe many of our difficulties in connexion with this group of plants would be solved." Commenting on *R. peltatus* var. *floribundus,* sent by Mr. White from W. Glos., he says: "The *peltatus*-like form with shorter peduncles, which I understand by the name. A beautiful specimen, showing what can be done by careful floating out, in marked contrast to the draggled apologies for specimens one so often has to examine. There is no group of plants that better repay care than the aquatic *Ranunculi*. It seems to me that it is worth while in the case of these and other water plants to float them out; the trouble is not great, especially when one is drying a number, and the results are far more satisfactory than if the plants are merely spread out as in the case of land plants." On a plant from West Hoathley, Sussex, he comments: "A weak state of *R. peltatus* with unusually small flowers, or a hybrid with that species as a parent. The aquatic *Ranunculi* hybridise freely, and, whenever specimens are met with having weak peduncles ascending after flowering and producing few or no carpels, the other members of the group should be looked for in the neighbourhood to account for their parentage." Such notes as these are very helpful, as coming from one whose admirable specimens, prepared by "floating-out," are illustrations of the process advocated. It may be noted here that the greater part of Mr. Groves's herbarium was presented recently to the National Herbarium, forming a welcome addition to the British Collection there.

The Rev. W. Moyle Rogers contributes among other notes, a description of a new variety (*Rubus thyrsoideus* Wimm. var. *viridescens* Rogers MS.) from N. Devon and W. Cornwall—the former collected as long ago as 1882 by himself and Mr. Archer Briggs. "The closeness of the connexion with type seems to be established especially by the combination of the strong deeply-furrowed glabrous stem with the comparatively short curved prickles and showy flowers of the panicle. It is, however, considerably unlike in habit and coloration, besides having leaflets narrower and soon bare beneath, with panicle (when fully developed) considerably branched and purplish petals. From *R. rusticanus*, towards which it takes a step from type, it may be readily distinguished by its epruinose stem, its more compressed prickles and longer stamens; and from my *B. Briggsianus*, which at first sight it recalls, by its sulcate stem and short curved panicle-prickles, as well as by its different leaves, greyer sepals and purplish petals." Of another of his varieties (*R. mucronatus* Blox. var. *nudicaulis*) Mr. Rogers writes:—"Though it is locally abundant in S.W. England, extending northwards to Swallowcliff (S. Wilts) and eastwards to Marvel Copse, near Newport (I. Wight), the distribution of this bramble seems remarkably limited, and I have not found it in Sussex, Somerset, Devon or Cornwall. Probably enough it occurs in all four counties. In Dorset and S. Hants it is frequent and constant, to the apparent exclusion of typical *R. mucronatus* Blox., from which it seems to keep distinct." In his introductory notes Mr. George Goode, the editor of the Report, thus refers to Mr. Rogers's withdrawal from the post of referee:—"The Rev. W. Moyle Rogers has for so many years given us the benefit of his unique knowledge of the *Rubi*, in furnishing us with criticisms on the specimens sent in, that members will hear with the deepest regret that on account of increasing infirmity he has at last felt compelled to resign his position of referee. We are happy to say that the Rev. H. J. Riddelsdell, who has lately assisted Mr. Rogers, has kindly promised to examine and—where necessary—criticise all specimens of that difficult genus."

A form of *Rosa pomifera*, sent by the Rev. H. E. Fox, under the name *R. cinnamomea*, from "Undercliff, Kingsdown, Kent, apparently indigenous" is thus commented upon by Mr. W. Barclay:—"This is not *R. cinnamomea* L. It is a variation of *R. pomifera* Herm., and as it has a certain number of subfoliar glands it might be considered as *R. pomifera* Herm., f. *recondita* Christ (*Rosen der Schweiz*)=*R. recondita* Puget in Déséglise, Revis. sect. Toment. 46."

Mr. White has an interesting note on *Pyrus Pyraster* var.

Deseglisei Rouy & Camus (*P. cordata* Déségl. non Desv.) from W. Gloucestershire—a tree which Mr. Marshall thinks is "probably a distinct species; it is quite different from *P. cordata* in fruit-character, and the leaves are more parallel-sided." Mr. White writes: "I take this to be the aboriginal wild pear of the country, which I have only once before seen—in the Wye valley—and then it had not flowered. The largest of the three trees found near Rangeworthy, from which these specimens were taken, has a girth of over four feet, and is about forty feet high, with a spread of thirty feet. Its age probably dates from a period prior to the enclosure of the district in which it stands. In characters it agrees well with those of *Deseglisei* so far as given by Rouy and Camus, the fruit being globular, about the size of a large cherry (diam. 20–25 mm.), on long, erect-patent stalks. Obviously it is a very different plant from the *P. cordata* Desv. (named *Briggsii* by Syme) of which Mr. Briggs sent me a specimen from Plymouth in 1881. That has tiny pyriform fruit, attenuate at the base, 'au plus de la grosseur d'une petite noisette' (Rouy), and is well described by Boreau (Fl. du Centre), where I find no mention of the form under notice. Rouy and Camus hold, however, that Boreau's description covers several of their varieties. *P. Deseglisei* appears to be on record only from Cher in Central France."

Mr. Marshall has notes on Saxifrages, including one on a new variety, which we transcribe: "*S. hypnoides* L., n. var. (*robusta* ined.). Root from West Ireland, on limestone (R. Ll. Praeger; received through Mr. E. W. Hunnybun); probably from Black Head, Co. Clare, v.c. 9, as I have a wild specimen, gathered there, which is clearly the same thing. Cult. garden, West Monkton, May 29, 1916, and May 31, 1917. Much stronger than the typical plant from Cheddar, grown under the same conditions. Axillary buds either absent or rudimentary. Stems stouter, stiffer, as are the lower cauline leaves. Flowers mostly larger."

Specimens of *Prunella laciniata* L. collected by Mr. H. S. Thompson in a "rough pasture above Cheddon, N. Somerset, after a horde had apparently cropped many of the plants," are noted by the collector as "very variable in form of leaf and colour of flowers, evidently hybridising with *P. vulgaris*. The pale yellow flowers predominate, but some were pale bluish-purple, and a few had the upper lip pale purple and the lower lip pale yellow." On this Mr. White notes:—"The specimens on Mr. Thompson's sheets that vary in flower-colouring to tints of bluish-purple have in general sub-entire leaves, a combination suggestive of hybridity with *P. vulgaris*. Such variations are mentioned in Fl. Brist., p. 478, and the idea that they are hybrids is there rejected for reasons given. Still, at my request, Mr. Bucknall has carefully dissected the flowers of these recent examples, and finds that my previous conclusion is confirmed by microscope. On comparing stamens and calyces with those of typical *laciniata* no marked deviation can be recognised, the subulate prolongation of the longer filaments and the calyx-teeth ciliation being practically identical . . . . As stated by the collector, the bulk of his contribution had been damaged by grazing, and so could not satisfactorily represent this rare Labiate in any herbarium. Surely it would have been wiser, in view of the plant's scarcity, to have allowed such roots to remain undisturbed until they produced acceptable specimens later on."

Mr. Marshall sends from his garden at West Monkton an unnamed *Betula*, with the following note :—" Root from boggy, peaty ground, at about 2800 feet, descending from the Lochnagar tableland towards the Dhu Loch, S. Aberdeen, v.c. 92, July 1906. In the wild state this was a very small shrub, only a few inches high, with hairy leaves, strongly suggesting a cross between *B. nana* and *B. pubescens* (I have never found the latter so high up). It has now grown into a good-sized bush, nearly six feet in height, but has never produced catkins. The leaf-outline has become much less crenate, and it might well pass for *B. pubescens*, var. *microphylla*; but I still think that it may be a *per-pubescens* form of × *B. alpestris* Fr."

The notes on Orchis relate to specimens collected at Mildenhall, W. Suffolk, by Mr. W. C. Barton, who writes: " All [are] from one marshy field, where, in addition to those now sent, *O. Fuchsii* Druce (*maculata* auctt.) occurred. The plants were sorted fresh, when the characters were easily distinguished. All forms varied much in size and in width of leaf (a character which I believe to be of no diagnostic value), and it is noticeable that all were gathered on the same day." They include a form of *O. incarnata*, which, according to Mr. Pugsley, " seems to show a somewhat greater foliar development and slightly broader lip than obtains in the extreme form of *O. incarnata* occurring in the Scotch Highlands, the flowers of which, in my experience, may be either purple or salmon-pink in colour in different localities": a plant named by Mr. Barton, who is " convinced it is a good species," *O. prætermissa* Druce, of which Mr. Pugsley says: " This appears to be the plant which I understand to be *O. prætermissa* Druce, and if so it is, I believe, the common marsh *Orchis* of the south of England, and the only form I have seen in Surrey. Though its flowers are usually purple, they are occasionally flesh-coloured, and there were formerly a few plants with these pale flowers among the common purple-flowered form on Wimbledon Common": and a hybrid—*O. Fuchsii* × *prætermissa*—the leaves of which " when fresh were distinctly spotted," on which Mr. Pugsley writes:—" If the leaves of this were spotted, and the plant was growing with the reputed parents, the identification is probably correct. The spur, however, simulates that of *O. latifolia*, and it seems possible that the plant belongs to a form with narrow, spotted leaves, occurring in the south of England, which has been referred to that species, but which may really be the above-mentioned hybrid. But in the example sent I can see no traces of the dark variegation of the lip which characterises most, if not all, the forms of *O. latifolia*."

Mr. C. E. Salmon has the following note on *Alopecurus geniculatus* × *pratensis* = *A. hybridus* Wimm.:—" This grass attracted the attention of Mr. L. B. Hall and myself when botanizing along the side of one of the numerous dykes of Amberley Wild Brooks. It was growing in plenty in close proximity to *A. geniculatus*, and formed handsome clumps with its brilliantly glaucous sheaths and yellow anthers. The spikes were larger and the awns longer than in *geniculatus*, and the plants were taller and more robust, although decidedly geniculate near the base. The glumes and pales reminded one more of *pratensis*, but the ligule was long, as in *geniculatus*. *A. pratensis* grew not very far away in comparatively dry ground, and it was noticeable that the hybrid preferred spots at the tops of the dyke banks, and did not choose, as is often the case with *geniculatus*, to have its roots in the water. These Amberley examples seem to agree well with Messrs. Bromwich & Jackson's Warwickshire plant (B.E.C. Rep. 1900, 650) and the Rev. H. P. Reader's specimens of the hybrid from Staffordshire (Watson B.E.C. Rep., 1900—1, 34). Mr. A. B. Jackson (Journ. Bot. 1901, 232) has also called attention to the remarkably glaucous sheath—a character which first caused us to take special notice of the plant."

Mr. Groves notes on a plant sent from Nailsea Moor, N. Somerset, as "*Chara vulgaris* L., small form, ? var. *crassicaulis*": "A form with broad secondary cortical-cells, well-developed spine-cells, and with the posterior bract-cells developed. Nothing like so extreme a plant as the var. or subsp. *crassicaulis*, which has a thick stem and more definitely botuliform bract and spine-cells."

The foregoing extracts, which will we think interest a wider circle than that afforded by the Club, are but examples of the contents of the Report. We note with pleasure the absence of plants which owe their presence among us to mill-sweepings or rubbish-heaps and in most cases "have their day and cease to be" even before their names appear in print.

J. W. H. TRAIL, M.D., F.R.S.

James William Helenus Trail, son of the Rev. Samuel Trail, M.D., LL.D., minister of Birsay and Harray in Orkney, afterwards professor of systematic theology in Aberdeen University, and Helen, daughter of Dr. Hercules Scott, professor of moral philosophy, King's College, Aberdeen, was born at Birsay on 4 March, 1851. Educated in the first instance at home, he was sent in due course to the Grammar School, Old Aberdeen, then famous for its classical training. From school Trail entered, in 1866, the arts faculty of the University of Aberdeen.

Dr. Trail had formed a high estimate of the lad's capacity and entertained the hope that his son, like himself, might become a churchman. But at school Trail hardly fulfilled his father's expectations. Always a diligent pupil he accomplished the tasks he was set, but showed no promise of attaining distinction as a classical scholar. Perhaps this was largely due to Trail's addiction to natural history pursuits, which was so pronounced as to earn from his school-mates a kindly if playful agnomen which had not yet fallen out of use when he became an undergraduate. His companions at school had, in fact, as sometimes happens, formed a sounder judgment with regard to his mental powers than had his teachers.

As an arts student Trail's academic career at first much resembled that of his school-days. For the humanities, in which he had so long been assiduously drilled, Trail had lost any liking he may ever have possessed. Mathematical work, though it hardly cost him an effort, never awakened any vivid interest. Even in philosophy, of which he showed, later in life, so firm a grasp, his youthful interest in natural processes other than mental was too engrossing to permit academic distinction. When, in 1867, Dr. Trail took up the duties of his chair and was once more in personal contact with his son, the situation induced grave paternal misgiving and provoked no little paternal impatience. That Trail had not taken the position which his father had felt justified in expecting, was attributed to the consumption of valuable time which Trail's devotion to natural history involved. In spite of discouragement, the harder to combat because its intention was kindly, Trail remained devoted to natural history. During the magistrand phase of his arts course his firmness of purpose was fully rewarded. Now he was able to attend the natural science classes and to show, by his appearance in these, that he was in reality one of the most distinguished students of his year.

When, in 1870, Trail graduated in arts with honours in natural science he passed on to the faculty of medicine, not from any desire to become a surgeon or a physician, but with the object of obtaining a further training in science. In the new faculty he maintained the brilliant position he had acquired in natural history, but when, in 1873, it was in his power to accompany, as botanist, an exploring expedition to the Amazon region, he laid aside his medical studies without hesitation rather than miss such an opportunity of first-hand acquaintance with a tropical fauna and flora. When he returned in 1875, Trail resumed his medical studies and graduated as M.B. with highest academical honours in the following year.

Trail had already commenced the publication of observations recorded by himself at the beginning of his medical course and before he left for Brazil had made his earliest contributions to the study of galls, a subject as to which he acquired in time a European reputation. On his return from the Amazon journey he at once began to work out his results; his earliest contributions, relating to the palms, appeared in the *Journal of Botany* during 1876–7. The ability he had displayed in securing his specimens, and the thoroughness of his descriptive work, attracted immediate attention and led to his appointment, towards the end of 1876, as government botanist in British Guiana; but before the date fixed for his departure had arrived Professor Dickie, then Professor of Botany at Aberdeen, was compelled to relinquish his chair owing to failing health. Trail was appointed by the Crown to the vacant post and took up his duties, shortly after his twenty-sixth birthday, at the commencement of the summer session of 1877. Having fulfilled these duties with the utmost efficiency for forty-two sessions he has now died, almost in harness, after a brief illness, which involved surgical treatment, in a nursing home in Aberdeen, on 18 September, 1919.

Without being a fluent speaker, Trail was a clear and convincing teacher. The precision with which his statements were made and the care with which his words were chosen made his lectures models as a means of instruction. The skilfulness of his method and the judgment shown in selecting his material rendered his practical classes equally perfect as a means of education. As the leader of a field-excursion Trail can have had few equals and certainly no superior. At the outset of his teaching career the resources of his department, chiefly owing to lack of accommodation, left much to be desired. With untiring energy he set to work to remedy defects, and he has left for his successor a botanical department fully equipped with an adequate teaching museum, good laboratories, and an excellent botanical garden.

On his return from Brazil in 1875 Trail was elected a Fellow of the Linnean Society. In 1879 he obtained the degree of M.D. in his own University. In 1886 he became president, on its foundation, of the Aberdeen Working Men's Natural History Society, a body in whose doings and welfare he took the keenest interest, presiding over its meetings and often leading its excursions. In 1893 he was elected a Fellow of the Royal Society. In 1910 he presided over the botanical section of the British Association at its eightieth meeting.

The capacity for business displayed in the organisation of his own department led to his help being much in demand in connection with University affairs. He made himself an efficient officer of the University battery, which owed its existence very largely to his efforts. When the territorial organisation displaced the volunteer system he became an invaluable member of the officers' training corps committee. From 1891 onwards he served as curator of the University library and chairman of the library committee, while from 1892 onwards he served as dean of the newly created faculty of science. He played a prominent part in the establishment of a lectureship on forestry, and in the development of an agricultural department. Authorities external to the University were equally eager to secure his aid, and where the object was the advancement of education, more especially scientific education, this aid was readily given. This involved acceptance of the governorship of various educational trusts and the chairmanship of more than one education committee.

To the furtherance of objects in which Trail was interested he devoted means as well as time. In memory of his mother he endowed a fund intended to benefit students in any faculty of the University who may have given proof of ability in the study of natural science. After having served as curator of the library for a quarter of a century, he established another fund whose income is available, 'in supplement of' grants from University revenues, for the addition to the library of works relating to natural science. In the Linnean Society, whose welfare and renown he always had much at heart, he founded an 'award and medal' in recognition of special research.

These recorded acts of generosity, however, represent but a small portion of Trail's thoughtful and unobtrusive benevolence, just as his published notes and papers, numerous and important though they be, represent but an infinitesimal part of the vast store of knowledge acquired by him as the result of exact and patient observation and investigation. The width of range of his information was as astonishing as its exactitude. That knowledge was always freely at the disposal of anyone who might seek his assistance, and those who have profited most by his aid are also those who most lament that Trail's high sense of public duty should have involved such inroads on his scanty leisure as to prevent the permanent record of much that he knew which it would benefit others to know.

It was not, however, his knowledge alone that made any intervention by Trail in discussion so valuable and gave such a charm to intercourse with him. The regard and esteem in which he was held, the authority with which he spoke, and the attention with which he was heard, were due to his sincerity and kindliness as much as to his knowledge. In Trail those who knew him deplore the loss of the wise counsellor and the generous friend even more than that of the eminent natural historian.

D. Prain.

BIBLIOGRAPHICAL NOTES.

LXXVII. John Ellis's Directions for Collectors.

A damaged copy of a pamphlet, printed (but apparently not published) in 1771 has lately been presented to the Department of Botany. It is entitled "Directions for bringing over Seeds and Plants from the East-Indies and other distant Countries in a State of Vegetation," and is anonymous. It proves to be a reissue of the first portion of the pamphlet published in 1770 (with the same title) by John Ellis (c. 1710–76): to the original, however, is added as a second part the account of *Dionæa* that Ellis sent to Linnæus, on which the description of the genus (Linn. Mant. ii. 238) was based—it may be noted in passing that the plate accompanying the letter was taken from a plant that flowered in [Ellis's] chambers in August 1768 (see letter from Ellis in Linnæus's *Correspondence*, ii. 73). The reissue does not entirely correspond with the original: the first and last paragraphs of the latter are omitted, as well as the long footnote (pp. 17, 18), and there are slight deviations in the text. It contains an additional chapter, with plate, on "The Method of catching and preserving Insects for Collections." The "Directions" is referred to by Lettsom (1744–1815) in his *Natural History of the Tea-Tree* (1772—I have only seen the "new edition" of 1799)—in which Ellis's plate illustrating "Boxes for conveying Plants by Sea" is reproduced, though without acknowledgement. It would appear from Lettsom's note (p. 54) that Ellis had contemplated the publication of a second edition of his "Directions," but this does not seem to have appeared. *The Naturalist's and Traveller's Companion*, to which the note makes reference, although published anonymously (1722) is Lettsom's own work.

James Britten.

SHORT NOTES.

New County Records for Argyle. In the course of a visit in September to the district at the north end of Loch Awe, I came across the following species which are not recorded for 98 Argyle in either Watson's *Topographical Botany* or Mr. Arthur Bennett's *Supplement*, and of which Mr. Bennett himself tells me that he has no subsequent record. *Hypericum pulchrum* L. Frequent, and ascending some way up the hill-sides.—*Prunus avium* L. Taychreggan.—*Centunculus minimus* L. Glen Nant.—*Tanacetum vulgare* L. ? Garden escape.—*Myrrhis odorata* Scop. Portsonachan. ? Garden escape.—"*Mentha sativa*" (aggr.). Kilchrenan.—*Polygonum Hydropiper* L. Frequent about Kilchrenan.—*Potamogeton perfoliatus* L. Loch Awe. Three other plants (*Cardamine flexuosa* With., *Juncus tenuis* Willd., and *Equisetum sylvaticum* L.) were also found which do not appear in either of the above works, but which Mr. Bennett informs me have been recorded elsewhere for the county. *Juncus tenuis* was growing in good quantity by the roadside in a wild glen a long way from any habitation.—L. V. Lester Garland.

Carex montana L. (p. 274). Since this was gathered by Mr. Mitten in May, 1842, in a heathy field, between Eridge and Tunbridge Wells, whence I have a specimen, its habitats have been greatly increased, and it is now on record for 17 counties. Of these, seven are recorded in Top. Botany, three in the Supplement,—these with Brecon (Bot. Ex. Club Report for 1883) make the eleven in the London Catalogue, ed. 10. Since then it is on record for: 2. Cornwall E., Curnow sp.; 9. Dorset, E. F. Linton sp.; 22. Berks, Rept. Bot. Ex. Club, 1918, 102; 24. Bucks, Miss Armitage, *l. c.*; 41. Glamorgan, Miss Vachell sp.; 57. Derby, Waterfall sp. Mr. Thompson's interesting notice speaks of its early flowering; in cultivation it flowers in April, before *ericetorum*, *præcox*, or *pilulifera*.—Arthur Bennett.

