

BOTANY.

CRYPTOGAMS.

Pteridophyta.

(By A. GEPP, M.A., F.L.S.)

New Goniopteris from Middle Eocene.*—E. W. Berry describes a new species of fossil *Goniopteris*, from the Middle Eocene, giving it the name *G. claiborniana*; it occurs rather commonly in some Tertiary clays of Louisiana and Mississippi. He discusses the venation of the typical pinnæ with care, and points out the differences to be found in pinnæ with shallow and deep lobulation of the margin respectively.

Lycopodiaceæ of Sweden.†—H. V. Rosendahl publishes a systematic account of the Lycopodiaceæ of Sweden, with diagnoses of all the varieties and forms, several of which are new to science, and illustrates most of them with photographs. *Lycopodium alpinum* has one variety; *L. annotinum* three vars. and twelve forms; *L. clavatum* three vars. and eleven forms; *L. complanatum* one sub-species and eleven forms; *L. inundatum* one var. and one form; *L. Selago* six vars.; *Isoetes lacustris* four vars. and five sub-vars.

Bryophyta.

(By A. GEPP.)

Development of Archegonium in Catharinea.‡—G. S. Bryan gives an account of the development of the archegonium of *Catherinea angustata* Brid., with special reference to the origin of the canal row in mosses, since, as he shows, the views of previous authors are very contradictory. The summary of his results is as follows:—1. The archegonia of *C. angustata* begin to develop in April. 2. The first-formed archegonium arises from the apical cell region, but whether from the apical cell itself or from one of its immediate segments must be determined later. 3. In the earlier stages of development the young archegonium is formed by the activity of an apical cell with two cutting faces, producing a filament of a few cells. 4. The archegonium proper is initiated by the appearance in the terminal cell of three oblique walls,

* Bull. Torrey Bot. Club, xliv. (1917) pp. 331-5 (1 pl.).

† Svepsk. Bot. Tidskrift, xi. (1917) pp. 39-59 (figs.).

‡ Bot. Gaz., lxiv. (1917) pp. 1-20 (8 pls. and 1 fig.).

cutting off three peripheral segments and originating the primary axial cell within, which on division gives rise to the cover cell and the central cell. 5. The central cell on division forms the primary neck canal cell and the ventral cell. 6. The cover cell is active for a time, cutting off peripheral segments for the outer cells of the neck and basal initials for the canal row. 7. The number of basal initials varies, but is at least three in *C. undulata*. 8. The cells of the canal row and the peripheral cells of the neck grow by intercalary divisions, and in any order. 9. The major growth of the archegonium is intercalary. 10. The cells of the neck canal row have a double origin. The lower are formed by the intercalary divisions of the primary neck canal cell; the upper through the intercalary divisions of the three or more initials cut from the base of the cover cell. 11. The ventral cell divides relatively early into ventral canal cell and egg. 12. The ventral canal cell is variable in size. 13. The mature archegonium has usually more than fifty neck canal cells, and may contain as many as eighty-six. 14. The canal row is generally multiple in its upper part, and occasionally throughout. 15. The disintegration of the canal row is acropetal, but does not involve the ventral canal cell. 16. If the number of neck canal cells is an indication of primitiveness, the most advanced group of the mosses (Polytrichaceæ) has the most primitive archegonium yet described among the Bryophyta.

Spermatogenesis of *Polytrichum juniperinum*.*—C. E. Allen, having previously described the "Cell-structure, Growth, and Division in the Antheridia of *Polytrichum juniperinum*"† as far as the formation of the androcyte mother-cells, now treats of the metamorphosis of the androcytes into antherozoids. 1. Each newly formed androcyte contains a small rounded blepharoplast which behaves like a centrosome in the division of the androcyte mother-cell, and is situated where recently was a spindle pole. 2. This blepharoplast elongates, places itself in contact with the plasma membrane, and ultimately forms a long, peripherally placed, curved cord; and two long cilia grow out from it, being attached to it a little behind its anterior end. 3. The nucleus moves into contact with the blepharoplast and stretches out alongside it. The blepharoplast ultimately becomes indistinguishable from the nucleus, save at its projecting anterior end. The nucleus becomes a long, slender, coiled, finally homogeneous body, of about one and a half turns; and with the blepharoplast it seems to constitute the whole antherozoid. 4. When the blepharoplast begins to elongate, a large spherical body, the limosphere, appears, variously situated in the cytoplasm; and soon it approaches the anterior end of the blepharoplast. It then divides unequally, the smaller portion becoming the apical body, and the larger remaining unchanged and retaining the name of the limosphere. 5. The apical body long remains in evidence, but does not appear to form part of the antherozoid. 6. The limosphere becomes placed in contact with the posterior portion of the nucleus, and persists in the cytoplasm until

* Ann. Bot., xxxi. (1917) pp. 269-91 (2 pls.).

† Arch. f. Zellforsch., viii. (1912) p. 121.

the antherozoid is mature. 7. During certain stages another conspicuous cytoplasmic body, called the *percnosome*, because of its staining properties, seems to be regularly present. It is probably identical with a smaller granule which is generally recognizable both at an earlier and at a later period. This smaller body sometimes lies in a rather large vacuole. 8. At this time the androcyte is approximately spherical, but becomes lenticular as the cytoplasm decreases. Part of the cytoplasm with the limosphere remains included within the curve of the posterior end of the mature antherozoid. 9. The walls that separate the androcytes become dissolved. The mature antherozoid lies in a vesicle which, as the contents ooze out of the antheridium, *appears* to be bounded by a distinct outline, though in fixed material no trace of such a membrane is to be found at this late stage. The separate vesicles are imbedded in a viscous substance which probably is derived from the material of the broken-down walls.