Isoetes Hystrix Durieu in Cornwall. On June 19th last I gathered this plant, hitherto unknown for England, at the Lizard, growing with *Trifolium strictum* and *T. Bocconii*. I saw one specimen only, but am convinced it is probably to be found in many similar situations. The specimen is small and the plant would be very difficult to find unless especially looked for, which I believe botanists have not been in the habit of doing in this particular neighbourhood.—Fred. Robinson.

Vaccinium intermedium Ruthe. I am quoted (p. 285) as having found this hybrid on Whitley Common. The site was on Whitmore Common—about a mile N.E. of Whitmore Station (L. & N.W. Ry.), and within two miles of Maer Woods—the date being Aug. 23rd of this year. The plants, growing with the parents and *Empetrum nigrum*, were in full flower and unusually fragrant, in scent resembling hawthorn or meadow-sweet.—W. Balfour Gourlay.

Calamagrostis stricta Timm. forma *pilosior* Norman Fl. Arct. Norway, p. 56, in Christ. Vid.-Selsk. Forhandl. No. 16 (1893), p. 56

"Pili floris paleam conspicue superantes, valvam interiorem subæquantes." Some of Mr. Robinson's Stow Bedon, W. Norfolk, specimens answer to the above, and are a greater development of the var. *Hookeri* Syme.—Arthur Bennett.

Elatine Hydropiper in Worcestershire. I was fortunate enough to find this plant growing in great abundance at Westwood Pool near Droitwich, on the 4th August, 1919. Irvine in the *Phytologist*, ii. 401 (1857–8) records it as having been found by him "in a mill-pond near Churchill Railway Station, Kidderminster, Worcestershire."—Carleton Rea.

REVIEWS.

Fossil Plants, Vol. IV., Ginkgoales, Coniferales, and Gnetales. By Prof. A. C. Seward. Cambridge University Press. 1919. [Pp. xvi + 544 with 190 illustrations. Price £1 1*s.* 0*d.* net.]

With the volume before us the author brings to a conclusion this text-book of Fossil Plants, of which the first volume appeared twenty-one years ago. Probably no one who has not actually undertaken a work of a similar character can gauge the magnitude of the task involved. The mere collation of the extensive and widely diffused literature of the subject is in itself no mean feat, and the comprehensive bibliographies are not the least useful part of a work that occupies an assured position amongst the standard text-books of Palæobotanical literature.

The first seventy-five pages deal with the Ginkgoales, a summary of the more important features of *Ginkgo biloba*, the "living fossil" serving as an introduction to the extinct representatives. With reference to these latter Prof. Seward expresses the opinion that none of the fossil wood referred to *Ginkgo* is above suspicion. For the leaves belonging to this and allied forms the author proposes a new genus, *Ginkgoites*, though the distinction from *Baiera*, which typically has narrower and more numerous segments, is admittedly arbitrary. The genera *Ginkgodium*, *Czeckanowskia*, *Feildenia*, *Phœnicopsis*, and *Desmicophyllum* are regarded as possible representatives of the group, but the other genera usually placed here, viz. *Ginkgopsis*, *Nephropsis*, *Psygmophyllum*, *Rhipidopsis*, *Saportæa*, *Dicranophyllum*, *Trichopitys*, and *Sewardia*, are considered to have been assigned to the Ginkgoales on totally inadequate grounds.

The account of the recent Conifers is not only admirable as supplying the proper perspective for the Palæobotanist, but also as furnishing a much-needed and judicious summary of the extensive literature on the anatomy of the family which will be welcomed by all classes of students. The author subdivides these into nine tribes, of which three, viz. the Sequoiineæ, the Sciadopitineæ, and the Phyllocladineæ, are each represented by but a single genus. The remaining tribes are the Araucarineæ, held to be the most primitive, the Cupressineæ, the Callitrineæ (including *Callitris*, *Actinostrobus*, and *Widdringtonia*), the Abietineæ, the Podocarpineæ, and the Taxineæ.

Following Saxton, *Tetraclinis* is assigned to the Cupressineæ, whilst *Taiwania*, *Fokienia*, and *Athrotaxis* are tentatively placed in the same tribe.

After a considered statement of the pitfalls besetting the path of the palæobotanist studying coniferous material, the fossil woods belonging to the Coniferales are classified under fifteen genera, of which one, *Mesembrioxylon*, is established for the inclusion of the three genera *Podocarpoxylon*, *Phyllocladoxylon*, and *Paraphyllocladoxylon*. New species are described in the genera *Dadoxylon*, *Cupressinoxylon* and *Protopiceoxylon*. *Cupressinocladus* is created for the reception, of vegetative shoots agreeing with recent Cupressineæ and *Pityites* for fertile specimens of Abietineous fossils whose more definite systematic position is unknown. Two species are placed in the latter, of which one is new. A chapter is devoted to a number of Coniferalean genera of uncertain position and also to *Podozamites* and *Nageiopsis* whose affinity is open to doubt.

After treating briefly of the recent Gnetales the author points out the lack of trustworthy records of Gnetalean plants as fossils, and suggests that a careful study of the older supposed Dicotyledonous plants might reveal members of this group. The entire omission of the Angiosperms will be regretted by all, but it is explained that a critical examination of the actual specimens, with the co-operation of a trained systematist, is needed before the value of the available material can be adequately estimated.

There are two indexes whose positions might preferably have been reversed—the first to the fossil genera enumerated throughout the work, and the second a special index to the present volume.

Like its predecessors, the present volume is fully illustrated with numerous photographs and drawings of recent and fossil species; the typography maintains the high standard which we are accustomed to look for in the productions of the Cambridge University Press. Though Prof. Seward expresses, in the preface, his relief that this text-book has been brought to a conclusion, the feeling must be accompanied by satisfaction at the completion of a task which will earn the gratitude of all English-speaking Palæobotanists.

E. J. S.

Lowson's Text-book of Botany (*Indian Edition*). Revised and adapted by Birbal Sahni, M.A., M.Sc., and M. Willis, with a Preface by J. C. Willis, M.A., D.Sc. London: W. B. Clive. Pp. xii, 610.

When the first Indian edition of this text-book came under review five years ago (Journ. Bot. 1914, p. 343), attention was drawn to Dr. Willis's preface—which re-appears in the present issue—remarking on the Oriental tendency to learn by rote. Recognizing this tendency, we are more than ever convinced that the very detailed completeness of Lowson's work unfits it for the Indian student, if real teaching and not merely success in the examination-room be the end in view. This is not to say that the adaptation of the work for India has been badly done: on the contrary, both Mrs. Willis and the present editor, Mr. Sahni, who is Lecturer in the University of Benares, have made the best of it. The chief alterations introduced by the latter are the re-arrangement of the Orders according to Engler's system and a re-casting of the descriptions of the stelar systems in the Pteridophyta. There are defects which are inevitable in an adaptation of a work to another purpose, and which give a greater force of appeal to a work written originally *ad hoc*.

Our objections are rather to Lowson's original work than to that of his editors. If this is meant for a first book, its beginning, with formal definitions and subdivisions, with pure morphology and histology, is certainly not calculated to attract the young student. Again, the sequence of the chapters in Part iii appears to us hopelessly illogical. Following the anatomy and taxonomy of angiosperms we have a chapter on Pteridophyta; then one on Gymnosperms; a third on Homologies in Angiosperms; a fourth on Relationship between Vascular Cryptogam and Flowering Plant, followed by one on Ecology!

A Manual of Elementary Botany for India, by Rai Bahadir K. Ranga Achari, published at Madras in 1916, seems to proceed on a sounder educational method. It begins heuristically by taking two excellent and well-known Indian types, *Tribulus terrestris* L. and *Gynandropsis pentaphylla* L.; introduces the principles of physiology gradually *pari passu* with the anatomy; and deals only with prominent Orders of Indian angiosperms, without attempting to force upon the beginner a bewilderingly concise summary of the complex variety of the Cryptogamia. Considering the immense area and varied flora of India, it is, perhaps, better that text-book writers should not attempt to provide one book for the whole empire. Writing in Madras, Rai Achari gives Tamil and Telugu equivalents in his Index, while Mrs. Willis and Mr. Sahni give preference to Hindustani. In his "Note on Second Edition" the latter dwells on the European facies of the flora of the North-west Himalaya: it would have been instructive to have given instead a brief sketch of the various florulas of which the whole Indian flora is made up—a summary, in fact, of the admirable summary drawn up by Sir Joseph Hooker for the Imperial Gazetteer of India.

G. S. Boulger.

Gossypium in Pre-Linnean Literature. By H. J. Denham, M.A. *Botanical Memoirs* No. 2. 8vo, pp. 24. Price 2*s*. net. Oxford University Press.

In this interesting pamphlet the author gives a very thorough account of what is known of the early history of the Cotton plant in cultivation. The scheduled list of pre-Linnæan authorities, so far confined to early and little-known writers, includes sixty authors, from Herodotus, Theophrastus and early voyagers, to Fuchsius and Ximenes, Caspar Bauhin, and Linnæus. It affords an extremely interesting study of the manner in which the story of the races of a plant of greatest economic importance in different parts of the world has been gradually collected and put together by European herbalists and systematists of the past, to be crystallized with difficulty in more recent literature. The cultivated strains may of course be largely conventional, of unknown origin and of wholly unknown antiquity, thus rendering the isolation of the elementary species a labour of the future, before selection and hybridization by modern methods can be put on a satisfactory footing. It is interesting to note the reproductions of the oldest recognizable figures of the plants, as the 'Xylon' (*G. herbaceum*) of Fuchsius (1542) and Matthiolus (1563), for comparison with the 'Gotnemsegiar' (*G. arboreum*) of Alpinus (1592), and the 'Ychcaxihuitl' (*G. mexicanum*) of Ximenes (1651), as illustrating the earliest-known strains; as also the early significance of the last as a textile in the New World, as compared with the independent evolution of the Old-World cottons in India, and the later extension of *G. herbaceum* to Europe and Africa.

The economic species of Cotton are essentially tropical, and it is difficult to get an idea of them at their best in this country, but the future of *Gossypium* in colonial dependencies is assured, and everything bearing on the organization of so highly specialized a herbaceous type, which responds so readily to changes in the environment, has a significance beyond present estimation in the future control of tropical agriculture.

The arrangement of the bibliographical list leaves something to be desired. It begins with "Herodotus, *Historia*. Ed. Rawlinson. Murray, 1858"; it would have been better, we think, to have given the date of the original, while indicating the edition used. Mr. Henry Lee's little volume on *The Vegetable Lamb of Tartary: a Curious Fable of the Cotton Plant* (London, 1887) seems to have escaped Mr. Denham's notice and should be referred to should his essay reach another edition.

BOOK-NOTES, NEWS, ETC.

Some months ago a committee, of which Sir David Prain was chairman, was appointed to consider what steps could be taken to increase the usefulness of the Royal Botanic Society, which was incorporated in 1839 and holds a lease of eighteen acres in Regent's Park. From the published report we learn that the committee have formed the opinion that the Society could be made more useful both from the scientific and educational point of view by the establishment of:—(1) A school of economic botany, at which a knowledge of the economic plants and their products, including those of tropical regions, might be obtained; (2) an institute which might be made a centre for research, more especially in plant physiology, where the living plant is essential; (3) a centre for teaching in horticulture, the students of which could receive their necessary training in pure science at existing London colleges; (4) courses in school gardening, at times suitable for teachers in elementary, continuation, and other schools. In addition, the committee consider that the Gardens might extend their present utility as a centre from which colleges and botany schools could be supplied with material for teaching and research, and in which students could make use of the existing facilities for the study of systematic botany.

A NEW botanical magazine, *The Journal of Indian Botany*, edited by Mr. P. F. Fyson, of Presidency College, Madras, is being published by the Methodist Publishing House of that city. The Journal "has been founded for the publication of original papers in Botany which would not naturally find a place in the existing Indian journals, for there is no other journal in India which could accept a paper on ecology, physiology, histology, or the cryptogams, except such as might be of agricultural interest." The first number (September) contains the following papers: "Dimorphic Carpellate Flower of *Acalypha indica*" by L. A. Kenoyer, with two plates; "The Myxophyceæ of Lahore" by S. L. Ghose, with plate; "On *Alysicarpus rugosus* and its allies," by L. G. Sedgwick; a "Note on the Ecology of *Spinifex squarrosus*" by P. F. Fyson and M. Balasubrahmanyam; and a useful series of abstracts of current literature relating to Indian botany.

THE Kew *Bulletin* (no. 5) contains a very interesting account, by Mr. W. Dallimore, of the Falkland Islands, especially relating to their forestry, abstracted from the correspondence between Kew and the Governors of the islands, dating from 1842; it includes an account of the introduction of the Tussock Grass (*Poa flabellata* Hook. f.) into Britain. Hooker's specific name for the plant, published in Phil. Trans. clxviii. (1879) p. 22, footnote, doubtless stands, as the first description is that of Lamarck (Encycl. ii. pt. 2, 462) as *Festuca flabellata*; this part, according to Journ. Bot. 1906, 319 (which should be consulted when the dates of the *Encyclopedia* are in question) was published in April, 1788. Forster's *Poa cæspitosa* stands as a *nomen nudum* in his *Prodromus*, p. 89 (1786); he did not describe it until 1789 (as *Dactylis*: Comm. Goett. ix. 22). There is no ground for the doubt expressed by Hooker (*l. c.*) as to the identity of Forster's plant: Steudel, who calls it *P. Forsteri* (*Gramineæ*, p. 260: 1854) cites Forster's name as a synonym without hesitation, and we have in the National Herbarium a specimen from Forster so named.

In nos. 6–7 of the *Bulletin* Mr. W. B. Turrill summarizes the "Botanical Results of Swedish South American and Antarctic Expeditions," and there is an "abridged translation of the more important parts" of Mr. W. E. Hart's history of the Botanic Gardens of Pamplemousses, Mauritius. In no. 8 Mr. Sprague has a monograph of the Bignoniaceous genera *Dolichandrone* and *Markhamia*, to which attention was called by Seemann (who named the genera) in the early volumes of this Journal (1863–70).

MR. W. WILSON, of Honolulu, has brought together in a pamphlet all that is known of *David Douglas at Hawaii* (Thrum, Honolulu, price 1 dollar). It does not add materially to our knowledge, but contains some interesting views of places associated with Douglas's journeys and a picture of the memorial tablet erected to his memory on the front wall of Kawaiahao Church, Honolulu.

The friends of the late Clarence Bicknell (see Journ. Bot. 1918, 303) are anxious to place in Bordighera some memorial of his forty years' residence there. "In addition to his keen scientific work in many varied fields, he took the deepest interest in the welfare of the poor and was one of their best friends and most generous benefactors, and it is proposed that the memorial should take the form of a dispensary for the gratuitous treatment of the poor and an increased endowment of the Home for the aged. Many botanists who have visited Bordighera have benefited by Bicknell's knowledge and kindness, and it is thought that there may be some who would like to coöperate in the scheme": contributions should be sent to P. D. Leake, Esq., K 1 The Albany, Piccadilly, London, W.1.

We note with pleasure the greatly improved appearance of the *Transactions of the British Mycological Society* for 1918 (Cambridge University Press, price 10*s.* 6*d.*) for which we think our continued protests have been at least partly responsible. Among the contents may be noted the presidential address of Dr. David Paul, "On the Earlier Study of Fungi in Britain"; notes on some Saprophytic Fungi of Potatoes, by Dr. Pethybridge, with two plates; notes on *Colus Gardneri* (1 plate) by Mr. Petch; New British Fungi, by Miss Wakefield; New or Rare Microfungi by Miss A. L. Smith; a Revision of British Clavariæ, by Mr. A. D. Cotton and Miss Wakefield, with a new species, *C. Broomei*; Some Concepts in Mycology, by Mr. W. B. Brierley; *Mycena epipterygioides*, n. sp. (not localized), by Mr. A. A. Pearson.

The Rev. E. F. Linton has re-issued his *Flora of Bournemouth*, which appeared in 1900, with an appendix containing numerous additional localities and a list of *Rubi* by the Rev. W. Moyle Rogers, as well as one or two additional species, to which we think attention should have been called in the prefatory note. Of these the most interesting is *Lobelia urens* "on a heathy piece of woodland, to which I was conducted by the Rev. C. O. S. Hatton, in Hinton, where we were both of opinion that it was a native station."

Mr. Martin Nijhoff of the Hague announces the publication of the first volume of an *Enumeratio Systematica Fungorum* by the late C. A. J. A. Oudemans († 1906). In the preface, which has been distributed as a circular, the editor, Mr. J. W. Moll, gives an interesting account of the work and of the botanists who have contributed in its production. When completed it will consist of five volumes of about 1200 pages each: the price of each is £3.

Dr. S. H. Vines is retiring from the Professorship of Botany at Oxford at the end of this year.

The attention of our readers is called to the advertisement of the volumes of the Journal which appears on p. 3 of the wrapper of this number.

HISTORICAL REVIEW OF THE FLORIDEÆ.—II.

By A. H. Church, D.Sc.

Taken at their simplest valuation as original autotrophic phytobenthon of the sea, and removed from all academic prejudices with regard to an antithetic alternation of generations, which have obscured the discussion of the origin of the vegetation of the land [1]—the latter, so far as the Florideæ are concerned, being considered as yet non-existent,—this remarkable race expresses an independent line of evolution in the sea from some ancestral stage of encysted plankton-flagellate, attaining somatic and reproductive specialization along its own lines, and meeting the problems of inevitable benthic wastage in its own way, as a race apart from other residual marine phyla; and now narrowly circumscribed, but wholly intelligible by reference to other benthic phyla also found in the sea, which had to meet the same problems though with somewhat different equipment. Haustorial connections and even nuclear migrations, which play so conspicuous a part in the nutrition of the carposporophyte, are but the extension of the secondary pit-connections and nuclear migration observed in somatic organization, though less obvious and more minute [2]—again rendered possible by the special nature of the soft gelatinous polysaccharides of the wall-membranes and the mechanism of the primary 'Floridean-pit.' Cœnocytic decadence of the trophocyte [3] is paralleled by secondary cœnocytic organization in the vegetative soma of distinct generic types [4]. Deterioration of the unilocular sporangium, normally restricted to the production of one meiotic tetrad [5] to a mere monosporangium [6], may be traced in Phæophyceæ, though not becoming such a general feature [7]: while loss of phases in the life-cycle (asexual, as in *Nemalion*, *Scinaia*, *Lemanea*, or sexual, as in *Rhodochorton*, *Rhodymenia palmata*) is again but the familiar indication of the deterioration induced by inferior and limiting environment [8].

The plants are no longer a group of mystery, but are readily intelligible in all their domestic relations, though presenting a wide range of variation in such processes, as also in somatic form and construction. The general working-plan of the life-cycle of the vast majority of the better-differentiated types is based on a three-phase system; involving, that is to say, three successive individuals, or pre-

[1] *Cf.* Bower (1908), *The Origin of a Land-Flora*, p. 163.

[2] Oltmanns (1904), *Algæ*, p. 602: Rosenvinge (1888).

[3] 'Trophocyte,' the ultimate shapeless cœnocytic fusion-mass of zygote and parental plasma.

[4] Cf. *Griffithsia*, *Callithamnion* sp., *Bornetia*, *Monospora*.

[5] *Compsothamnion gracillimum* according to Buffham (1896, p. 189) produces 8 spores, *Pleonosporium* extends to 16–32.

[6] Monosporangia in many *Chantransia*-forms; the 'monospore' of *Monospora* is multinucleate.

[7] Phæophycean monosporangia in *Haplospora*, *Akinetospora*: Oltmanns (1904), *loc. cit.* p. 475.

[8] *Cutleria*, apogamous in the English Channel, is only represented by asexual *Aglazonia* in Northern Seas: *Rhodochorton* is wholly asexual in several species; most *Chantransia*-forms; as also the fresh-water *Thorea*.

ferably *generations*, since the sexual phase itself is commonly represented by male and female persons; two of the generations are asexual, and produce spores which express the output necessitated by the dispersal function, and the amount of wastage to be counterbalanced.

The meaning of 'Alternation of Generations,' when viewed from the locus of the sea and not from the standpoint of transmigrant Land-Flora, is simple and illuminating. The assumption of a sessile benthic state of organism as an improvement on the older phase of suspended plankton, although wholly advantageous in mechanism of nutrition, and leading to the specialization of the efficient algal soma of marine phytobenthon, brings with it the necessity of regression to the active flagellated condition for purposes of the 'sexual' reproduction initiated and established in the antecedent plankton-state. Hence algal phyla produce flagellated zoïd-gametes, some of which conjugate to give a sexually produced zygote; others remaining '*apogamous*,' if so far failures, may nevertheless 'germinate' on attachment to a substratum to give a new individual.

Such production of gametes fulfills two functions:—(1) that of *sexual fusion* as the continuation of an older plankton-phenomenon; (2) that of *dispersal*, a new phenomenon, first necessitated in the benthic state, as a biological function of henceforward supreme significance.

As progressive differentiation of sexual mechanism leads through inevitable stages of heterogamy to oogamy and fertilization *in situ*, following the ultimate failure of the oosphere to be discharged in the open medium, different phyla of algæ may attain different degrees of perfection in this respect. But while such fertilization *in situ* expresses the maximum economy in reducing the wastage of the sexual process, and the successful attachment of the zygote, it leaves the function of dispersal wholly unprovided for. Hence the further differentiation of special individuals devoted to this latter purpose, to be taken on by the 'unilocular sporangium' as an adapted unilocular gametangium now desexed, becomes equally inevitable. All advanced phyla thus tend to differentiate two generations, as the ultimate response to the necessities of two great physiological functions; one secures the sexual act and chances subsequent dispersal, the other secures dispersal and omits the sexual act. What was originally simple differentiation (*Dictyota*) becomes a more exact alternation as soon as fertilization *in situ* is established, since a sexual plant sessile and parasitic on a parent would be absurd; and all phyla of advanced plant-organism present this specialization, apart from any consideration of what may be the state of the nuclear organization, or of alternation of generations for the sake of academic considerations.

The special point of interest of the Florideæ is not so much that they should have attained fertilization *in situ*, a parasitic zygote and a 'sporophyte generation' producing asexual spores, but that they now present a succession of *three* generations, according to the scheme:—

I. Gametophyte, with sexual organs, and spermatogamic fertilization *in situ*: the parasitic zygote becoming a reduced

II. Carposporophyte, bearing reduced unilocular monosporangia, dispersing *diploid* carpospores. The latter germinates to a

III. Tetrasporophyte, as a free autotrophic individual, also producing unilocular sporangia, but these giving rise to one tetrad of 4 spores, associated with meiotic mechanism and dispersing *haploid* tetraspores.

Or, considering these general phenomena in further detail:—

I. The sexual plants (gametophytes) have long attained to the extreme limit of sexual economy and efficiency as expressed by fertilization *in situ*; in the progression to which the flagellated zoïd (antherozoid) has been wholly lost. The contents of the antheridium, reduced to the limiting expression of an immobile 'spermatium' discharged in its endochiton, fuse (spermatogamy) with a specialized hair-attachment process (trichogyne) of the oogonium (carpogonium). Preceding states of heterogamic progression are superseded by post-sexual nutrition, and the gametes are expressed as mere nuclei (a condition otherwise attained by the highest Angiosperms only by very devious routes). The possibility of the initiation of such post-sexual nutrition of the zygote is now seen to depend on the mechanism of the primary pit-connection left open at the base of the young carpogonium, and hence follows legitimately as an opportunist utilization of a factor of ancestral organization.

II. The parasitic zygote thus 'germinating' *in situ*, and nourished by the parent, is necessarily asexual and devoted to the production of asexual spores, since a sexual plant parasitic on a parental sexual organism would be in bad case; but such plants *in catena*, with fertilization *in situ*, would be an impossibility, as destroying the whole idea of the retention of the sexual process. Whether such a second generation is diploid or haploid is purely immaterial (the former is as a matter of fact the rule, since there was no inducement afforded for meiosis at 'germination'), but they must produce freely-shed spores. On the other hand, the extreme decadence of the attached parasitic generation, recognized as a mere tuft of gonimoblasts at the best, is expressed also in the deterioration of the unilocular sporangium (which should have been a tetrasporangium at one time, in the manner of *Dictyota*) to the state of a monosporangium, in which the uninucleated contents are discharged in endochiton as carpospores; meiosis being omitted, or alternatively described as 'delayed.' Hence the second parasitic individual or generation may be conveniently termed the carposporophyte, prevailingly, though by no means necessarily, diploid in its nuclear organization.

III. The free carpospores, being dispersed, take the small chances of immediate germination on attachment to any available substratum, and grow to a free autotrophic soma, in all respects like the first autotrophic individual; vegetating in exactly the same way, and carrying on the nuclear organization of the parent carposporophyte, to produce again unilocular sporangia, this time with fully nourished meiotic mechanism and production of the limiting tetrad of four tetraspores. The latter are in turn freely discharged to the external medium, as haploid immobile units. The third individual is thus conveniently indicated as the tetrasporophyte, and is equally a distinct 'generation' or 'phase' in the life-cycle.

Such haploid spores, on immediate 'germination,' give a haploid soma of normal free and autotrophic organization, which may be sexual and repeat the sequence. But there is no reason at all why, by omitting the sexual organs, it might not produce unilocular sporangia, which being haploid would not require a meiotic division; and hence would not give a tetrad system, but yet 'spores' of sorts for free dispersal. Many decadent Floridean genera are in this position, at the verge of latitudinal or vertical distribution; as also in many cases so-called tetraspores are found freely on the sexual plants[1].

Special interest also attaches to cases in which the tetraspores are wanting, as indicating the failure to produce meiotic sporangia; and the reducing-division has to be effected elsewhere. That the locus of such a process is again wholly subsidiary and secondary is shown by the details now available of cases in which the stages have been followed. Thus in *Scinaia*, according to Svedelius (1915)[2], the zygote divides meiotically to 4 nuclei, one of which is the parent nucleus of the carposporophyte, while the other three are rejected—a method which recalls that of the transmigrant *Spirogyra*[3], and is equally bad business, the expression of deterioration in organization, since there is no compensatory gain. In *Nemalion*, on the other hand, according to Kylin (1916)[4] and Cleland (1919)[5], the zygote nucleus divides, and a septum appears after the meiotic spindle, a feature not known elsewhere[6]; the meiotic tetrad is not completed, and the homotype division of the basal segment does not follow on, or is incomplete (Cleland). Such a variant on the meiotic mechanism can again be only interpreted as evidence of deterioration in the process, and the haploid sporophyte is thus quite a secondary idea in the life-cycle of such forms, by cutting out a whole phase; so far affording an interesting light on the deterioration of this otherwise undoubtedly archaic type, left vestigial in Northern Seas, in which again monœcism and autogamy are the normal rule for the sexual plants[7].

The clue to all peculiar behaviour on the part of the zygote and young carposporophyte, in its relations to auxiliary cells, is seen in its practically holoparasitic habit; the idea being to pass as quickly as possible to the nearest source of available food-supply (commonly and most efficiently to the subtending cell of the carpogonial branch,

[1] In *Gracilaria confervoides* tetraspores, antheridia, carpogonial branches, and cystocarps may all occur on the same individual. 'Tetraspores' on sexual plants are frequent in several species of *Polysiphonia*; *cf.* Yamanouchi, Bot. Gaz. (1906), p. 435. The cytology of these organs is so far unrecorded.

[2] Svedelius (1915), *Nova Acta*, *Upsala*, iv. p. 1.

[3] Tröndle (1911), Zeitsch. für Bot. iii. p. 593.

[4] Kylin (1916), *Berichte*, xxxiv. p. 257.

[5] Cleland (1919), Annals Bot. p. 323.

[6] C. Allen (1905), *Berichte*, xxiii. p. 289, describes the full homotype divisions in the first divisions of the zygote nucleus of the vestigial rather than incipient sporophyte individual of *Coleochæte*.

[7] Kylin (1916), *loc. cit.* p. 259, gives *Nemalion* as diœcious; but the precocious production of antheridia is usual for small plants.

on which the curved carpogonial ramulus is reflexed in orientating it to point the trichogyne to the exterior), as draining the food-supply of the parent by taking possession of the cytoplasm of a weaker vegetative cell in the path of conduction, and replacing the original nucleus by an active one sexually produced[1]. This again is rendered possible by the mechanism of secondary pit-connection, dependent in turn on the peculiarly soft penetrable wall-membranes. It is the blind adhesion to conceptions of 'impenetrable,' 'rigid,' cellulose envelopes, based on the study of the xerophytic land-flora, that has hindered perception in dealing with the simpler polysaccharide membranes of early marine phytobenthon; and more than any other group the Florideæ present the negation of older misconceived and traditional cell-theory.

Probably the clearest view to be taken of the Florideæ, as they exist at the present time, is that of a multitude of, so far as they can be traced, quite distinct phyla[2], as the survivors of a specialized and narrowly circumscribed race of Marine Algæ, the origin of which is beyond recall; all the living representatives (300 genera) are on a closely comparable physiological plane, and are alike in the attainment of an advanced limiting phase of reproductive mechanism, with a practically constant limiting type of antheridium, oogonium, and unilocular sporangium (as tetrasporangium): all present the same secondary supersession of flagellated heterogamy, with consequent attached, parasitic, and hence vegetatively decadent carposporophyte, the more so as the latter is immersed in the parental tissues. On the other hand, the phyla diverge widely (1) in respect of types of somatic construction and organization, in correlation with factors of mechanical tenacity, the relative amount of surface-exposure for absorption from the nutrient medium, and utilization of the available light-supply, according to their habitat in the different biological stations of the sea; but all tending to more quiet water, and taking the chances of depth and diminished light in order to secure it: also (2) with regard to their internal economy, becoming more specialized in relation to the *new stimulus* of the parasitic carposporophyte, which is a drain on the system—and requires to be *nourished* and *protected* as it becomes less and less able to continue as a mechanically efficient, autotrophic, individual. Ultimately the latter reduces to the status of a mere reproductive organ (of sporangium-habit), and a mechanism for the *emission* of the free carpospores may be added to the parental tissues.

It is obvious that the phases of haustorial connection, progressively more intimate and devastating in their relation to the parental thallus they drain, constitute but one aspect of the question. The production

[1] Oltmanns (1898), Bot. Zeit. p. 114, for *Callithamnion* and *Dudresnaya purpurifera*; Algæ (1904), pp. 689–700.

[2] For example, the Nemalionales of Schmitz, as including all types with no specially fore-shadowed auxiliary cell, or with none at all, are merely a non-descript collection of vestigial lines, which in somatic organization have no connection whatever with each other, and the brilliant generalization which groups them by the physiological factor of zygote-nutrition, merely expresses convergence in this particular respect: cf. *Nemalion*, *Batrachospermum*, *Chantransia*, *Lemanea*, *Thorea*, *Scinaia*, *Dermonema*, *Galaxaura*, etc.

of a cystocarpic *wall*, without or with the differentiation of an *ostiole* after fertilization, passing on to the initiation of these structures before fertilization (in the special case of the *ceramidium*), represents a sequence of morphological specialization of a significance fully equal to that of the parasitic connection by secondary-pits and nuclear migration, as new departures in the race. A true phylogenetic classification should thus combine—(1) the 'auxiliary cell' standpoint of Schmitz, with (2) the special features of thallus-organization, and (3) adult cystocarp-differentiation, more clearly recognized as significant by the intuition of the older algologists (Harvey). And though it may be convenient temporarily to attach an exaggerated significance to one special line at one time more than to another, just because it is obscure and hence less known (as in more recent years cytological problems have been regarded as the *sine qua non*), phylogeny takes count of all paths of progress.

Apart from the 'general equipment' of the Florideæ as a race, the 'special lines' are for practical purposes thus reduced to *three*; it may be pointed out that these do not necessarily run concurrently; though in the more primitive types (Helminthocladieæ) all are simple, and in the higher types (Eu-Florideæ) all are extremely elaborate (cf. *Polysiphonia*). The three factors in order of time may be defined as:—

I. The evolution of the autotrophic vegetative soma, with differentiated members and tissues of special function, particularly in the form of corticated axial-filament types with segmenting apical cells and precise differentiation of lateral ramuli.

II. The germination of the zygote *in situ*, and its parasitic attachment to the adjacent parental tissues as a drain on the paths of conduction.

III. The structural response of the gametophyte to the stimulus of the parasitic carposporophyte.

The variations expressed by the different combinations of phases involving these factors[1] constitute the special charm of the Florideæ as a class, far in advance of anything remotely suggested by the more dominant phytobenthon of the Phæophyceæ of Northern Seas, as expressed more particularly by the familiar Fucoids and Laminarians of our own shores; this being in turn but the expression of the fact that the Florideæ are pre-eminently tropical in distribution and origin, as denizens of the reef-pools of warmer seas; comparatively few reach northern waters, and these are often the last much-enduring relics of a warmer geological epoch.

Thus while Boswarva's admittedly imperfect list for Plymouth Sound[2], before steamer traffic had fouled the water, extends to 147 species, the Færoe list at the northern limit of British distribution gives only 75 species; and in the Arctic Sea, according to Kjellman, Spitzbergen, which feels the last influence of the Gulf-stream, can show 47 species, and the Siberian seas only 11.

[1] When the respective value of these three factors can be determined, it will be time to re-arrange the admittedly wholly provisional present classification.

[2] Boswarva (1887), Journal M. B. A. i. p. 153; Börgesen (1903), *Botany of the Færoes*, pp. 350, 403; Kjellman (1883), *Algæ of the Arctic Sea*, p. 72.

THE GENUS EUPHRASIA AND E. MINIMA.

By H. Stuart Thompson, F.L.S.

There is an interesting and apparently overlooked reference to, and short description of, *Euphrasia minima* by the late John Ball, F.R.S., in his paper "On Descriptions of some new Species, Subspecies, and Varieties of Plants collected in Morocco by J. D. Hooker, G. Maw, and J. Ball," in Journ. Bot. vol. xi. (1873) p. 272. This paper does not appear to have been quoted by Townsend, Hiern, Marshall, Bucknall, Pugsley, nor any other writer on *Euphrasia* in this Journal.

Mr. Hiern pointed out (*l. c.* 1909, p. 165) that Townsend in Journ. Bot. 1884, p. 161, discussed at considerable length the question whether *Euphrasia officinalis* L. represents a single polymorphic species or a collective species; and at that time Townsend expressed the belief that all the European forms with which he was then acquainted "are members of a single polymorphic species, and that none of these members can be ranked as of a higher grade than a subspecies." This opinion, of course, he afterwards modified, as mentioned by Mr. Hiern. But Townsend did quote in this paper on *Euphrasia officinalis* (l. c.) some remarks in a letter from John Ball in which Ball said that a study of the forms should be connected with that of the insect-visitors.

Writing in this Journal (1873, 271) Ball expressed very similar views to Townsend's, when the former was illustrating his ideas of species, subspecies, and varieties, for he said: "In our islands the forms included under this name [*Euphrasia officinalis*] differ so slightly, that, as I believe, no botanist has proposed to designate them by distinct specific names, but on the continent of Europe . . . . we find a large number of such forms presenting wide differences of shape and aspect. The floral organs, indeed, vary little except in size, but the leaves are so dissimilar that if only a few be selected for comparison most botanists would at once refer them to different species." He then proceeded to speak of *E. salisburgensis*, and remarked that "The careful observer will, however, find that all the differences which mark these so-called species are no more than exaggerations of the slighter variations which the common plant everywhere exhibits, and further that the groups of forms belonging to one region do not exactly correspond with those inhabiting a different region of the same continent." After a reference to Jordan, Ball adds that "most botanists would rank the remainder as undoubted varieties of *E. officinalis*," and he proceeds:—

"There is one among the forms closely allied to our common Euphrasy which shows differences more marked and more constant than the others. This is the *E. minima* of Schleicher, a plant inhabiting the higher regions of the Alps, Pyrenees, and Carpathians, distinguished by its dwarf stature, very small, usually yellow flowers, and shortly oval crenate leaves, much smaller than in any other plant of the same group. The mere fact of the presence of this form on several widely dissevered mountain masses, while it is absent from the intervening country, is strong evidence of its high antiquity; while a comparison between it and several of the forms that we refer to *E. officinalis* leaves little doubt that it is related to the latter by generic descent. This I am inclined to cite as a typical instance of a subspecies."

In Ball's "Distribution of Plants on the South Side of the Alps" (Trans. Linn. Soc. vol. v. pt. 4, 1896, p. 119) *Euphrasia minima* figures from 41 out of 50 districts (chiefly Italian) on the south side of the Alps, and from six or seven of the ten other mountain ranges of Europe dealt with, viz. French Alps, Swiss Alps, German Alps, Illyrian Alps (Neapolitan Apennines?), Pyrenees, and Carpathians.

In Jaccard's *Catalogue de la Flore Valaisanne*, Zürich, 1895, another excellent work in the hands of few British botanists (hence these transcriptions) we find, on p. 281, under *Euphrasia minima* Jacq., "Pâturages secs, répandu dans tout le pays [*i. e.* Canton Valais] 1200–3000 m. Cette espèce très variable se rencontre sur tous les terrains sous différentes formes et présente une grande extension verticale." The Gornergrat above Zermatt, 3000 metres (*fide* Heer) is Jaccard's highest altitude, and he says the variety *bicolor* is the most frequent. Variety *minor* Jord., is only the reduced form of high stations or of poor soils. The variety *flava* appears to him peculiar to the crystalline rocks, and is abundant on the pastures of Conches and at Gletsch (near the source of the Rhone). Variety *pallida* he records from the Col de l'Evêque, 3000 m., and from the Riffel and Gletsch. Vaccari gives 3100 m. as the highest limit for *E. minima* and its varieties and forms *minor*, *bicolor*, and *flava* on the Monte Rosa massif (see *La Flora Nivale del Monte Rosa*, Aosta, 1911).

When studying the altitudinal limits of Alpine plants in the Western Alps during the summer and autumn of 1907 I observed (Bull. Acad. Géograph. Bot. 1908, pp. 195–248) that *Euphrasia minima* was one of the seventy plants with the greatest vertical range of distribution, though I do not appear to have seen it higher than 2684 m.=8800 ft. (Col Giaset near Mont Cenis) nor lower than about 1000 metres. My *Euphrasiæ* of that year were determined by Wettstein, Chabert, and Bucknall. *E. salisburgensis* and an autumnal form of *E. Bicknelli* Wetts. were both collected at a higher elevation than *minima*, viz. at 2745 m. or 9000 ft. on the Aiguille du Goléon in Dauphiné.

After ten years' scepticism on the subject of *E. minima* in Britain (largely because it is chiefly a plant of hot dry mountain slopes on the Continent, and has not the leaves and much branching of the Exmoor plant), I still believe with Pugsley that what he appropriately calls *Euphrasia confusa* cannot be regarded as conspecific with *E. minima* Jacq. But further research into the literature of the subject has shown me how much is to be learnt from the polymorphic genus *Euphrasia* in regard to plant evolution and distribution, including the marked differences in forms gathered in Britain and on the Continent of Europe; and not only between plants of separate ranges of mountains but of neighbouring valleys; as well as about the interesting question of æstival and autumnal forms of this and some allied genera in the family Scrophulariaceæ. If the vexed and unimportant question of specific rank were the only *raison d'être* of the study of these critical plants, I, for one, would regret the time so many have devoted to it. But such investigation is elucidating other and more interesting matters, bearing not only upon the life-history of the plants as known to-day but upon their evolution in different climes and on different rocks, and upon their differences in different countries, the summer and autumn states of some, and the varying degrees of parasiticism of others. Nor let us forget to follow up the suggestion of that great naturalist and traveller John Ball, when, in writing to F. Townsend in 1884, he drew attention to the part insect-visitors may play.

As far as we are aware, no seeds of *Euphrasia* have been found in the late Glacial beds of Britain; but Clement Reid records seeds of the allied *Bartsia Odontites* from the Clyde Beds at Garvel Park (*The Origin of the British Flora*, 1899, p. 135), a most helpful book now out of print, and I am told much in demand.

The distinguishing features of *Euphrasia*, *Odontites*, *Bartsia*, *Eufragia*, and of his new genus *Dispermotheca* were very ably stated and clearly illustrated (fig. 7) by Beauverd in his paper "Plantes Nouvelles ou Critiques de la Flore du Bassin du Rhone," in Bull. Soc. Bot. de Genève, vol. iii. (1911), pp. 297–337.

In addition to the coloured figures of *Euphrasia minima* in Schroeter's *Flore des Alpes* and in my *Sub-Alpine Plants*, there is a clearer one in the well-illustrated *Atlas colorée de la Flore Alpine*, by Beauverie et Faucheron, Paris, 1906.

THE CRYPTOGAMS OF ANDREWS'S HERBARIUM.

By G. S. Boulger, F.L.S.

The following list is supplementary to the enumeration of the phanerogams of Andrews's Herbarium which was published in last year's *Journal*, pp. 294–8, 323–331, 346–354.

Cystopteris fragilis Bernhardi. R. S. 3. 125. 7. In the road from Mendip hills to Wells, June, 1731. [Dale's ticket.]

Mosses.

Among the Mosses, which have been examined by Mr. Gepp, are the following: all are from Essex unless otherwise noted:—

Sphagnum cymbifolium Ehrh. Bogs at the foot of Link hills, Maplestead, June 1744.

S. subsecundum Nees. An *Muscus palustris albicans terrestris capitulis erectis brevibus*. R. S. 2. 37. 4; 3. 104. 1. [Same locality: 11 July, 1746.]

Polytrichum juniperinum Willd. Little Cornard Church [Suffolk] and Brake hill, Bulmur, April 18, 1746.

P. commune L. Link hills, Maplestead, May 27, 1746.

Funaria hygrometrica Sibth. Ballindon hills, Jan. 28, 1740.

Philonotis fontana Brid. Bogs at foot of Link hills, Maplestead, May 27, 1746.

Bryum capillare L. On the bank upon the top of Brake Moore hill, Middleton, May 30, 1746.

Mnium undulatum L. "Bryum serpyllifolium." Link hills, Maplestead, 11 July, 1746; Ball Street, Stoke near Nayland, with the *Trichomanes*. April 21, 1746. [Suffolk.]

M. hornum L. Moist bank next John Stebings field by Sandy Lane, Bulmur, Feb. 4, 1740, April 5, 1745, and April 10, 1746.

Hypnum aduncum Hedw. var. Upon the Water in a little pond in a wood between Willmore Lane and Gentries. July 11, 1746. [County?]

H. fluitans L. Boggy place in the lane from Lamask Brook farm to Alphamston Church, April 22, 1746, and Armsey, Bulmur, July, 1752.

Hylocomium triquetrum B. & S. Ballingdon Hills. Jan. 28, 1742.

Hepaticæ.

Pellia epiphylla Nees. *An* 4 *Lichen petræus cauliculo calceato* C. B., R. S. 3. 110. The taste is hot and burning. Found in the gripes by the side of the hill where the lodge stands in the Boys hall park. April. Sandy Lane, Bulmur & Crow bridge, Barfield Bridge, Brundon Mill. 18 April, 1745. ["Broad-leaved Star-lip." Hemsted.]

Lunularia vulgaris Mich. *Lichen seu Hepatica lunulata ἐπιφυλλόκαρπος* D. Dale, R. Syn. i. 20; ii. 41; iii. 115, 5. I received it from Mr. Dale, March, 1716.

Marchantia polymorpha L. 5. *Lichen petræus stellatus* R. S. 3. 115. *An* 88 *Lichenoides peltatum terrestre rufescens* R. S. 3. 77. In my garden, 18 June, 1745, & In Counsellor Theobald's Yard and in the Vestry yard, St. Gregories Church & In Mr. John Burkitt's Yard. In a Boggy pasture Meadow behind Box Mill, Halstead, 9 July, 1745, plentifully. Amongst the Grass & is often covered with water when the river is full. As soon as you are out of Henny Street towards Middleton in Essex . . . . with the Lentibularia [*Utricularia*] 26 June, 1740. [The first Rayan name, applied to the garden specimens, is probably erroneous, and refers rather to *Lunularia*.]

Fegatella conica Corda. 4. *Lichen petræus latifolius sive Hepatica fontana*. R. S. 3. 115. *Lichen sive Hepatica vulgaris* Park. R. S. 40. *An Lichen petræus pileatus* Park. *Lichen verrucosus* Doody, R. S. 3. 114. 1. On the north side of Milford hall, 28 June, 1745. In Chappel Lane, Cornard, 25 April, 1745. This I call the Lichen offic. In the watery lane between Lossins Mill and Corks farm, with Saxifraga aurea, both sorts [*Chrysosplenium*], Lujula [*Oxalis*], Nasturtium aq. amar. [*Cardamine amara*], Cardamine impatiens altera hirsutior [*C. hirsuta*], Veronica-Chamædryoides fol. pediculis [*V. montana*].

Reboulia hemisphærica Raddi. 2. *Lichen pileatus parvus, foliis crenatis* R. S. 3. 114. Great Cornard, 2 April, 1745. On a drie bank in Bull St., Stoke near Nayland, plentifully, 21 April,

1746. Lane from Nayland to Heney Tye. [Dillenius attributes the discovery of this species to Andrews. He says "Found by Mr. Andrews of Sudbury in Suffolk, sent by Mr. Dale," though he identifies it with a specimen, *Lichen petræus cauliculo pileum pavum sustinente* in Buddle's Hortus Siccus, vol. ii, 13, and mentions its having been observed by Dandridge, "the pattern-drawer in Moorfields" (fl. 1723–30).]

ANTHOCEROS PUNCTATUS L. *Lichenastrum* gramineo pediculo & capitulo oblongo, bifurco. R. S. 3. 109. 1. Bulmur. July, 1725 and 1739. Ditch at foot of Link hills, Maplestead, July, 1746.

ALGÆ.

HALIDRYS SILIQUOSA Lyngb. "Codded Sea Lintels." "Podded Oar-weed." [One of the set of "Curious Sea Plants" collected by W. Paine between Yarmouth and Lynn. They are not further localised and will here have merely the name "Paine" following each.] R. S. 3. 48. 39, where Dale's record of the species from Harwich is quoted from Ray's Hist. Plant. iii. 11.

FUCUS VESICULOSUS L. By the Thorn near Manningtree, 12 May, 1740. Mersey Island. An 4. *Quercus marina varietas* Ger. em. 1567, R. S. 3. 40.

F. CERANOIDES L. *An* 16 *Fucus membranaceus ceranoides varie dissectus* R. S. 3. 44. Bucks Horn Wrack. Paine.

F. SERRATUS L. Mersey Island.

F. NODOSUS L. Paine.

PELVETIA CANALICULATA Dcne & Thuret. Paine.

LAMINARIA SACCHARINA L. *An* 31 *Fucus arboreus polyschides edulis.* R. S. 3. 46. Paine.

CLADOSTEPHUS VERTICILLATUS Lyngb. "Fine Wrack." Paine.

C. SPONGIOSUS Ag. "Black grassy Wrack." R. S. 3. 46. 27, Paine.

CERAMIUM RUBRUM Ag. Paine.

FURCELLARIA FASTIGIATA Grev. "Sea Fenill." Paine.

CHONDRUS CRISPUS Lx. "Wrack." Paine.

GRACILARIA CONFERVOIDES Grev. *An* 26 *Fucus trichoides nostras aurei coloris ramulorum apicibus furcatis.* R. S. 3. 45.

PLOCAMIUM COCCINEUM Lyngb. Paine.

CORALLINA OFFICINALIS L. R. S. 3. 33. 1. Paine.

JANIA RUBENS Lx. Paine.

ODONTHALIA DENTATA Lyngb. *Fucus dentatus* With. III. 248. Gathered on the shore at Leith by my brother Fenwick. Mr. Skrimshire 1796. [A Hemsted addition.]

RHODOMELA LYCOPODIOIDES Ag. "Grassy Wrack." Paine.

POLYSIPHONIA NIGRESCENS Grev. "Tall silke oare." Paine.

DASYA COCCINEA Ag. Paine.

CLADOPHORA RUPESTRIS Kg. "Grassy silk oars." Paine.

LICHENS.

PELTIGERA CANINA Hoffm. 87. *An Lichenoides peltatum terrestre cinereum majus foliis divisis* R. S. 3. 76. *Lichen terrestris cinereus* R. S. 2. 23. I gathered this in Collidge Wood Middleton amongst the moss on the tops of the stubs, 24 November, 1741. Brakemore hill, Middleton, 1746. From off the thatch of the Blacksmith's shop in Foxearth Street, 30 Jan. 1746. Great Cornard. 3 April, 1746.

P. POLYDACTYLA Hoffm. Cornard mere. 27 July, 1739.

STICTA PULMONACEA Ach. Oak Lungs. New Forest, Hampshire. W. Paine.

S. SCROBICULATA Ach. 86. *An Lichenoides peltatum arboreum* R. S. 3. 76. Upon the thatch of Ned Parmenters shed Ballingdon Brickkill, where they set the white ware. 24 November, 1741. I never gathered it elsewhere.

FUNGI.

GEOPYXIS COCCINEA Massee. R. S. 3. 18. 5. On rotten stick. Jan. 1729, Feb. 1752.

GEASTER RUFESCENS Pers. ? *An Fungus pulverulentus coli instar perforatus cum volva stellata* Doody. R. S. 3. 28. 12. Between Ballingdon and Sudbury.

[LYCOPERDON COLIFORME. "Cullander Puff-ball, Hemsted.]

AURICULARIA MESENTERICA Fries. On a piece of Elm at Middelton. 23 Jan. 1740.

MERULIUS LACRYMANS Fries. Rotten joysts in Humphry's workeshop, Sudbury. 27 July, 1753.

ARMILLARIA MELLEA Vahl. (rhizomorph). *Clavaria hypoxylon.* This odd Plant grows frequently to the Planks and Timbers that cover wells & to the Pump Trees in Sudbury, Suffolk. This I had from Mr. Stephen Oliver's Junr. May 28, 1745.

An 6 *Spongia ramosa fluviatilis.* R. S. 3. 30. It grows to the . . . . old stone Bridge and to the . . . . wooden Piles in Ballingdon River. alwaies covered. 1 July, 1740. [The freshwater Sponges, which, until quite recently, were looked upon as plants, are very abundant in the north of Essex.]

NOTE ON CENTAUREA.

BY C. E. BRITTON.

IN part 2 of the *Prodromus Floræ Britannicæ* (Nov. 1901), after dealing with the forms of *Centaurea Jacea* L. in a manner never before attempted by any native botanist, Mr. F. N. Williams remarked that "the critical study of the British Knapweeds has still to be undertaken." Although many years have elapsed since this was written, very little attention has in the meantime been given to *Centaurea* by our critical botanists, and Babington's arrangement of the forms seems still to mark the limits of their study. Mr. Williams's survey was chiefly notable for the transference of *C. nigra* var. *decipiens* of British collectors to *C. Jacea* as a variety (*C. Jacea* var. *nigrescens* Wild. & Dur.). In associating "var. *decipiens*" with *C. Jacea* rather than with *C. nigra*, I believe that Mr. Williams expresses the natural affinity of the plant, though I am unable to agree with his subordination of it to *C. Jacea* as a variety.

At present, it would seem that a good deal of field work is necessary before an approximately accurate knowledge of the various forms of *Centaurea* can be obtained and their distribution worked out. Botanists who have the opportunity could render important service in investigating whether or not *C. Jacea* is an aboriginal species in the various localities from which it has been recorded. All specimens of alleged *C. Jacea* require very careful examination, as it appears certain that allied forms have been erroneously recorded under this name. I here particularly refer to Sussex specimens of *C. Jacea*, various examples so named having recently passed through my hands. Equally important, perhaps, is an enquiry into the plants recorded by British botanists as *C. nigra* var. *decipiens*, as forms nearer related to *C. Jacea*, and even *C. Jacea* itself, have been recorded under this name.

It may be thought impossible that *C. Jacea* could pass as *C. nigra* var. *decipiens*, but the following shows that it has done so. In Mr. H. W. Monckton's compact little *Flora of the Bagshot District* (noticed in this Journal for 1916, p. 94), *C. nigra* var. *decipiens* (Thuill.) is recorded from the Upper Bagshot sands of Wellington College, Berkshire. Mr. C. E. Salmon has in his herbarium a sheet of Mr. Monckton's plant, which I have seen. These specimens are not what usually pass with British botanists as *nigra* var. *decipiens*, nor do they agree with French conceptions of Thuillier's plant. Hearing of my interest in the matter, Mr. Monckton kindly sent me a few dried specimens bearing the same name and from the identical locality, with a note saying that "this form grows in considerable abundance at Wellington College on the Bagshot Sand; it is most abundant on the Upper Bagshot Sand but spreads on to the sandy upper part of the Middle Bagshot Sand as well." To my surprise, the examples that reached me were unmistakable *C. Jacea* L. During the past summer I have received fresh flowering specimens from Mr. Monckton, who has kindly given me much information about the present and past conditions of the locality. Referring to the specimens sent to me, Mr. Monckton wrote "they are what I meant by *C. nigra* var. *decipiens* in my *Flora of the Bagshot District*. They occur in a limited area here, say, in the square mile between Crowthorne Church and the South-Eastern Railway in the eastern corner of Berkshire. At the present they are in flower by the hundred or perhaps by the thousand. The ordinary *C. nigra* is also present and is frequent all around here, both on the Bagshot Sand and on London Clay, but I only find the species of which I sent you specimens on Bagshot Sand and at the particular place above mentioned. I see *C. nigra* b. *decipiens* is mentioned in the Sixth Annual Report of the Wellington College Natural Science Society published in 1876; it may occur in earlier Reports, but I have not such at hand."

As the *Centaurea* was so abundant, and no doubt was expressed as to its status as a British plant, I visited the locality to observe under what conditions it occurred. The plants grow chiefly along the border of a road, among turf, etc., for a distance of about half a mile. The road is bounded at intervals by strips of turf of varying extent, but chiefly by shrubs and undergrowth of the heath-formations; the Centaureas are found with the grass, and also plentifully among the undergrowth, such as young birch and oak, sallows, *Erica cinerea*, *Calluna vulgaris*, *Cytisus scoparius*, Rubi, young *Pinus sylvestris*: beyond is a background of *Pinus sylvestris* and *Cedrus Deodara*. The Centaureas occurring under these conditions gave me the impression of being intrusive species, naturalised but decidedly not aboriginal. *Centaurea Jacea*, very variable as to bracts and as to whether the heads are radiant or not, is abundant, the var. *longifolia* Schultz-Bip. being well represented. Here are also a number of puzzling allied forms very similar to others found in Surrey, where I am disposed to consider them native. The most notable of these allies was *C. pratensis* Thuill. Under other conditions I would readily accept this as native, as it is a well-distributed British plant, ranging from Kent to Perth, and represented in herbaria under such names as *C. nigra* var. *pallens* Koch; *C. nigra* var. *decipiens* (Thuill.) of British authors (Syme, etc.); it comprises most of the plants referred by Mr. Williams to *C. nigra* var. *rivularis*.

As to the source of introduction of these plants at the Berkshire locality, the adjoining playing-fields probably offer the solution, as whilst the ground devoted to the summer games was well mown and rolled, the football ground was covered with a thick growth of flowering and seeding Centaureas of various kinds. Grass-formations do not naturally occur on the dry Bagshot Sands, and the playing-fields have no doubt been formed by the laying down of turf or by the sowing of grass-seed, the Centaureas being present in the turf or the fruits being mixed with the grass-seed.

RUBIACEÆ BATESIANÆ.—II.

By H. F. Wernham.

(Continued from p. 283.)

Tarenna eketensis Wernham in Journ. Bot. lii. 4 (1914).

No. 1410. "Vine, forest. Flowers white."

This species has been represented hitherto only by the original type, discovered by the Talbots in the Eket district of Nigeria in 1913.

Gardenia nigrificans, sp. nov.

Arbor parva nisi corolla omnino glabra, ramulis gracilibus. *Folia* anguste elliptica utrinque acuminata apice ipso obtusa, basi acuta *petiolo* brevi; *venæ* primariæ subtus prominentes laterales perpaucæ (utrinque 3–4); *stipulæ* parvæ triangulares inconspicuæ acutissimæ. *Flores* inter maximos sessiles axillares solitarii. *Calyx* spathaceus glaber conspicuus uno latere fere ad basin fissus insuper in lobis 5 linearibus longiusculis divisus apice subacutis. *Corollæ* tubus elongatus insuper leniter infundibulariter ampliatus extus minute sericeo-tomentosus insuper sparsius, lobi 5 adscendentes pro rata breves ovato-triangulares acuminati acutissimi glabrati. *Antheræ* longe tenui-lineares quisque brevissime e corolla exsertæ.

No. 1291. "A small tree, forest. Name—*abentek.* Corolla greenish-white. Juice of fruit used to stain black."

Allied to *G. spathicalyx* (see p. 280), but differs conspicuously in the shape and venation of the leaves, and in the completely glabrous character of all its parts, excepting the corolla, which is much larger in our species.

Leaves 11–14 cm. × 2·5–3·5 cm., with *petiole* usually barely 5 mm., sometimes 1 cm., long. *Calyx* 6 cm. or even longer, of which the lobes take about 2 cm. *Corolla*-tube about 15 cm. long, measured from its exsertion from tube of calyx, 3·5–4 cm. wide at mouth; lobes 3·3 cm. long and 1·5 cm. broad at base. *Anthers* over 2 cm. long.

Oxyanthus Leptactina, sp. nov.

Frutex alte scandens, ramulis gracillimis nisi nonnunquam minutissime pulverulo-pubescentibus glabratis. *Folia* pro genere minuscula papyracea elliptica acuminata apice vix acuta, basi acuta *petiolo* graciliusculo, utrinque nisi venarum in axillis lateralium (utrinque 5–6) primarium cum mediana minute tamen manifeste barbellata glabra; *stipulæ* glabratæ anguste triangulares longe acuminatæ apice acutissimæ sæpius subsetaceæ. *Flores* in umbellis pedunculatis trifloris dispositi superioribus in axillis; pedunculi cum pedicellis brevibus glabri; *bracteolæ* 2 pedicelli in apice insertæ caducæ lanceolatæ basin versus scaphoideæ acuminatissimæ valde acutæ apice subsetosæ. *Ovarium* subcampanulatum appresse griseo-pubescens; *calycis* tubus brevissimus, dentes lineares valde acuminato-acuti elongati. *Corollæ* tubus pro genere validiusculus extus infra sparsissime pilosus insuper inconspicue necnon breviter sericeus; lobi lanceolati acuminati acuti.

No. 1326. "Climbing high, forest. Corolla white, glabrate."

Allied to the Liberian *O. tenuis* Stapf, from which it may be readily distinguished by its much longer leaf-stalks and calyx-teeth, and the relatively much shorter corolla-tube.

Leaves 8–12 cm. × 4–5 cm.; stalk from 1·5–2·5 cm. or longer; *stipules* 6 mm. long, 2·5 mm. broad at base. *Peduncle* barely 2 cm., *pedicels* rarely over 5 mm. long; *bracteoles* 4–5 mm. long. *Ovary* 3–7 mm. high, tube of *calyx* barely 1 mm., lobes over 1 cm. long. *Corolla*-tube nearly 7 cm. long, lobes about 3 cm. × 5–6 mm.

Atractogyne Batesii, sp. nov.

Frutex scandens ramulis gracilibus striatis glabris; *folia* majuscula firme chartacea glabra ovata breviter acuminata apice vix acuta potius obtusiuscula, basi cordata *petiolo* validiusculo pro rata longiusculo, *venæ* primariæ laterales utrinque 6–9 prominulæ; *stipulæ* in vaginam brevem cohærentes latam apiculo centrali brevi onustam. *Flores* in cymis abbreviatis dispositi 5–6-floris.

Calyx hemisphærico-campanulatus minute pubescens obscure brevissime dentatus; *corolla* anguste campanulata lobis deflexis brevissimis late deltoideis obtusis. *Antheræ* rectæ lineares basi alte sagittatæ furcis obtusis, filamentis brevibus necnon manifestis. *Stylus* claviformis obtusus. *Fructus* angustissime linearis utrinque attenuatus, subteres insigniter costulatus calyce persistente coronatus, bilocularis seminibus irregulariter angulatis.

No. 1217. Readily distinguished from the only other species known, *A. Gabonii*, by the shape and venation of the *leaves*. These measure 10–17 cm. × 6–10 cm., with *petiole* up to 5 cm. or longer; sheath of *stipule* nearly 5 mm. deep, the acumen about the same height. *Calyx* barely 1 mm. in depth; *corolla* 10–15 mm. long, 6–7 mm. broad at the mouth. *Anthers* 5 mm. long; filaments barely 1 mm. long. *Fruit* 10 cm. long, barely ·5 cm. in diameter.

Pavetta antennifera, sp. nov.

Frutex erectus caule gracili orgyalis ramulis mox cortice minute pubescente nec dense indutis graciliusculis. *Folia* magna papyracea elliptica vix acuminata apice subacuta, basi acuta in *petiolum* longiusculum pubescentem desinentia. *Flores* in cymis axillaribus dispositi trichotomis multifloris minute tomentosis folia nec excedentibus, *bracteis* exiguis v. obsoletis; *pedunculo* validiusculo pubescente, *pedicellis* similiter indutis brevissimis. *Calycis* minuti tubus sericeus nigricans exiguus, lobi elongati setaceo-subulati rufo-pilosi. *Corollæ* tubus graciliusculus pro rata brevis, extus glabratus tubularis insuper nec ampliatus, lobi patentes oblanceolati mucronato-acuminati glabri. *Antheræ* lineares conspicuæ exsertæ; *stylus* longissime exsertus, valde conspicuus.

No. 1422. "Shrub with slender stem 6 feet long. Ekotôk, lately forest. Flowers white."

Related undoubtedly to the Angolan *P. angolensis* Hiern, from which this species may be readily distinguished by the shape and venation of the *leaves*. These measure about 20 cm. × 10 cm., with 12–14 pairs of primary lateral *veins*. Primary *peduncle* (measured from leaf-axil to first trichotomous branching) about 2 cm.; secondary peduncles, 6–7 mm. *Pedicel* and ovary together, 3–4 mm. long. *Calyx*-lobes 12 mm. or longer. *Corolla*-tube 2–2·5 cm. long, lobes 10 mm. × 3 mm. broad in upper half. *Anthers* 7–8 mm. long. *Style* exserted ±5 cm.

Coffea jasminoides Welwitsch ex Hiern in Trans. Linn. Soc. ser. ii. i. 175 (1876); Hiern, Cat. Welw. Afr. Pl. ii. 490.

No. 1313. "Vine, stem creeping on ground, forest. Corolla white, tinged with purple in throat."

This species, readily distinguished by its precocious flowers, which fall before the leaves appear, and the glumaceous bracts, has been recorded from Angola and Nigeria, but not hitherto, apparently, from the Cameroons.

Rutidea. This genus, by no means a large one, is represented in this collection by three new species:—

Rutidea Batesii, sp. nov.

Frutex volubilis ramulis gracilibus dense necnon brevissime rufo-tomentosis. *Folia* pergamaceo-coriacea elliptica vix acuminata apice rotundata basi brevissime manifeste tamen cordata, *petiolo* qua ramula induto brevissimo, validiusculo, supra glaberrima subnitentia, subtus ubique densissime in venis molliter necnon minutissime rufo-tomentosa; *venæ* primariæ laterales utrinque ±6 subtus prominulæ supra valde impressæ; *stipulæ* e basi anguste triangulari subulatæ integræ. *Flores* parvi in capitulis 3–4-floris breviter pedunculatis dispositi; *capitula* pyramidali in thyrso amplo disposita laxo terminali, ramulis rufo-tomentosis; *bracteæ* stipulis similes nisi angustiores. *Calyx* densissime minute sericeo-strigosus; *corollæ* inter minimas tubus gracilis insuper paullo ampliatus basi breviter glaber insuper griseo-tomentosus, limbi diametrum subæquans, lobi late ovati vix acuminati; *antheræ* ellipsoideæ conspicue nec longe exsertæ.

No. 1353. "Vine, forest."

Allied to *R. olenotricha* Hiern, from which it differs especially in the relative lengths of corolla-tube and limb-diameter, and in the leaf-apex.

Leaves about 10 cm. × 5 cm., with *petiole* not more than 7 mm. long; *stipules* 8–9 mm. long and 2–3 mm. broad at base. *Thyrsus* about 16 cm. long, measuring from the last foliage-leaf, and 14–16 cm. in diameter at base. The whole *calyx* is barely 1·5 mm. in length; *corolla*-tube 5 mm. long, the limb 4–5 mm. in diameter; *anthers* 1·4 mm. long; *style* 8–9 mm.

Rutidea pavettoides, sp. nov.

Frutex ramulis validiusculis densissime pilis longis hispidulis. *Folia* papyracea, utrinque plus minus molliter hispida, elliptica v. late obovato-lanceolata, basi subtruncata ad subcordata, *petiolo* sæpius brevi densissime hispidulo, apice vix v. brevissime acuminata sed acutissima; *stipulæ* infra ovato-lanceolatæ insuper in setam longiusculam plus minus subito desinentes, intus glabræ, extus necnon margine pilis longis onustæ. *Flores* multifloris in capitulis dispositi in cymis trichotomis dispositis, capitulo centrali ramulum terminante, *pedunculis* brevibus qua *pedicelli* brevissimi v. obsoleti hirsutissimis; *bracteæ* minusculæ tripartitæ basiovatæ lobis anguste lanceolatis acuminatis acutissimis lateralibus 2 brevibus mediano producto extus pilosæ intus glabræ; flores pro genere inter majores, *bracteolis* quisque 3 lineari-lanceolatis valde acuminatis acutissimis extus pilosis. *Calyx* minutus lobis tamen manifestis lanceolatis acutissimis extus pilosissimus intus glaber. *Corollæ* tubus gracillimus infra glabrescens insuper sparse breviter pilosus vix ampliatus, lobi oblanceolati nisi dorso prope apicem hispiduli glabri, tubi dimidium vix æquantes. *Antheræ* exsertæ curvatæ versatiles. *Stylus* angustissime clavatus longe exsertus.

No. 1197. Like its ally *R. hispida* Hiern, from which it differs in the structure and indumentum of the corolla, this species bears some resemblance to some species of *Pavetta*. *Leaves* 10–12 cm. × 5–7 cm., with *petiole* ±8 mm. long; *stipules*, the ovate basal part about 5 mm. long, the seta 1 cm. or longer. Primary *peduncles* (3 in each inflorescence), ±1·2 cm. long. *Bracts*, from the constricted base to tip of lateral lobes, 3 mm.; total length, from base to tip of median lobe, 1 cm.; *pedicel* about ·5 mm. long, bearing 3 *bracteoles*, each 6 mm. long, and passing into a pyriform *ovary* 1 mm. in height. *Calyx*-tube ·4 mm., lobes 1 mm. long. *Corolla*-tube 1·4 mm., lobes 6 mm. long. Filaments exserted 1 mm., *anthers* 4 mm. long. *Style* exserted about 9 mm.

Rutidea tarennoides, sp. nov.

Suffrutex volubilis nisi inflorescentia glaberrimus, ramulis gracilibus striatis. *Folia* pro genere inter majora papyracea elliptica utrinque breviter necnon leniter acuminata apice subacuta basi acuta, *petiolo* validiusculo tardius pro rata subelongato; *venæ* primariæ tenues utrinque prominulæ e centrali eminentes utrinque 7–9; *stipulæ* basi brevissime vaginantes angustissime lanceolato-subulatæ nonnunquam apice setaceæ breves longiuscule persistentes. *Flores* ad normam generis inter majores in axillis superioribus laxiuscule parvis in cymis nec multifloris dispositi folia nec excedentibus; *pedunculi* primarii graciles manifesti, secundarii irregulariter trichotome sæpe obscure partiti; *bracteæ* inconspicuæ setaceo-lanceolatæ; *ovarium* campanulatum, *calycis* dentibus minutis triangularibus coronatum acutis. *Corollæ* glaberrimæ tubus angustissime tubularis, lobi obovati obtusi nec acuminati. *Antheræ* oblongæ in toto exsertæ notabiliter apiculatæ. *Stylus* longe exsertus, *stigmate* magno conspicuo.

No. 1344. "Vine in clearing, lately forest. Flowers white."

This species resembles, and is doubtless nearly allied to, the erect shrub-species *R. odorata* K. Kr., a native of Amani, in East Africa; the two differ in the structure and relative dimensions of calyx and corolla, as well as in the habit. Another perhaps nearer ally to our species is *R. glabra* Hiern, a native of Old Calabar, and scandent in habit; our species is readily distinguished by the greater predominance of the limb over the tube of the corolla, and the leaf-shape is characteristic.

Leaves 9–14 cm. × 3·5–6 cm.; *petiole* barely 2 cm.; *stipules* 4 mm. long. Primary *peduncle*, arising in leaf-axil, up to ±2 cm. long, secondary ones to 4 mm.; *pedicels* obsolete, to 1–2 mm. long; *bracts* to 5 mm. *Calyx* minute, barely exceeding 1 mm., including the teeth. *Corolla*-tube 1 cm. long; lobes ±3 mm. × 1·6 mm., forming a limb 6–7 mm. in diameter.

Randia Dorothea, sp. nov.

Frutex ramulis gracilibus sparse necnon minute puberulis, in juventute validiuscule striatis tardius lævibus teretibus. *Folia* inter minora pergamacea elliptica apicem acutum versus longe caudato-acuminata basi cuneata, *petiolo* brevi tenuiusculo, supra glabra venis impressis, subtus in *venis* prominulis minute sericea lateralibus utrinque raro 4 excedentibus; *stipulæ* parvæ lanceolatæ acuminatæ acutæ dense sericeæ. *Flores* pentameri alaribus in cymis paucifloris dispositi subsessilibus subsessiles. *Calyx* subtubularis insuper parum ampliatus densissime griseo-sericeus dentibus lanceolatis acutis. *Corolla* pro genere inter minores, tubo anguste infundibulari extus puberulo-sericeo, lobis oblongis ad oblanceolatis nec acuminatis apice vix acutis intus glabris. *Antheræ* lineares conspicue exsertæ. *Stylus* breviter apice bifidus exsertus.

No. 1232. Corresponding closely in the vegetative parts, and probably assignable to the same species, is no. 1330; but this bears a single fruit only—a globular berry rather larger than a pea.

The greyish-green appearance of the leaves when dried, as well as the general appearance of the shoots, suggests the genus *Dorothea*, whence the specific name. But the flowers point to affinity with *R. angolensis* Hiern, from which our species differs in its much shorter corolla-tube and in the caudately acuminate *leaves*—the latter measure 11–15 cm. × 3·5–5 cm., with *petiole* not exceeding 5–6 mm.; *stipules* barely 4 mm. long. *Calyx*-tube 4·5 mm., teeth 3 mm. long. *Corolla*-tube 1·5 cm. long, and about 8 mm. in diameter at the mouth; lobes 1·2 cm. long, 4·3 mm. broad (above the middle), 3 mm. broad at base. *Anthers* over 1 cm. long. The *berry* in no. 1330 is rather more than 1 cm. in diameter.

[*Note.* P. 280, line 16 from bottom—"Allied to this, but readily distinguishable, is the following:—" should be deleted.]

PEMBROKESHIRE AND CARMARTHENSHIRE PLANTS.

BY ANTHONY WALLIS; EDITED BY C. E. SALMON, F.L.S.

[IN printing these notes, made by my late friend Anthony Wallis in 1916, it may not be out of place to give a few particulars of his life.

Born at Reading July 14, 1879, Anthony Wallis was educated at Leighton Park School, passed one year at Owens College, Manchester, and entered King's College, Cambridge. Here rowing absorbed much of his leisure, but time was found to compile "The Flora of the Cambridge District," mainly upon ecological lines, for Marr and Shipley's *Natural History of Cambridgeshire*, 1904.

After taking his degree with Second Class Honours in Nat. Sci. Tripos, and studying and passing in Pedagogy at Bishop Stortford School, he was, at the early age of 23, appointed a Junior Inspector for Bucks of the Education Department. Stationed at Aylesbury, a good centre for botanical as well as educational activities, plant-hunting claimed a large part of his spare time; *Cladium Mariscus* was discovered by him in the county (Bot. Ex. Club Rep. 1904, 35) and many records were supplied to Mr. G. C. Druce for inclusion in his forthcoming *Flora*, such as *Anemone Pulsatilla* which we found on the Downs. From Aylesbury, Wallis was transferred to Leeds, and subsequently became Junior Inspector to the North Riding with headquarters at Darlington. Whilst there he married Miss A. E. Mounsey, of Blackwell Hill, near Darlington.

After a few years, during which many botanical observations were made during vacations (see Journ. Bot. 1910, 225, where *Luzula arcuata* is mentioned from a fresh station, Ben Nevis, and Journ. Bot. 1916, 165), Wallis was given the Senior Inspectorate for Cumberland and Westmorland with headquarters at Penrith. To work thoroughly these mountainous counties, ill-served by road or rail, proved almost too much for his strength even with the help of a car; the arduous work of bicycling long distances in all weathers, when the car was stopped during the War, brought about lung and other troubles and ultimately caused his death, which occurred at his house at Penrith on August 28th.

His friends regret the loss of a charming personality and an ideal companion. The results of our joint expeditions to Cross Fell and elsewhere, in the summer of 1919, together with many of the North Country records, I hope to print later.

In the following notes * denotes a seeming addition to the vice-county, † an alien, ! a specimen seen by me. Barker=*Handbook to the Natural History of Carmarthenshire*, 1905; Falconer=*Contributions towards a Catalogue of Plants of Tenby*, 1848.—C. E. S.]

PEMBROKESHIRE, v.c. 45.

Clematis Vitalba L. Tenby Burrows; hedges near Hundleton, Pembroke.—*Thalictrum dunense* Dum. Tenby Burrows!

**Berberis valgaris* L. Hedges near Lydstep.

†*Papaver somniferum* L. Tenby Tip and Railway Station. *P. Rhœas* L. var. *strigosum* (Bœnn.). Tenby. Var. *Pryorii* Druce. The common form round Tenby!—*Glaucium flavum* Crantz. Manorbier; Tenby Burrows.—*Chelidonium majus* L. Lydstep.—†*Corydalis lutea* DC. Escape, Tenby.

Diplotaxis tenuifolia DC. Cliffs and walls, Tenby. A satisfactory record in view of the rather depressing account given by E. Lees many years ago respecting its decrease (Phytol. iv. 1013, 1853).—*Coronopus didymus* Sm. Roadside, W. end, Ridgeway.—*Lepidium Smithii* Hook. Roadside, Freshwater East.

Reseda lutea L. Tenby.

Silene anglica L. Cult. ground, Ridgeway. **S. noctiflora* L. Cult. ground, Castle Martin.—*Lychnis Githago* Scop. Cult. ground, Ridgeway.—*Cerastium tetrandrum* Curt. Tenby Burrows.—*Arenaria peploides* L. Waterwynch.

†*Hypericum elatum* Ait. Two or three bushes in hedge, Hundleton. **H. dubium* Leers. Minarton Quarry near Tenby! This proved to be the usual British form, var. *erosum* Schinz. *H. montanum* L. Carew.

Linum angustifolium Huds. Lane side to Ridgeway from Penally.

Geranium columbinum L. Tenby Burrows.

Medicago arabica Huds. Carew; Tenby.—*Trifolium medium* L. Ridgeway. *T. scabrum* L. Pembroke Castle walls. †*T. hybridum* L. Cult. ground, Ridgeway.—*Lathyrus sylvestris* L. Cliffs N. of Tenby. *L. montanus* Bernh. Waterwynch Cove.

Prunus Cerasus L. In hedges near Freshwater West.—*Agrimonia odorata* Mill. Ridgeway.—*Rosa spinosissima* L. Tenby Burrows.

†*Sedum reflexum* L. Wall tops, Tenby.

†*Epilobium angustifolium* L. Tenby Station.—†*Œnothera biennis* L. Lydstep.

Caucalis nodosa Scop. Dry spot in Tenby Marsh.

Cornus sanguinea L. Ridgeway. This plant is queried for v.c. 45 in *Top. Bot.*, notwithstanding the fact that there are two localities for it in *Falconer* (p. 23) and its inclusion in C. C. Babington's article on Pembrokeshire plants in Journ. Bot. 1863, p. 264.

Valerianella dentata Poll. Fields on Ridgeway!

Inula Helenium L. Manorbier Road to Gumfreston. *I. crithmoides* L. Lydstep cliffs.—*Bidens cernua* L. Penally marsh. **B. tripartita* L. Manorbier. No personal authority in Top. Bot.—*Matricaria Chamomilla* L. Ridgeway. †*M. suaveolens* Buchen. Pembroke.—†*Senecio Cineraria* DC. Lydstep Beach!—*Carduus tenuiflorus* Curt. Tenby Burrows; Manorbier.—†*Silybum Marianum* Gaertn. Manorbier.

Statice humilis C. E. Salm. Carew Castle, Milford Haven!

Anagallis arvensis L. var. *carnea* (Schrank.). Sandhills, Freshwater West. Probably native in this locality (see Journ. Bot. 1917, 322).—*Samolus Valerandi* L. Freshwater.

Fraxinus excelsior L. Hoyle's Hole wood, a natural ash wood on limestone.

†*Anchusa sempervirens* L. Penally.—*Lithospermum officinale* L. Minarton W. of Tenby. *Calystegia Soldanella* Br. Manorbier; Freshwater.

Solanum nigrum L. Top of Giltar Head.—†*Lycium chinense* Mill. Tenby.

Verbascum Blattaria L. Near railway line, Penally!—**Linaria minor* Desf. Tenby station.—*Veronica Buxbaumii* Ten. Ridgeway.

Orobanche Hederæ Duby. Tenby Castle!

Mentha sativa L. Manorbier! This comes under Watson's *rivalis*.—*Calamintha officinalis* Moench. Tenby Castle.—*Prunella vulgaris* L. A state of this about twelve inches high with pale blue flowers and toothed leaves occurs as the common form for some distance by the roadside E. of Lamphey!

Rumex pulcher L. Tenby.

Euphorbia Paralias L. Penally beach and cliffs. *E. portlandica* L. Penally beach. *E. exigua* L. Truly wild on the beach at Penally.

Parietaria ramiflora Moench. Lydstep beach, a really wild locality.

Orchis incarnata L. Tenby marsh.

Allium vineale L. Tenby. *A. ursinum* L. Lamphey.

Juncus Gerardi Lois. Tenby marsh. *J. obtusiflorus* Ehrh. Freshwater West.

Alisma lanceolatum With. Tenby marsh.

Schœnus nigricans L. Freshwater West.

Carex pendula Huds. Tenby marsh.

†*Phalaris canariensis* L. Tenby Tip. *Catabrosa aquatica* Beauv. Penally marsh.—**Festuca pratensis* Huds. Tenby marsh.—*Bromus madritensis* L. Pembroke Castle!—**Lepturus filiformis* Trin. Carew, Milford Haven.—**Elymus arenarius* L. Penally beach.

Ceterach officinarum Willd. Lamphey.

Ophioglossum vulgatum L. Minarton Quarry.

Carmarthenshire, v.c. 44.

Sambucus Ebulus L. Plashett in Laugharne. The only record in *Barker* is said to be an escape.

Statice Limonium L. Laugharne! This is the second specimen I have examined from the county, the first being one from Kidwelly, collected in 1912 by D. Hamer seen in Herb. G. C. Druce. *Barker* relied upon Watson's "Motley Cat." record for including it as a Carmarthenshire species.

Chlora perfoliata L. Laugharne Burrows.—*Erythrea pulchella* Fries. Pendine!—*Gentiana Amarella* L. Laugharne Burrows.

Mentha sativa L. *α rivalis* Wats. Pendine!

Epipactis palustris Crantz. Laugharne Burrows, abundant.

Juncus acutus L. Laugharne.

GLOUCESTERSHIRE NOTES.

By the Rev. H. J. Riddelsdell.

Adonis annua L. This was recently found in considerable quantity in cornfields about Culkerton and Rodmarton by E. M. Day. But it is nowadays far less frequent than formerly.

Ranunculus ophioglossifolius Vill. is remarkably uncertain in its appearance, rarely making so great a show as it did in 1912. It seems to have "periods" very similar to those of many orchids. When I visited the locality at the end of August 1919, signs were not lacking of a gradual change in its character, a change which may possibly prove fatal to the plant: for farm-yard species of *Atriplex* and *Chenopodium* were beginning to encroach. It is to be hoped, however, that a more normal season may witness the return of the locality to its old bogginess, and that the buttercup may long survive.

Helleborus fœtidus L. is undoubtedly native on the Cotteswolds, which, as a friend suggests, are probably the head-quarters of the species in Britain. This is an opinion I have long held with respect to the Fly Orchid and *Polygonatum officinale.* The latter is quite a common plant on these Hills, occurring usually in company with the Lily of the Valley: whereas *P. multiflorum* is decidedly scarce there. These facts, coupled with the occurrence of *Stachys alpina* and the abundance of *Thlaspi perfoliatum, Carex tomentosa, Cephalanthera rubra,* &c., serve to emphasise the unusual botanical importance of the area.

Glaucium flavum Crantz. Well known on the Bristol side of the Severn. Miss Ormerod in 1845 found it in luxuriance on the other side, near Beachley, in our district 4: it subsequently became very scarce. I have not heard of it there in recent years.

Cochlearia danica L. 2 *b.* Sharpness, 1864, *S. Brody*: Gloucester 1846, *Hbm. in Gloucester Museum.* 4. Lydney and Severn Bridge. The various records do not suggest a native plant: yet it seems an unlikely species to be carried any distance. It occurs, of course, in abundance farther down the Bristol Channel, in Glamorgan and Devon, and may possibly be a dying-out species here. It is not always confined to the actual coast: I have known it flourish in Glamorgan on rocks 2 or 3 miles inland.

Thlaspi perfoliatum L. occurs in such abundance in districts 1 (5 miles from Campden), 6, and particularly 7, that it may be regarded as one of the characteristic Cotteswold plants. It happily occurs usually in such out of the way places, and on such stony and "useless" soil, that it is most unlikely to disappear. In some neighbourhoods, it can be found on almost every suitable-looking piece of bare soil. On one occasion, I looked over a low wall into some wet ground for a chance of bog plants, and was surprised to find the reverse side of the wall for some distance covered with a luxuriant growth of *T. perfoliatum* 4 to 6 inches high.

Cakile maritima Scop. 2 *b*. Sharpness. 4. Sand near Beachley, 1863, *St. Brody*. 5. 1 specimen on the Bristol side of the Severn, 1910, *E. M. Day*. Evidently in the same case as *Glaucium* and *Eryngium maritimum*: appearing rarely, and disappearing for many years. All three species may possibly appear as the result of tidal action.

Stellaria Holostea L. A form has been sent to me by J. W. Haines from Birdlip with petals shortened and more deeply cleft than usual. The sepals are also sometimes shortly ciliate in their lower half. I suppose this is just a step away from type towards the apetalous form.

Geranium columbinum L. is a frequent and characteristic plant of rough stony upland pastures on the Cotteswold Hills: more at home there than any other species of this genus.

Rubus Godroni Lec. & Lam. var. *clivicola* Ley appears to be a common bramble of the neighbourhood of Birdlip, usually occurring at 800 to 900 feet of elevation. Too many of the *Rubus* records for v.c. 33 rest on the occurrence of a single bush or at best a single clump: but much work remains to be done in the genus, as far as E. Gloster is concerned.

Pyrus scandica Aschers. This species (I believe) occurs in quantity with *P. Aria* in a grove near the top of Haresfield Hill v.c. 33. As *Betula* is there too, both are probably introduced in the locality.

Chrysosplenium alternifolium L. is a species characteristic of ditches and small streams in deep shade all over the Cotteswolds. It is, I believe, even more frequent than *C. oppositifolium*.

Carum Bulbocastanum Koch has of late years been found by several botanists in cornfields near Cheltenham. It is an introduced plant in this locality.

Senecio integrifolius Clairv. has been found at different times, usually in very small quantity, in three or four spots on the Cotteswold Hills: on one occasion I saw it in great quantity and luxuriance. But sheep nibble it and it does not get much chance. It is not a characteristic plant of the Cotteswolds, and is quite uncertain in its appearance. A few plants were seen on downs near Northleach last year.

Centaurea Scabiosa L. In August I found a clump of this species between Cheltenham and Birdlip, with the heads of flowers much smaller than usual, and lacking the ray florets. If it is anything more than a *lusus*, the form deserves naming as a variety.

Cynoglossum montanum L. A MS. note of F. Townsend's records this note from "woods near Chastleton, but whether in Glos or Oxon I know not."

Verbascum nigrum × *Thapsus*. I have this hybrid both from the Sheepscombe and the Slad Valleys, near Painswick.

Teucrium Botrys L. I saw this species again last August: it was in great quantity and extended even into a second field. I am not quite sure that it is exactly the spot to which I was taken some years ago: if not, there are two large groups of the plant, within a mile of one another, near Sapperton.

Betula alba L. grows on the top of Haresfield Hill, and occurs on the lower slopes, near the Edge–Pitchcombe Road, as small scrubby bushes. It may be native here, but I doubt it. It so greatly prefers wood on damp or even boggy soil that its appearance on these dry calcareous slopes looks most unnatural.

Cephalanthera rubra Rich. turns up in some fresh spot every year. It is recorded from at least a dozen places, all within our district 6 (*i.e.* south of Birdlip). In most cases one or a few plants only are found. In only one case do I know of it in considerable quantity, and I am told that even there it is diminishing. The felling of a wood threatens to destroy it in one place, for the timber is left lying on the very space where the plant grows. I have one record for *C. rubra* from district 7 *b*, but it is probably an error.

Orchis hircina Crantz. Mr. Druce told me that he had seen a 1917 specimen from the Painswick neighbourhood, and I have since seen the finder and been told where it grew. Mr. Horwood wrote to me of his good fortune in discovering it again in Suffolk that year. The finder of the one Gloucestershire plant (v.c. 33) described the peculiar behaviour of the open flowers, which have the habit of "following the sun round" during the day, so that they always face it, in whatever part of the sky it is.

Ophrys apifera Huds. var. *Trollii* Reichb. fil. By no means unfrequent, both in the Vale of Severn and on the hills.

Juncus subnodulosus Schrank. In v.c. 33 certainly, *e.g.* in the Stroud water-valley, and at the Seven Springs on the R. Windrush.

Potamogeton Friesii Rupr. occurs not only in the Stroudwater Canal, but also in the R. Leadon: *i.e.*, it is found in v.c. 34 as well as 33.

Scirpus compressus Pers. is a plant characteristic of the tops of the Cotteswolds. Almost every wet grassy open pasture produces it, and many bogs in woods. Here it is entirely at home, though perhaps it would, as a rule, be expected on lower ground in other areas.

Eriophorum latifolium Hoppe is being found more plentifully in Gloucestershire, in both vice-counties. A bog on the hills near Newnham has it.

Carex tomentosa L. Buckman's record from the Cheltenham district was for many years rejected. But the species is found near the sources of the Colne at Withington. A sedge first known from Marston Meysey in Wilts, it turns out to be characteristically a native of the Colne drainage, for it has been found lately on the driest parts of the elevated downs near Northleach, and it is quite frequent in the lower Colne Valley about Fairford. It appears to be quite indifferent to the amount of moisture in its neighbourhood, as indifferent as *C. glauca*, with which it appears to hybridize: I have seen plants which seemed to be this hybrid growing at Whelford, and a similar intermediate was sent me from near Northleach.

C. strigosa Huds. is quite of frequent occurrence in E. Gloster; it is not confined there to woods, growing in one place in a ditch under a hedge.

Poa palustris L. var. *effusa* Asch. & Graebn. Has at last been found in v.c. 34, and so is now on record for both parts of Gloucestershire.

Lastrea montana T. Moore, a specimen from Cranham Wood, is in St. Brody's Herbarium: this is in v.c. 33. I have seen *Phegopteris Dryopteris* in minute quantity at Cranham in v.c. 33, and *Botrychium Lunaria* Sw. in v.c. 34 near Tidenham Chase. Ferns are, as regards quantity, much scarcer in E. Glos than in W. Glos, yet there are only one or two species present in the latter and absent from the former. *Asplenium lanceolatum* and *Lastrea æmula* stand, I believe, alone in this category.

I should say that probably the Cotteswolds are the headquarters of the Limestone Polypody in England—at any rate, I know of no other area where it is so ubiquitous.

BIBLIOGRAPHICAL NOTES.

LXXVIII. "John Frederick Miller and his Icones."

In the note (LIII.) published in this Journal for 1913 (p. 255) I described at length a fascicle of seven plates to which I had not then been able to find any reference, and which, owing to the fact that they were bound with the *Icones Animalium et Plantarum* of John Frederick Miller in a volume lettered on the back "Miller's Plates," I then attributed to that artist. I now find that the fascicle is described in the *Supplementum* to Dryander's Catalogue (v. 63), the words "Plures non prodierunt" being added, and it is also mentioned in Dict. Nat. Biogr. xxxvii. 413—in both places it is accurately ascribed to John Miller, the father of John Frederick. As the plates are all lettered John Miller, my mistake, which can only be accounted for by their correlation with John Frederick's work, is inexcusable.

James Britten.

SHORT NOTES.

Habitats of Hypericum humifusum (pp. 195, 225, 287). Mr. H. S. Thompson notes the frequent occurrence of this plant on "rides" in woods upon Carboniferous Limestone, though most ecologists prefer to regard it as a lime-hater. In West Somerset its usual habitat is in open woodlands upon a siliceous formation; it is a common and by no means a thinly distributed plant on the sparsely wooded portions of the banks of the river Barle. It occasionally occurs on roadside banks where these are damp or shaded by a wall, as at Exford, or by overhanging trees as at Nettlecombe. Its occurrence in other situations is, as Mr. Thompson remarks, almost certainly due to the agency of man. During this summer I found it in a recently cleared woodland, in a district where I had not previously noted it. Its occurrence upon limestone soils must be looked upon with suspicion; it is not a deep-rooted plant and the soil may, as Mr. Woodruffe-Peacock says (p. 225), be "acid sandy above, or the upper root-soil is neutral from endless rain-wash and plant-decay." Wrington Warren, where Mr. Thompson notes its occurrence, is an example of a "calcareous heath" where many lime-hating bryophytes are abundant. In July of this year I found it growing abundantly in a fallow corn-field near Rayleigh's Cross on the Brendon Hills, where most of the plants associated with it suggest a calcareous substratum, the floristic composition of the field being very similar to that on White Lias pastures. Of the chief plants noted the following, besides the *Hypericum*, were abundant: *Geranium columbinum*, *Sherardia arvensis*, *Thymus Serpyllum*, *Rumex Acetosella*; *Ononis repens*, *Alchemilla arvensis*, *Filago germanica*, *Euphrasia rostkoviana*, *E. curta*, *Bartsia Odontites*, *Calamintha arvensis*, *Plantago lanceolata*, and *Aira caryophyllea* were occasional. The abundance of *H. humifusum* and *R. Acetosella* amidst such company presents an ecological problem, the solution of which may lie in the superficial distribution of humus over a calcareous substratum; the time available was insufficient for a thorough examination of the geological, physical, and chemical data. The mosses noted were not characteristic of limestone.—W. Watson.

Argyle Records (p. 322). With the exception of *Centunculus*, all the plants mentioned are already on record for v.c. 98—*Potamogeton perfoliatus* (Macvicar) in Ann. Scot. N. H. 1899, 40 and the remainder by Prof. King in Ewing's *Glasgow Catalogue*, 1899.—C. E. Salmon.

REVIEWS.

The English Rock-Garden. By Reginald Farrer. 2 vols. 4to, cloth, pp. lxiv, 504, viii. 524, 102 plates. T. C. & E. C. Jack, London and Edinburgh. Price £3 3*s*. net.

These handsome volumes—well printed on good paper, illustrated by about two hundred admirable reproductions from photographs (there are two figures on nearly every plate), and suitably bound, are in every way a credit to the publishers. The author, Mr. Reginald Farrer, has long been known as an authority on Rock-Gardens, on which he has already published more than one book, and which he has enriched by the results of his travels. The present work, he tells us, "was written in 1913 and corrected for press in China during the winter of 1914"; its appearance was delayed by "the exigencies of war," which "even now prohibit such perpetual re-settings of the type as would be necessary to bring it completely abreast of the most recent discoveries and diagnoses."

The introduction, of more than sixty pages, contains practical details as to the building of rock-gardens; not the least useful portion is that which shows how this should *not* be done, both as to material and form. It also includes a long and detailed explanation of the objects Mr. Farrer had in view in writing the book, and the trouble that he took in various directions in order to secure the success which he evidently thinks he has attained—we have seldom met with a work wherein the author's self-satisfaction was so conspicuous. And here we are at once brought face to face with a defect which permeates the whole work: we refer to the literary style, of which we cannot give a better example than is afforded by Mr. Farrer's own description of it. It has been his endeavour, he tells us, "all through the book to preserve the vivid and personal note at any cost to the arid gray gravity usually considered necessary to the dignity of a dictionary; not only that so the work may perhaps be found more readable and pleasant, but also that other gardeners, finding their best beloveds, may be, here slighted or condemned, may be able to mitigate their wrath by constant contemplation of the fact that such opinions are but the *obiter dicta* of a warm-blooded fellow-mortal, not the weighed everlasting pronouncements of some pompous and Olympian lexicographer, veiled in an awful impersonality that admits of no appeal" (p. xxvi).

In his endeavour to preserve the same note "all through the book," Mr. Farrer has succeeded only too well: confused and complicated construction, irrelevancies, and a plethora of words confront us on almost every page: "he never uses one word where three would suffice" was said of a verbose writer—Mr. Farrer is seldom content with fewer than a dozen. He tells us that he has exceeded the space allotted to him by "exactly one half"; the book as it stands could be reduced at least by that amount without any diminution of its usefulness and to the comfort of the reader.

If this mode of writing were confined to the introduction it would not be so intolerable, but, as we have said, it permeates the book—we take at random the first sentences on *Pulmonaria*:—

"*Pulmonaria* will not easily find a lovelier representative than the narrow-leaved brilliant Spotted-dog of the Dorsetshire woods, with its 6- or 8-inch stems, and its hanging lovely bugles of rich clear blue in April—so much more modest in the leaf, well-bred in the growth, and brilliant in the flower than the towzled and morbid-looking heaps of leprous leafage made by the common Lungwort of gardens, with leafy stems and indecisive heads of dim pinky-blue flowers that look as if they were going bad. This is sometimes *P. saccharata* of the Southern ranges, a species of even startling foliage-beauty when you come upon the marvellous and awful mottlings and splashed whitenesses of its lush leaves in the woods, for instance above the Boréon, seeming as if some Suffragette had been liberal in these parts with vitriol" (ii. 201). It may be noticed in passing that Mr. Farrer's treatment of the genus is unsatisfactory;

he regards *P. azurea* Bess. as "simply *P. angustifolia*, of which English woods have one form, perhaps the best, and the upper Alps another": Mr. Wilmott's paper in this Journal for 1917 (pp. 233–240) may be consulted with advantage.

The body of the work is alphabetically arranged under genera, the more important of which are discussed at considerable and often unnecessary length: *Campanula* occupies 50 pages, *Gentiana* 37, *Androsace* 20, *Saxifraga* and *Primula* nearly 200 each. Mr. Farrar tells us in his introduction that the work has had to be "severely selective," but it is not easy to understand what principle has been followed—under *Primula*, for example, *P. tosaensis*, one of four species on a page taken at random (ii. 199) "comes from realms so southerly of the Rising Sun that there is little hope that it will be of any use in our gardens"; another, *P. Traillii* "is a species imperfectly described and so far unknown to our gardens"—of this Mr. Farrer gives a characteristic account: "Unfortunately, though *P. Traillii* seems to have two blooming-seasons, so that Sir G. Watt was able to get ripe seed, as well as revel in the blossoms of his find, this seed got mixed in its packet, and, when at last it came home to Wisley and germinated with much gladness, the promises thus raised proved to yield nothing else but *P. involucrata*, though confidingly described by Mr. Wilson in the *Gardeners' Chronicle* under the name of *Traillii*, which they ought to have had a better right to bear." Occasionally names seem introduced in order to afford the author an opportunity for a small joke: *e. g.* "*Noœa spinosissima* expresses in the first syllable of its name what the wise gardener will say when offered it: nor need he even trouble to add 'Thank you'" (ii. 3). Nor does there seem any reason for occupying space with such entries as "*Cousinia*, weedy, coarse, thistlish, woolly-headed biennials from Himalaya, of no attractiveness for us" (i. 242), or, on the following page, "*Crassula alpestris*, a rather ugly-looking succulent of most doubtful hardiness . . . it seems [?] only about 3 inches high, and might prosper permanently in a hot and stony place, though without contributing anything in the way of adornment."

Returning to the introduction, we find that Mr. Farrer is much exercised as to the popular mispronunciation of certain names: "there is nowadays really no reason why *Gladĭŏlus*, *Gladiōlus*, *Saxifrāga*, *Pentstēmon*, *Androsācē* and *Erīca* should still be allowed to stand up, like dark islets of ignorance, above the pervasive widening flood of modern education." To remedy this he would alter the spelling—"surely if they see *Ereica* written, and *Aeizōōn*, even the least experienced gardeners will easily learn "to pronounce them accurately": on like grounds he "restores the Greek diphthong in ei to its proper spelling," writing the termination "oides" as "oeides." Other innovations are "*Asarrhina*," "*Phyllodoke*," and "*Leucoion*." We note with pleasure his condemnation of what are called "English names," for the manufacture of which he seems to consider Ruskin mainly responsible, but the industry existed long before his time: Sir John Hill (1716–1765) was an expert at the work, and many names now in general use were not, as Mr. Farrer puts it, "slowly coined in a nation's love," but invented by the older herbalists such as Gerard and Parkinson. Mr. Farrer thoroughly recognises the principle of priority in nomenclature: "this book has aimed at getting back to the genuine original specific name for every species, so that these may never again appear disguised as novelties in the same list that also contains their more common superseded name": "in the pursuit of final correctness over specific names," he tells us, "I have spared no trouble to myself and no inconvenience to or upset to my readers." How far he has succeeded it is not easy to judge, as he seldom adds the authorities to the names, but in the cases in which these are given his conclusions, so far as we have tested them, are correct, though we do not know why *Hypericum rhodopeum* (1836) is accepted in preference to *H. origanifolium* (1822).

The book on the whole is carefully printed, though there are occasional slips—*e. g.* "arrow roots" for *Sagittaria* (ii. 226); "poor man's pepper" can hardly be correctly applied to *Sanguisorba officinalis* (ii. 229); *Cimicifuga* was not so called because it "put *fleas* to flight" (i. 225). There are appendixes containing additional notes on *Meconopsis* and *Primula*, of no obvious utility, as most of the latter are comparatively unknown—of *P. Waltonii*, for example, which "cries aloud to be collected from its home on the high gaunt hills of Holy Lhasa," only two sheets of dried specimens have been seen . . . . and a "Report of Year's Work (1914) in Kansu and Tibet," which seems out of place in a book on "The English Rock Garden" and has been printed in the *Journal of the Royal Horticultural Society*.

Readers are cautioned that the uncut edges are at the bottom of the pages instead of at the top—an inconvenient practice for which it is difficult to see the reason and which may lead to tearing the pages if these be turned over rapidly.

Mendelism. By R. C. PUNNETT, F.R.S. Fifth Edition. Macmillan & Co. London, 1919. Price 7*s.* 6*d.* net.

WHEN this book first appeared in 1905 the present reviewer welcomed it as a thoroughly satisfactory account of what was then almost a new subject. It was then a little volume which would almost have fitted into the waistcoat pocket; though still of no very great size, it has now expanded into a larger volume, and has come to a fifth edition; it has been translated into German, Swedish, Russian, Japanese, and has been published in an American edition. It is unnecessary to pour out fresh praises on a book with such a record: it is enough to say that it continues to be by far the best manual on a subject which is as interesting to biologists as it was when the first edition appeared. The new matter which has been published, even during the War, is dealt with in this edition; special mention may be made of Morgan's work with the account of his very remarkable observations on *Drosophila*, the fruit fly. But perhaps the most interesting point relates to the discovery that the numerous hybrid forms of *Hieracium* normally produce seed by a curious process of parthenogenesis. It will doubtless be remembered that Mendel himself made a number of experiments on this genus because he thought that its great richness in varieties would afford him splendid material for research. Greatly to his disappointment things did not work out as he had hoped: in place of the classical division into dominant and recessives the descendants all bred true. Mendel did not know why; but we have now learnt that the cells from which the ova develop (parthenogenetically, as we have indicated) are not of the same nature as the normal ova of the ordinary plant, but should rather be considered as buds which have early become detached from the parent stock to lead an independent existence; and that, like buds, they exactly reproduce the maternal characteristics. It is one more lesson in the need for caution in the interpretation of facts, for of this state of affairs Mendel was ignorant and could scarcely have formed any conception. B. C. A. W.

BOOK-NOTES, NEWS, ETC.

The Kew *Bulletin* (no. 9) contains a note by Mr. W. B. Turrill on the occurrence "in considerable quantity on cultivated crops in South Wales" of *Cuscuta suaveolens* Sér., with a reference to Dr. Hemsley's paper in this Journal for 1908 (p. 241), where the history of the plant in this country is given. In South Wales, "Onions and carrots were the plants chiefly affected, but the parasite seems almost indifferent to the nature of its hosts, for it had spread on to various weeds, including *Lotus corniculatus*, *Arenaria serpyllifolia*, *Trifolium repens*, *Pastinaca sativa*, and several grasses." *C. Tinei* Insenga, mentioned by Mr. Turrill, was also noticed by Dr. Hemsley (*l. c.* 244), who gives useful figures of the flowers of the two species.

A Natural History Society for the Isle of Wight was inaugurated at a well-attended meeting held at Newport on Nov. 15. The chair was occupied by Mr. James Groves, who delivered an address in which it was pointed out that although much had been done in cataloguing the animals and plants of the island, their life-history provided an inexhaustible field of study. Mr. G. W. Colenutt, F.G.S., was elected first president and Mr. F. Morey—author of the *Guide to the Natural History* of the island, by whose exertions the meeting had been convened—hon. secretary.

The Rev. Coslett Herbert Waddell died very suddenly on June 8th at Grey Abbey, Co. Down, of which place he was Rector. He was born at Maralin in the same county on March 6, 1858, graduated M.A. and B.D. at Trinity College, Dublin, was ordained in 1880, and became Rector of Saintfield, whence he proceeded to Grey Abbey. He took a great interest in the work of the Belfast Naturalists' Field Club, of which he was at one time President, and was a Member of the Royal Irish Academy. His principal botanical work, in which he was much associated with Canon Lett, was in Mosses: in 1896 he published in this Journal (p. 88) a proposal for the establishment of a Moss Exchange Club which was duly taken up; of this he became Secretary, retaining that position until 1903, when he was succeeded by Mr. W. Ingham who still holds the post. In 1897 he published for the Club a *Catalogue of British Hepaticæ*, which is noticed on p. 413 of this Journal for that year. Numerous notes were contributed by Waddell to this Journal, relating principally to Mosses, from 1896 onwards; in the volume for 1910 he published biographies of George Stabler and James Martindale Barnes, who were among his numerous correspondents. Rubi also occupied his attention: notes on those collected by him in Yorkshire, Warwickshire, and Worcestershire will be found in Journ. Bot. 1902, 296; 1908, 172; in the Journal for 1900 (p. 445) is a note on the winter buds of *Zannichellia*, and in 1905 (p. 244) he criticized Mr. Praeger's numbering of the botanical county-divisions of Ireland. His collection of mosses was bequeathed to the Royal College of Science, Dublin, and his flowering plants to Queen's College, Belfast.

At the meeting of the Linnean Society on 6th November, Colonel H. E. Rawson read a paper entitled "Plant-sports produced at will." He had observed near Cape Town, that shrubs of Kei-apple, *Aberia caffra*, died when they were deprived of the full sun up to a certain altitude in the early morning. This led to experiments in screening plants about this hour, for various periods. 'Selective screening' resulted in various sports in form and modifications of colour in *Tropæolum majus*. A special form of *Papaver Rhœas* was obtained and fixed, and other experiments were detailed. The author sums up thus:—The intensity of the light regulates and modifies the coloured bands upon all parts of the plant, which have been excited by interference. In nature selective screening prevails universally, and these experiments suggest that it is deserving of study, to bring out its latent potentialities.

In *Mededeelingen Van's Rijks Herbarium*, Nos. 31–36 (1917 en 1918) which has recently come to hand, Dr. Hans Hallier has a long paper on the plants described in Aublet's *Histoire des Plantes de la Guiane Française* (1775), and a short one on those of Patrick Browne's *Natural History of Jamaica* (1756: ed. 2, 1789). With regard to the former, the extensive collection of Aublet's Guiana plants from Herb. Banks in the National Herbarium, in which are numerous types of the plants described in the *Histoire*, should have been mentioned; the species represented are ticked off in Banks's copy of the work, and the identifications (by Dryander and others) are often added in the margin. Dr. Hallier's remarks prefatory to the paper on Browne's book suggest that his knowledge of the plants, as well as of the literature concerning them, is far from complete: he does not mention that Browne's plants are in the Linnean Herbarium and formed the basis of the *Plantarum Jamaicensium Pugillus* (1759) reprinted in Amœn. Acad. v. 389–413 (1760). The most important omission is that of the long account of Browne's work by Urban in *Symbolæ Antillanæ*, i. 18–28, wherein many of his genera are discussed. Browne's plants will all be taken up in Fawcett and Rendle's *Flora of Jamaica*, now in course of publication; reference may also be made to the article on Browne's book published in this Journal for 1912, p. 129.

The *Gardeners' Chronicle* of October 18 contains an interesting article—the eighth of the series—by Mr. Reginald Farrer on his Second Exploration in Asia. The *Chronicle* has also published in full

Sir Daniel Morris's British Association address on Botany and the Empire, of which we gave some account on p. 296.

Messrs. Dulau have published (10*s.*) an Index to the Plates and Names in the fourth Series (vols. i.–xxx.) of *Hooker's Icones Plantarum.*

TO OUR SUBSCRIBERS.

It will be remembered that at the close of 1916, the financial position of this Journal was so unsatisfactory that its discontinuance seemed imminent. Until the first year of the War, it had always paid its way, and had even left an infinitesimal margin of profit; in 1915 the balance was on the other side, and in 1916 the deficit was such that it would not have been possible to continue publication had it not been for the generous activity of friends, through whose exertions the debt was removed, leaving a small balance on the right side. The matter is dwelt on at some length in the volume for 1917 (p. 143): at the end of that year and of 1918, the balance, though small, was still adverse, and the expenses of the present year are not likely to be covered by the sales and subscriptions for the period.

Under these circumstances, and acting on the advice of our publishers, it is necessary to take further steps to meet the coming liabilities, and it has been decided that this can best be done by increasing the rate of subscription and of sale. It is obvious that an appeal such as that of 1916 could not be renewed, either with reason or with any prospect of success; moreover, although we may look for cheaper paper, the rate of wages continues to increase, and the cost of printing is thus not likely to diminish. As was remarked in 1915, the Editor has never acted with a view to profit: so long as expenses were covered, he was willing to carry on the work, and, at the end of forty years, he is still prepared to do so; but he is not prepared to expend money as well as time and trouble.

It is therefore proposed to make the Journal a net publication, and to raise the Annual Subscription to 17*s.* 6*d.* (post free); single numbers will cost 1*s.* 8*d.* net. It is thought that those who feel that the cessation of the Journal would be a misfortune, especially British botanists whose principal organ it has always been, will not demur to this slight increase in view of its preservation. We need hardly say that in the event of a lessening of the cost of output, of which there seems no immediate prospect, we shall take the earliest opportunity of restoring the Journal to its former bulk. It seems right to add that the cost of the Supplements to the April and June numbers—"The Phæophycean Zoïd" and "The Plankton-phase and Plankton-rate"—was defrayed by the author, Dr. A. H. Church.

The Editor.

INDEX.

For Classified Articles, see—County Records; Obituary; Reviews. New genera, species, and varieties published in this volume, as well as new names, are distinguished by an asterisk.

CORRIGENDA.

P. 48, l. 23 from top, for "Craig" read "Craib."
P. 133, l. 2 from bottom, for "Banks" read "Lyell."
P. 167, l. 12 from top, for "Smith" read "Small."
P. 225, l. 2 from top, delete "coronulâ exclusâ."
P. 274, l. 20 from top, for "late" read "Rev."
P. 280, l. 16 from bottom should be deleted.
P. 316, ll. 17, 18 from bottom, for "Cheddon" read "Cheddar," for "horde" read "horse."

Printed by Taylor and Francis, Red Lion Court, Fleet Street.

Supp. pp. 23-3 bound at end of Jnl. no.

THE PHÆOPHYCEAN ZOÏD.

By A. H. Church.

Considered as a ciliated reproductive cell, the characteristic "zoospore" or "swarm-spore" of the Phæophyceæ presents little interest; but regarded from a broader standpoint as the retention of a flagellated phase in the life-cycle, linking this great group of marine algæ with other flagellated races of phytoplankton, it acquires an intensive value—not only as opening up the question of the flagellate ancestry of the Phæophyceæ, but as expressing the high-grade differentiation attained by such a zoïd in some previous phase of existence and its isolated phyletic history.

The organization of the Phæophycean zoïd as presented most typically in the zoogonidia of *Ectocarpus*, the gametes of *Laminaria*, or the antherozoid of *Fucus*, is that of a simple naked protoplast, rounding off at about 5 μ diam., with nucleus, suggestions of granular cytoplasm and either a single discoid chloroplast reduced to an eye-spot (*stigma*) only, or associated with such a residual plastid; larger zoïds may contain several chloroplasts. Such a zoïd, though typically possessing autotrophic mechanism, differs in one fundamental respect from a typical flagellate, in that it has lost the power of binary fission and is so far retained wholly for a "reproductive" function. On the other hand, many "Brown Flagellates" are similarly restricted to binary fission in the non-motile "cyst"-stage (cf. *Hydrurus*, *Phæosphæra*, *Phæocapsa*, *Hymenomonas*).

The zoïd is thus to be regarded from the standpoint of the organization of a flagellate, though such details have been as yet but little investigated.

Though generally described as pyriform in shape, with pointed anterior end, the protoplast possesses little in the way of a permanent space-form; when at rest the body rounds off in response to surface-tension; and in the motile stage the pointed end is largely the expression of "metabolic" or "euglenoid" contractility; in this way a 5 μ individual may extend to 7–10 or 12 μ in length, as an elongated zoïd with active movements. The point of insertion of the flagella must be regarded as the "*pole*" of the zoïd; and in such case the direction of the movement implies a change of polarity, of about 90°, from the original condition of the isokont phase with equal distally inserted flagella.

A similar change of polarity obtains in other flagellate phyla, noticeably in many Cryptomonads (cf. *Nephroselmis*), and in the Peridiniaceæ, with a very similar result; and this is undoubtedly correlated with a differentiation in function between the two flagella, as expressed in a reversal of the direction of contractility in one which becomes a *propeller*, while the other remains a *tractor*. With two flagella thus widely divergent, and falling into line at 180° with each other across the axis of antecedent polarity, both act in the same direction, and a new "anterior" end is acquired.

Details of zoïd organization in terms of flagellate construction are still meagre:—

Yamanouchi (1913) for *Zanardinia* described a suggestive chain of granules between the insertion of the flagella and the nucleus, in the manner of a rhizoplast-strand, but decided against any connection between such basal granule and a blepharoplast as a "cell-organ." Retzius (1906), for *Fucus Areschougii* and *F. serratus*, showed the presence of a group of 4 (rarely 5) "Nebenkern"-granules (Mitochondria, Plastochondria) probably of nutritive function, and confused by previous observers with the nucleus (Guignard). Retzius also demonstrated the "end-piece" of the flagella, as a short delicate terminal portion (5 μ long), regarded either as a projecting core (Minchin, p. 52), or as a prolongation of the extreme plasmatic film. Meves (1908) confirmed the presence of plastochondria which might become confluent, and also demonstrated distinct "basal granules" in *Fucus serratus* associated with each flagellum, to be described as "centrioles" (=blepharoplasts), and in direct contact with the nuclear body of the protoplast. According to Meves also the two flagella of *Fucus serratus* grow round the zoïd in the same sense (cf. *Chara*), while according to Retzius they are so exactly in the same line that they appear as practically continuous. Older hypotheses that flagella are formed from a peripheral zone of cytoplasm (Guignard, Yamanouchi, 1913) require to be replaced by the view that they grow outwards from the point indicated by the basal granule, in the manner generally characteristic of flagellates (Minchin, p. 82).

The special feature of the mobile zoïd is its asymmetrical organization as expressed in the "lateral insertion" of the two unequal flagella; and this arrangement, so constant and characteristic, is in marked contrast with the isokont habit of the zoïds of the Chlorophyceæ-Isokontæ and Chrysomonadina-Isokontæ. It may be termed the "*anisokont*" condition.

Of the two flagella one projects forward beyond the pointed anterior end as a *tractor* mechanism; the posterior merely trails behind as a long "steering-oar": to what extent it acts as a definite *propeller* is still obscure. The names "tractor" and "trailer" may be adopted as sufficiently distinctive and concise (Minchin, p. 53). *Isokont* is preferable to *isomastigote*, and *anisokont* to *heteromastigote*: "trailer" is preferable to *gubernaculum* (*cf.* Willey & Hickson in Mastigophora, Lankester's 'Zoology,' i. (1909) p. 158, Minchin, p. 259); Lankester (Enc. Brit., Protozoa) introduced the terms *tractellum* and *pulsellum* respectively, the latter indicating the propeller; and these terms have been retained in works on Protozoa, as Saville Kent (1880), Infu o ia; Minchin, Pıotozoa (1912), p. 52.

On general principles it may be concluded that the asymmetrical habit is secondary, as the transformation of a symmetrical mode of construction; and that the differentiation of two flagella with different functions is secondary to that of the type of the isokont green algæ; the latter may be so far regarded as a more primitive phase of zoïd construction; as in turn the condition of the single anterior tractor-flagellum may be considered to represent the first step in the evolution of such a kinetic mechanism.

Zoïds with a *monokont* organization survive in the case of *Botrydium* (Chlorophyceæ), and among several groups of Brown Flagellates (Chrysomonadina–Monokontæ, Silicoflagellatæ, Coccolithophoridæ, *Hydrurus*; among Fungus phyla in Chytridiaceæ and *Monoblepharis*; in vestigial flagellated Radiolarians, flagellulæ of Mycetozoa, and as reproductive phases in Foraminifera as *Peneroplis*.

The *Isokont* condition is characteristic of Chrysomonadina-Isokontæ

(=Hymenomonadaceæ), Green Algæ, as marine *Codium* and freshwater *Volvox*, etc.; as also as flagellated phases of many Heliozoa, Radiolaria, *Chara*, the Bryophyta, and even *Selaginella*.

The movement of the anterior tractor is always that of a sharp rhythmic contractility in three-dimensional space, working out a movement which would be observed as a *spiral vortex* if the zoïd were still; but being freely suspended in the medium the body is pulled along and at the same time rotated on its axis, while the movements of the tractor appear as a mere undulatory lashing like tha shaking of a rope. Such a mechanism is clearly the expression of a limiting term of economy and precision in swimming, and it is to this that it owes its constancy. It can be only improved by increasing the effective power of the tractor, as by increasing the mass of the contractile plasma, or by adding to the length of the stroke.

The feeblest monokont flagella are usually about one body-length (flagellulæ of Mycetozoa); yet many Cryptomonads are intensely active, with darting action, with flagella relatively no longer (*Chilomonas*).

In megazoïds of the Phæophyceæ efficiency obviously falls off as the flagella are left less than one body-length.

The most efficient are 3–4 body-lengths, though ranging to 4–6 body-lengths with more rounded zoïds (*Dictyota*). Among the Phæophyceæ the finest expressions of the type are found in the Cutleriaceæ (Yamanouchi). Thus:—

Cutleria megazoïd 26μ long, ovoid, anterior flagellum 40μ. *Aglaozonia* zoïd 22·5μ long, ant. flagellum 65μ. *Zanardinia*, zoogonidium 22·5 long, ant. flag. 45μ.

Where the zoïd is enlarged in correlation with phenomena of heterogamy the *relative* dimensions are diminished; and the large oosphere of *Cutleria* with 30 chloroplasts presents an anterior flagellum of 40μ only, or 1·5 body-lengths. It may be noted that 3 body-lengths bears a suggestive relation to the circumference of the zoïd, as one complete turn of the body in ontogeny.

In many more specialized and powerful holozoic flagellates, the tractor-flagellum is distinctly broadened to a band-form. [*Cf.* also *Euglena*, *Cyathomonas*, and animal spermatozoa (Retzius, 1906; Doflein, 1916, p. 38).]

Again, regarded as complex kinetic organs of primary significance involving problems of life and death to the organism, such flagella are the result of long and complex natural selection on pre-existing factors of growth and contractility. Their structure, as presenting a thin film of intensely katabolic contractile plasma apparently investing an axial core of more resistant endoplasm, possibly affords in its minute dimensions (·5 μ diam.) as vivid an idea of the complex nature of living plasma as any other part of the cell; such a structure as the first evolved "member" or "organ" of the cell-soma, projecting far beyond the limit of the main body, must involve a special system of conduction, nutrition, and control, of which little is yet known, but is to be considered from the standpoint of "basal granule," "mitochondria," and "rhizoplast."

The primary function is undoubtedly that of a means of *vertical ascent* for autotrophic photosynthetic pelagic phytoplankton; lateral progression in such a medium is meaningless: but it is obvious that in the case of increasing mass or form-resistance in the body of the protoplast, the vertical motion will become a means of impelling food-particles on to the point of insertion of the tractor; and in the vast series of more dominantly holozoic flagellate organism this becomes the essential mode of "feeding"; such particles being absorbed, ingested, and ultimately digested in an oral depression, cytostome, or gullet, as the "animal" flagellate is more definitely outlined (cf. *Chilomonas*, *Cyathomonas*, Gymnodiniaceæ). No trace of such holozoic nutrition has been observed in any zoïd of the Phæophyceæ; and the utilization of these as non-metabolizing reproductive cells suggests that any such tendency will be further eliminated in their short life-period (as the anterior tractor has been apparently eliminated in Metazoan sperms). For ingestion by Green Algal zoïds *cf.* Pascher, Berichte xxxiii. p. 427.

Secondary increase in volume obtains throughout the group in several series independently, as heterogamy progresses (to define the "female" gamete), as also in the case of the correlated increase of the asexual zoogonidia. In such case the zoïd retains its general attributes; the chloroplasts may be greatly increased in number, and the flagella keep pace to a certain extent; in extreme cases, however, the latter begin to dwindle (*Giffordia virescens*, *Pylaiella fulvescens* Sauvageau *, 1896), and may be apparently wholly lost (*Acinetospora* Bornet †), though euglenoid motility may be retained. In the larger megagametes ("oospheres") no trace of flagellation remains, and the same applies to the correspondingly enlarged tetraspores of *Dictyota* and the "monospore" of *Haplospora*.

Interest also centres in the evidence of distinct *reduction* in the case of the microgamete (antherozoid) in correlation with the differentiation of heterogamy and the relegation of the zoïd to the mere value of a "sperm." Thus in *Fucus serratus*, according to Retzius (1906), the body of the zoïd is practically restricted to an oval nucleus, more or less flattened (Meves), to which the cytoplasm constitutes only a thin film, more exaggerated to form the anterior pointed end. The residual "eye-spot" and the "mitochondrial apparatus" of 4 granules (often merging into one, Meves), whether of cytoplasmic nature or merely physodes (Kylin), so far project from the surface of the plasma-film, and may be even stripped off (Retzius, Biolog. Untersuch. 1906) ‡. The case of *Dictyota* suggests the gradual elimination of the shorter "trailer," reduced to negligible proportions in *Giffordia virescens* and *Pylaiella fulvescens* (less than ½ body-length); and in such case a residual *tractor* is curiously complementary to that of the animal sperm with propeller only. The chloroplast-content is reduced to a vestigial eye-spot (*Fucus*, *Dictyota*, *Laminaria*); and the eye-spot may be pale in

* Sauvageau (1896), Journ. de Bot. p. 185, for *Pylaiella fulvescens*, *Giffordia*, p. 119.

† Bornet (1891), Bull. Soc. Bot. p. 357, for *Acinetospora*.

‡ Retzius compares the mitochondrial mechanism (Nebenkern-system) with that of the sperms of Nemertines and simpler Mollusca of the sea: Biolog. Untersuch. 1906).

colour, giving no carotin-reaction (*Pelvetia*, *Durvillæa*); but in no case can it be said to be wholly eliminated. The function is undoubtedly that of light-perception, while in ontogeny it is always derived from a localized area in a chloroplast (Yamanouchi), and the orange pigment ("carotin") apparently indicates that the cytoplasm must be stimulated by the absorption of violet rays.

The zoïds in no case swim backward (as is normal for an anterior tractor-mechanism); but as they slow down they move in larger to smaller circles as the expression of the loss of steering-power and some sense of direction. Apart from any question of nutrition, the flagellum acts as a tactile sensitive organ; thus in response to stimulus of contact, as in collisions with foreign objects, the zoïd may slightly change it course (*cf.* Jennings, 1904). This sensitiveness is emphasized by "chemotropic" phenomena, and apparently represents the factor of greatest significance in the employment of the zoïd as a "sexual" cell.

Thus in Cutleriaceæ (Yamanouchi) the anterior flagellum is the first to come out of the gametangium, and first makes contact with the other gamete. The spinning of the oospheres of *Fucus* and *Ascophyllum* in fertilization is apparently the expression of the activity of the shorter anterior arm in the antherozoids of these types, when the longer trailer is entangled in the oosphere. In other genera (*Halidrys*, *Himanthalia*) the sperms entangled by the longer driving anterior tractor merely gyrate on the point of contact.

Euglenoid movement is always retained, and the larger zoïds bend and curve, or "nose about," in a very suggestive mouse-like manner, exhibiting contractility all over the body-surface as a general property of the cytoplasm.

Amœboid movements are more rare; but irregular protrusions of pseudopodia-like nature may follow benthic attachment to the substratum in germinating zoïds of *Myrionema*.

Exact data for the *speed* attained are wanting; it would appear that 1–2 ft. per hour is a fair rate for a 7 μ zoïd; but active units do better than this for short distances across the field of the microscope. As seen under the microscope the movements are wholly erratic, like those of a swarm of ants, or mice in a box; and it would be absurd to interpret the motor mechanism only in terms of such observations. Under the low power it is possible to time zoïds along the scale of the micrometer eye-piece; and a moderate estimate for gametes of *Laminaria saccharina* gave 1 mm. in 5 seconds, or over 2 ft. an hour; gametes of *Ectocarpus* are half as quick again. The large zoïds of *Pylaiella fulvescens*, according to Sauvageau, do not move faster than a Diatom. The rate again probably bears a relation to temperature and oxygen-supply, as well as to the condition of the material. Measurements are difficult for longer distances, as the field of the low power is only 2 mm. diam.: Sauvageau records zoïds crossing a 5 mm. drop in about a minute, or approximately a foot an an hour.

Records of the *duration* of the motility are vitiated by observation in water in which a full oxygen-supply is not maintained (as

* Jennings (1904) 'Behaviour of Lower Organisms.'

under a coverslip). "Several hours" is the rule; many swim all day, but none have been checked longer than 24 hours (Yamanouchi, for *Zanardinia*, 1913). In open water there seems to be no reason why zoïds with several chloroplasts might not continue for much longer periods. For the shorter motile phase of more decadent types Sauvageau gives 4–5 minutes for the megazoid of *Giffordia virescens*, and 15 minutes for the microzoïd. In other examples the "megazoïd," only just tumbles out of the gametangium, or is discharged immotile (*Acinetospora*); probably all transitions occur.

From such data it would appear improbable that these zoïds can raise themselves from any great depth; though they do so freely enough in culture vessels, spreading out as a film on the surface (*Cutleria*, *Aglaozonia*).

Monstrosities in zoïd-segregation suggest further points of interest as tending to throw light on the organization of other zoïds. The occurrence of "twin"-zoïds, apparently due to the imperfect separation of protoplast-primordia in the "sporangium" is described for *Pylaiella fulvescens* (Sauvageau) and *Aglaozonia* (Kuckuck). The more aberrant case of a "triplet" zoïd in *Aglaozonia* (Kuckuck, 1899, W. M. K. p. 103) with triangular arrangement of 3 clear "anterior ends," and a single flagellum on two adjacent sides, is of special interest from the standpoint of the suggested flagellated phase of the Diatom *Biddulphia mobiliensis* (Bergon, 1907, Bull. Soc. Bot. p. 348), in which a protoplast is figured with 3 "flagella" at three angles.

Several phyla of the Phæophyceæ are distinguished by distinct variants on the type. In Phæosporeæ the zoïd is typically ovoid, with distinctly-pointed anterior end, and two flagella inserted laterally near the pointed anterior end: the anterior (tractor) flagellum is 2–3 (or 4) body-lengths, and the trailer short (one body-length). Throughout the Laminariaceæ and Cutleriaceæ the same type prevails; but among the more advanced Fucoids of the *Cystoseira*-alliance the antherozoid is more rounded, and often shows no pointed end at all; the anterior flagellum is still long (2–4 body-lengths). Among the Fuceæ, in the stricter sense, a more specialized zoïd is characteristic, with a slender bottle-shaped form and a sharp-pointed beak; the anterior flagellum is now the shorter ($1\frac{1}{2}$–2 body-lengths) with stout basal portion, and the posterior as a long trailing steering-oar is $2\frac{1}{2}$–3 body-lengths. *Pelvetia* has the shortest working-arm (1 length), and the movements are more jerky than those of *Fucus*, the zoïds of which show a straight gliding movement. The pattern with the boring tip is characteristic of the littoral forms (*Fucus*, *Pelvetia*, *Ascophyllum*), and it would appear that the forms with more advanced oogamy (*Cystoseira*, *Himanthalia*, *Sargassum*) are tending to further decadence of the flagellated phase in the case of the microgamete, as is certainly the case in the advanced series of the Dictyotaceæ.

It may be concluded that, evolved as a somatic organ in an active plankton-phase, now reduced to a rejuvenated zoïd, the flagella had no original value for lateral progression; but the inherited mechanism on hand suffices to bring the protoplast into close contact with a fellow-gamete at short range, as soon as these come within the scope of a "chemotactic" or agglutinating influence (*Fucus*); but in a violently agitated medium (as on a rocky shore) the flagella are of little value, and tend to be reduced (Reef-pool forms, Dictyotaceæ), as they have been with ultimate complete loss in Florideæ; on the other hand, in perfectly still water, it is evident that their motility will remain the only agency of sexual approximation, and they may prove increasingly useful, and so tend to become greatly exaggerated (as in *Chara* and *Sphagnum*), though always remaining distinct in their inherited attributes from the spermatozoa of the animal phyla (Metazoa).

Literature.

Guignard (1889), Revue Gén. p. 145.

Kuckuck (1901), Wiss. Meeres. Kiel. p. 177.

Yamanouchi (1909), Bot. Gaz. *Fucus*; (1913), *Zanardinia*.

Kylin (1916), Berichte, xxxiv.

Retzius (1906), Archiv. för Bot. v. 10; Biolog. Untersuch. xiii. (1906) p. 95.

Meves (1918), Archiv. Mikrosk. Anat. p. 274.

Minchin (1912), Protozoa, pp. 52, 82, 84.

Doflein (1916), Protozoenkunde, p. 30.

Sept. 1918.

THE PLANKTON-PHASE AND PLANKTON-RATE.

By A. H. Church.

The term Plankton, proposed by Victor Hensen of Kiel (1887), for the floating population of the sea (πλάγκτος=roaming; *i. e.*, in a moving medium, not merely passively suspended) was established by the classical researches of the Plankton-Expedition of the Steamship 'National' (1889), published in many volumes from 1892 on, as representing a fundamental conception of the greatest biological significance, though still very inadequately recognized by botanists in this country. Like other satisfactory and picturesque terms the word has been much abused by lesser lights, and diverted from its original intention in marine biology, more particularly by land-botanists. A subject of primarily pelagic interest has been degraded to the paltry notion of the "Limnoplankton" of a pond, the "Saproplankton" of dirty water, and to such curious expressions as the "Cryoplankton" of algæ found on snow (Warming); while a similar analogy might suggest "Dendroplankton" for *Pleurococcus* living on the bark of a tree, or for Diatoms on the leaves of a tropical rain-forest. Though such usage may be justified in a minor degree when the true significance of the word is fully understood, such subsidiary variants must not be allowed to obscure the original meaning of the term, and the almost infinite magnitude of the problems it covers. A certain amount of perspective may be demanded; otherwise, as Bunthorne would say, we look for oceans and find puddles.

A preliminary idea of the subject may be gained by the consideration of the sea as seen in summer from any headland on the British coast, or by watching the breakers rolling in as apparently mere blocks of water, and remembering that every drop of these seas contains at least one living organism, and that the amount of water in sight, within the range of only a few miles, is but an insignificant fraction of the Narrow Seas for which the same generalization would hold. The organisms being fewer in bottom water, beyond 10 fathoms, but many more at the surface; a "drop" of water being taken as $\frac{1}{20}$ c.c., and containing 50 c.mm.

The term Plankton, again, originally understood as including anything taken by Hensen's vertically hauled hoop-net, with aperture of one square metre, and constructed of fine bolting-silk, the open meshes of which are 40–50 μ diam., is again somewhat vague, since larger organisms may evade the net, and the smallest, often in the majority, may slip through; hence net-observations afford only a rough idea, and the centrifuge (Gran), and filters (Lohmann), or actual cultures (Allen) have been employed for finer work. But the extension of the term to "Macrophytoplankton" for floating Angiosperms, or to material which might in the limit include a dead whale or the Sargasso-weed, is clearly beyond the original intention of the term; and such innovations as "Seston" (Kolkwitz) to include inorganic detritus, only tend to obscure the main issue. The word in its original sense involved a *physiological* rather than a morphological conception, and relates to the problem of the food-supply of the sea; and it is in this sense of "primary food-supply," the base of the "marine pyramid of life in the sea," that the word should be always considered, and its meaning further limited as required; the spirit of the expression being more significant than the letter. Thus, omitting smaller fishes, Salpæ, Medusæ, Fish-ova, Copepods, Nauplii, and other larval forms, and everything holozoic that lives by eating somebody or something else, the expression really reduces to the suspended *autotrophic vegetation* of the sea, on which ultimately the great mass of heterotrophic life depends; and whatever connotation be given the term in zoological work, the botanical sense is perfectly clear and defined, as the subject is essentially a botanical one. The word reduces, according to Hensen's original conception, to the *free unicellular forms of plant-life, maintained in suspension in pelagic water*; any extension to such forms living anywhere else is purely metaphorical and secondary; while its application to animal forms, eating the plants and each other, represents an equally secondary and crude application in another direction; a convenient convention so long as all the forms are captured together, and by the same methods. The difficulty is increased by the fact that in many cases it is still vague to what extent nutrition may be dominantly holophytic or holozoic: thus, the vast bulk of pelagic phytoplankton consists of Diatoms; to a lesser extent, under conditions usually of diluted sea-water, of Cyanophyceæ, and to a considerable extent of Peridiniaceæ aud Gymnodiniaceæ, all more or less holozoic; as also of Flagellate races as Brown Chrysomonads, Coccolithophoridæ, Cryptomonads, and green Chloromonads, the majority of which are probably at least as much holozoic as holophytic.

The amount of plankton-life possible in sea-water is almost incredible, since it is invisible to the eye except in special cases, as when the colour of the water is affected. Thus Gran records the water of Christiania Fjord (1911) as showing a milky tint with *Pontosphæra Huxleyi* (a Coccosphere), at the rate of 5–6 millions per litre. Moseley (1879, p. 566) on the 'Challenger' describes the water of Arafura Sea, supplied by the large rivers of New Guinea, as brown and smelling like a stagnant pond with *Trichodesmium* (Cyanophyceæ); the "black-water" of the Arctic Seas, the haunt of the Right Whale, for stretches of 50–100 miles, may be deep black and opaque, or again grass-green, apparently mainly due to Diatoms (Robert Brown); Peridiniaceæ, as *Gonyaulax*, may turn the sea to blood (Bombay, California, Australia), killing the fish by removal of free oxygen (Carter, McClendon). As a rule, maximum plankton-content occurs where coastal waters bringing salts and land-débris meet thoroughly aerated and relatively bacteria-free oceanic water, and the deep blue of the ocean is characterized by a poor flora and fauna. Thus the green water of the North Sea is richer than the Atlantic, and the summer-heated, shallow and silty Baltic, more than half-fresh, supplies the richest plankton known. The detailed observations of Lohmann (1908) for the highly nutritive water of Kiel Bay afford the standard for further investigation, and are sufficiently thorough to give a very comprehensive view of the relation of plant and animal forms, as also their seasonal periodicity. For example, maximum monthly averages give:—*Skeletonema costatum* in June at 2,460,000 per litre; all other Diatoms 20,000 per litre; Green Flagellates (July) 146,800 per litre; Peridiniaceæ (July) 382,000 per litre; or taking all presumed autotrophic organism, over *two millions* per litre in May, over two and a half millions in June, and over half a million in July. Taking a litre as a million c.mm., a million per litre means 50 in a "drop." Lebour, for Plymouth (1917), gives total Diatoms in April as 40,000 per litre, or 2 per drop, and the June crop of Peridiniaceæ as 1000 per litre; though in this case the smaller and more naked organisms are probably wholly lost. The consideration of Bacteria may be omitted, as these must be considered heterotrophic; but immense numbers of algal zoospores, or units even of the 100 μ standard of *Fucus* oospheres, are again apparently irrecoverable. Special interest attaches to recent observations by cultural methods (Allen, 1919), since these ignore the question of heterotrophic Bacteria, all purely holozoic forms, as also holozoic Peridiniaceæ; these last rapidly die on removal from open water, and the organisms which will grow are practically restricted to holophytic Diatoms and a few Brown Flagellates, etc. The number of such recognizably holophytic plankton-forms is given as at least 464,000 per litre, or 464 per c.c., about 23 per drop, with the suggested possibility of there being really *a million per litre*. In this case, control observations by centrifuge-methods gave a total estimate of only 14,450 per litre and thus illustrated their imperfection (M. B. A., Plymouth, Sept. 1918). In view of such data, it may be pointed out that we are still far from knowing the limit of living organism in the sea, or what may be the material on which minute flagellates and Peridines feed.

The recognition of the primary autotrophic nature of phytoplankton, again presents a greater botanical interest, in that, putting all holozoic races on one side as of secondary importance, the problem of Plankton enters on another stage as representing an older condition of life in the sea conceived as a "Plankton-Epoch," before the evolution of any benthic life had been rendered possible by the rise of the sea-bottom to within a distance of 100–50 fathoms from the surface. This may be regarded as the expression of the first stage of biological life on this world, as existing, and in fact evolved, in the surface-water of the primal universal ocean, directly from the sea-water itself. The conception of Plankton thus acquires a *Phyletic* significance; and this Plankton-Epoch, including a period of indefinite millions of years, in which living organism acquired the morphological and physiological organization of what is now known as the "cell" from nothing at all but ionized sea-water,—once universal and the highest expression of living organism—is now represented in the sea by residual races, more or less isolated and specialized, or vestigial, which may be said to survive in the "Plankton-Phase"; though higher forms of life have passed on to successively higher stages with the introduction of the physical factors of sea-bottom and dry land. It is, in fact, from such races that we have to build up our conception of what the sea has done for living organism, or what the latter really is in terms of sea-water; while higher organisms may continually revert to similar conditions of life, or pass through such recapitulatory stages in their Life-History. In other words they may retain a Plankton-Phase in the Life-Cycle. The ova and spermatozoa of higher Metazoa thus represent a return to the ancestral condition of a preceding suspended Plankton-organization; as do also the zoïds both asexual and gamete, mobile and immobile, of marine algæ. Even the highest animals retain in their spermatozoa the evidence of their plankton-origin as marine flagellates, and acquire in this phase a "plankton-value" (Prenant); only in most specialized types of land-vegetation (Siphonogamic Phanerogams and a few Fungi) does the sexual process, itself a plankton-mechanism, eliminate all direct evidence of its marine origin.

A purely empirical estimate of the autotrophic plankton of the sea, based on the observations of Lohmann (Kiel, 1908), suggests the possibility of visualizing a fair average plankton-rate as expressed by the amount of cytoplasm in one million zoïds per litre; taking a zoïd of 5 μ diam. ("rounded off"), with approximate volume of 100 c. μ as a standard. Such a value would be probably regarded as liberal for the English Channel, as bearing reference to the primary autotrophic organism, more particularly Diatoms and zoospores on which more holozoic organisms depend; though little is yet known of the zoïd life of the sea, or of anything conceivably still smaller; since there is so far no known method of collecting living organism of fluid plasma, no denser than milk, and held more or less in spherical form merely by the operation of surface-tension; the same applies to all algal reproductive cells, from the great oospheres of *Himanthalia*, 300 μ diam., and visible to the naked eye, to the smaller zoïds of 5 μ, or so, continually emitted by the Green and Brown Algæ. With such a convenient unit, for example, it may be possible to express a Laminarian producing 300,000 million zoïds (*Saccorhiza*) as approximately equivalent to the plankton of 300 cubic metres of sea-water; or to give a corresponding plankton-value to a fish, based on the number and volume of its ova or spermatozoa. In this way benthic organisms may be compared with plankton-phases, and with each other. Thus taking an estimate of 7 million ova at 1·39 mm. diam. (Masterman, p. 236), a spawning cod of the same weight as the seaweed may be possibly regarded as returning plankton to 100,000 cubic metres, or 100 million litres of sea-water; though data from the spermatozoa would be probably more reliable, as representing cytoplasm rather than food-material and oil, the idea is sufficient for present purposes, and may be compared with an estimate for such a fish in terms of 12,500 sq. metres of surface-area for the North Sea (Johnstone, p. 171). Such a method of visualizing the reproductive output of an organism is again of interest as enabling some sort of rough comparison to be established in the case of the later developments of Land-Flora. The return of benthic organism to the flagellated plankton-phase clearly expresses the wastage of the reproductive processes, as included under "fertilization" and "dispersal"; while the further control and economy of such wastage becomes at once the aim and mark of higher organization, *i. e.* organism. The wastage of a *Saccorhiza* in a plankton-phase, to the extent of 300,000 million or more of 5 μ zoïds, is the expression of the cost of the race to the individual. The increasing intensity of the incidence of wastage in the case of emergent Land Flora is simply expressed by the fact that in the common Fern, *Aspidium Filix-mas* of to-day, the spore output of a single plant may be estimated at 500–1000 million of air-borne spores of 50 μ diam., or each 1000 times the volume of the Phæophycean zoïd; while the spore-output of a single staminate strobilus of *Araucaria brasiliensis*, of 1000 stamens, has been estimated at ten million spores of 50 μ diam. (Burlinghame, 1913). Such air-borne spores are, it is true, no longer plankton, but they are the lineal descendants of the immobile "tetraspores" of benthic seaweeds, in which flagellation has been suppressed in correlation with increasing bulk.

A little consideration, again, suggests that such a plankton-rate, of a million per litre, is one per cubic millimetre, and a volume of 100 c. μ in 1,000,000,000 c. μ is *one in ten million* (taking volumes as approximately equivalent as densities). The generalization that a fair plankton-rate may be approximately equal to the ionization of the H_2O only, is sufficiently striking, although the two phenomena have clearly no causal relation; since the mass of the water affords a practically infinite source for the production of further $H^{\cdot}$, OH' ions, if any be removed; while the limiting factor for the amount of life in the sea has been very generally accepted as due to the scarcity of ions of Nitrogen and Phosphorus. Hence in coastal waters, or in the enclosed shallow Baltic, the plankton-rate rises considerably as compared with the English Channel, Mediterranean, or open Atlantic. The Sargasso Sea affords an interesting case:—the Gulf-Weed vegetating as a sparse crop in the surface-water possibly takes the greater part of the available N and P ions, giving nothing back directly, as it is wholly sterile, and dead plants sink in two miles of water; hence there is little scope for other autotrophic life, and beyond the hosts of small animals feeding on the weed and on each other, the Sargasso Sea is conspicuously sterile. [Total Plankton-rate 5000 per litre, plant-cells, all sorts, including Peridines (Murray and Hjort, p. 365) net-results only, admittedly imperfect and much too low; while there is no strict justification for regarding the *Sargassum* as more intensely proteid-metabolizing than the autotrophic plankton.]

The fundamental factors which determine the amount of plankton-life the sea can carry remains still extremely obscure; as previously indicated, the supply of N and P ions has been put forward (Brandt's Hypothesis, 1902) as constituting a limiting factor for autotrophic organism; for holozoic organism food and the amount of available oxygen are obviously significant, and for Bacteria also the amount of special "food-material" to be metabolized. Zoologists have shown a tendency to assume that the amount of holozoic organism must be limited by the toxic effect of nitrogenous waste and excreta (Johnstone, p. 286); but the botanist is not sensitive on these points; there is no evidence of nitrogenous waste in the plant; the membranes are apparently solely of polysaccharide excreta; chitin is rare, and may be probably taken as evidence of heterotrophic nutrition (Peridines). *All primary life in the sea must be considered as autotrophic*; the animal life dependent on it need not be taken into consideration at all. So far as the plant is concerned this "Mean Plankton-rate" may be taken as a rough basis of comparison, and a convenient unit to remember; and thus without necessarily implying that such a rate bears reference to the total autotrophic plankton of sea-water, it may still be used as a fair average unit of comparison in the case of each organism separately; since in the case of either the benthic fish or the benthic sea-weed, the plankton return is localized and subject to infinite dilution in the moving medium; while in the case of free pelagic plankton-forms the complex relations of physical conditions imply that only a few types are dominant at any particular period. It is interesting to compare Lohmann's maximum rate for Kiel Bay, given by the Diatom *Skeletonema costatum* (at 5 fathoms in August), with an average of 9 millions per litre, or approximately 10 per cubic millimetre; assuming a volume of 150 c. μ (Lohmann, p. 241), this implies a total plankton-rate practically 15 times that of the mean. Lohmann (*loc. cit.*, p. 351) also gives the maximum plankton-yield for all "plants" (autotrophic, and including all pigmented flagellates) in August, as equivalent to a volume of 105·4 c.mm. per 100 litres; *i. e.* 1·054 c.mm. per litre, or one part in a million, as an average rate 10 times the above mean. For *Ceratium tripos*, with an estimated volume of 100,000 c. μ (Lohmann), the plankton-rate would work out as 1000 per litre,—the maximum given for all Peridines at Plymouth (June; Lebour, p. 153); while Lohmann (p. 276) for Kiel, gives the plankton-rate of *C. tripos* (var. *balticum*) as 4 per litre in winter, rising to a maximum average of 4590 per litre in August, and the maximum range as 13,000 per litre (November, at 5 fathoms), thus agreeing with a value 13 times the suggested mean. An estimate for heterotrophic Bacteria in London sewage of only 5 millions per c.c. = 5000 millions per litre, or 5000 per c.mm.; and assuming a volume of 5 c. μ, this works out at 100 times the mean plankton-rate, and the estimate may be doubled. The plankton-rate of Yeast may be on a similar footing, as also that of hemi-holozoic *Euglena* in manure-water; these being like Bacteria special cases of heterotrophic nutrition dependent on elaborated organic food-supply other than ions of simple salts. For example, a laboratory culture of the apparently holozoic Cryptomonad *Chilomonas*, living as "Sapro-plankton" in pool-water, gave an estimated content of 4000 per "drop," or about 80 millions per litre. Taking this large flagellate as of approximate volume of 1000 c. μ, the plankton-rate would work out as 2400 times that of the suggested mean rate; such a culture again remained healthy and intensely active for several months without any indication of toxic effects, while surface-aggregation might represent a rate of 40,000 per drop.

Observations by Raben (1910, p. 310) give the total Nitrogen-content of the sea (Mediterranean and North Sea) as something between ·1 and ·2 mg. per litre (rarely exceeding ·2), or ·0001 g. per litre = 1–2 parts in ten millions also; a very similar result was given by Raben for the Phosphorus-content (as P_2O_5), at ·14 mg. per litre; though according to Matthews the amount in the English Channel (Plymouth, 1918) is much less, or ·06 mg. per litre in winter (maximum), and ·01 mg. as the spring minimum, or as little as one part in a hundred millions. There is nothing to show that plant-organism can exhaust all the available N and P ions in the solution; and it may be noted that all such estimations have to be made in the case of water already occupied by living plankton; while a considerable source of error must exist in the large amount of dead and decaying or macerating débris of plasmatic organism which apparently appears in analyses as "organic" nitrogen and "organic" phosphorus (Matthews). Thus according to Raben the nitrogen value rises in summer, as if from the greater death-rate at a higher temperature; and though Matthews accords a higher phosphorus value in winter, it may be pointed out that his results for water taken near the sewage outfall of a large town, presumably supplying enormous quantities of microcosmic salt, give only ·06 mg. per litre, suggesting that excess phosphorus compounds are rapidly precipitated as insoluble phosphates. From an interesting table of analyses for various marine invertebrates (Delff, 1912), it may be taken as a general estimate that the water-content of such organism varies from 70–90 %, the nitrogen-content (N) from 5–10 %, and the phosphorus-content (P_2O_5) as about $\frac{1}{6}$th of the nitrogen value. This may be probably taken as an approximate estimate for animal cytoplasm with little waste; and though plants with accumulated polysaccharide débris would give a much lower rate for nitrogen, of possibly only a third of this value (Brandt, 1898, p. 58); it may be also taken as approximately correct for zoospores and mobile naked flagellates. With the sea containing nitrogen ions at about one in ten millions, and plankton at the mean rate also of one in ten millions, it would appear that the plankton of a litre would not cover more than $\frac{1}{5}$–$\frac{1}{10}$ of the available nitrogen. In such case it is interesting to compare the figures of Lohmann for total autotrophic plankton (including Peridines) already given as suggesting an approximation to the nitrogen limit, as also the later figures of Allen (1919) for a suggested million of autotrophic organisms per litre (Diatoms, etc.), many of which may be several times larger than the hypothecated 5 μ zoïd; but the subject is again confused by the fact that we are still ignorant of the actual cyptoplasmic value of a Diatom, as compared with the "volume" of its vacuolated "cyst"-stage. Though the scarcity of Nitrogen ions is not definitely established as a limiting factor for pelagic life, the fact emerges that the actual quantities of living material and the more essential ions of the medium are in a state of somewhat comparable spatial tenuity. Although again clearly of no very exact scientific value at present, such considerations are justified as affording a general idea of the conditions under which living organism has been evolved in the aqueous phase of the sea; and the suggested "mean plankton-rate" may be useful in establishing some general basis for the consideration of the economy of the phyto-plankton and phytobenthon of the British coasts.

General Literature.

Hensen, Kiel (1887), Wiss. Untersuch. Deutsch. Meere, v., vi.

Plankton-Expedition der Humboldt-Stiftung (1889). Reports, 1892, *et seq.*

Warming (1909), 'Ecology of Plants,' pp. 161, 163.

Murray & Hjort (1912), 'Depths of the Ocean' (' Michael Sars' Exped.), p. 15.

Lohmann (1908), Wiss. Meeres. Unters. Kiel, pp. 252, 244.

Gran, in Murray & Hjort (1912), pp. 307, 332.

Gran (1915), "Plankton Production," Bulletin Planktonique, 1912.

Moseley (1879), "Naturalist on the 'Challenger,'" p. 566.

Carter, in Saville Kent's 'Infusoria' (1880), i. p. 450; Ann. Nat. Hist. (1858).

McClendon (1918), Tortugas Lab. p. 234.

Allen (1919), M. B. A. Journal, Plymouth, "Quantitative Study of Plankton."

Brandt (1902), W. M. K. p. 25.

Raben (1910), W. M. K. xi. p. 310.

Delff (1912), W. M. Kiel, xiv. p. 70.

Johnstone (1908), 'Conditions of Life in the Sea,' pp. 170, 190.

' Journal of Ecology' (1913), ii. p. 177.

Lebour (1917), M. B. A. Journal, "Microplankton of Plymouth Sound," pp. 141, 153.

Robert Brown (1868), Q. J. M. S. p. 242.

Matthews (1918), M. B. A. Journal, p. 257; (1916), p. 129.

Herdman (1918), J. L. S. p. 173, "Diatoms in the Irish Sea."

Masterman (1897), 'British Food-Fishes,' p. 238.

Kolkwitz (1912), 'Berichte,' xxx. p. 341.

Prenant (1915), 'L'année Biologique,' p. lxvii. "Les appareils ciliares et leurs dérivés."

Wilhemi (1917), 'Archiv für Hydrobiologie,' "Plankton und Tripton," p. 145, for over 40 sub-varieties of Plankton.