Illustrated Key to Ditrichaceæ.*—T. C. Frye publishes an illustrated key to the Ditrichaceæ of America west of the Rocky Mountains between Mexico and the Arctic Ocean. The number of species concerned is sixteen, half of which belong to *Ditrichum*. The other five genera are *Pleuridium*, *Swartzia*, *Trichodon*, *Ceratodon*, *Saelania*. Figures are given of the leaf-structure of each species and of the peristome characters. The keys provide for the determination of both genus and species, whether fertile or sterile.

Tasmanian Hepaticæ.†—L. Rodway publishes a systematic account of the Tasmanian Hepaticæ, which, issued separately, provides a handbook to this group of plants. Descriptions of all the orders, families, genera and species are given; and, by the insertion of keys to the genera and species, the determination of specimens is much facilitated. The number of species approaches 300, which means a very rich flora.

New Tasmanian Bryophyta.‡—L. Rodway describes some additions to the Bryophyte flora of Tasmania, namely, three mosses and nine Hepaticæ. Ten of these are new to science, as also probably is the moss referred to *Blindia acuta*, for it differs from the type in its leaf-structure. The nine new Hepaticæ represent eight genera.

Philippine Mosses.—R. S. Williams publishes a list of 240 mosses collected by him in 1903-5 in the Philippine Islands, Luzon and Mindanao. These fall into 118 genera. The author gives descriptions of 27 new species and three new genera, the structure of some of which is figured in the plates. The new genera are *Rhabdoweisiella*, *Pseudopohlia*, and *Stereodontopsis*.

* Bryologist, xx. (1917) pp. 49-60 (16 figs.).

† Proc. Roy. Soc. Tasmania for 1916 (Hobart, 1917) pp. 51-143.

‡ Proc. Roy. Soc. Tasmania for 1916 (Hobart, 1917) pp. 44-7.

§ Bull. New York Bot. Gard., viii. (1917) pp. 331-78 (4 pls.).

Thallophyta.

Algæ.

(By MRS. E. S. GEPP.)

New Epiphytic Flagellates.*—J. Pavillard describes two new Flagellates, epiphytic on pelagic diatoms. One, *Solenicola setigera*, is the type of a new genus, and has been described, though without a name, by Gran in 1902, and by Mangin in 1913. It is epiphytic on *Dactyliosolen*. The organism is described in detail. The genus *Solenicola* is most closely allied to *Oikomonas*. The second flagellate is *Bicæca mediterranea* Pav., and was found plentifully on *Cerataulina Bergonii*, *Chaetoceros anastomosans*, *Nitzschia seriata*, and *Skeletonema costatum*.

Australian Fresh-water Plankton.†—G. I. Playfair publishes a list of Fresh-water Phytoplankton (Protococcoideæ) which has been collected at intervals during the past ten years from the suburbs of Sydney, and from the neighbourhood of Lismore on the Richmond river. A few records are also included from still earlier up-country gatherings at Collector, and from certain samples which have been received from places outside the State of New South Wales. The author revises also the nomenclature of some of the plankton-forms noted in "Plankton of the Sydney Water-Supply."‡ The term plankton has been taken in a wide sense to include material found floating in the water of river, lake, lagoon, or pond, or shaken out of weeds in some depth of water. One new genus is described, *Bernardia*, which contains two species formerly included in *Lagerheimia*. The new species number eighteen, and the new varieties thirty-seven. Critical notes are appended to many of the records.

Pelagic Diatoms of the Gulf of Lyons.§—J. Pavillard publishes some researches on the pelagic diatoms of the Gulf of Lyons, and gives a list of the species recorded. He adds interesting general observations on epiphytism in pelagic diatoms, and the general aspect and periodic evolution of diatomaceous plankton, with useful biological notes.

Mastigocladus laminosus.||—L. Buscalioni has investigated the ramification of *Mastigocladus laminosus*, collected at the Baths of Valdieri. He reviews and criticizes the work of Prof. Borzi on the subject in his studies on Myxophyceæ, and then describes his own results, which he summarizes as follows:—*M. laminosus* possesses both true and spurious ramification. The former, however, in consequence of cellular dislocation arising during the formation of branches and flagella, often

* Comptes Rendus, cxliii. (1916) pp. 65–8 (figs.).

† Proc. Linn. Soc. New South Wales., xli. (1917) pp. 823–52 (4 pls.).

‡ Proc. Linn. Soc. New South Wales, 1913, pp. 512–52.

§ Trav. Inst. Bot. Univ., Montpellier et Stat. Zool., Cette sér. mixt. Mém. 5 (1916) 63 pp. (2 pls. and 5 figs.).

|| Malpighia, xxviii. (1917) pp. 83–96.

pass over into the latter, which are much more rare than would appear at first sight. The true nature of the branches reveals itself for the most part only in the earliest stages of their evolution. The flagella which result from them consist of a single filament of cells or, at the base, two rows of united cells, neither of which must be considered as an abortive branch.

Sexuality of *Spirogyra*.*—B. Cunningham discusses the question of sexuality in *Spirogyra*, and comes to the following conclusions: 1. Bisexuality of the filament does occur in certain species of *Spirogyra*, but not necessarily in all species. 2. Reduction may occur in the zygote, in which case a filament wholly of one sex arises, or reduction may occur just previous to reproduction, in which case none of the nuclei degenerates, and filaments of a bisexual nature are produced, which would conjugate either laterally or by cross-conjugation. 3. Cell-division may take place subsequent to reduction, some cases showing three divisions, and this is an essential difference between lateral and cross-conjugation, since the latter may continue cell-division after reduction is complete, but the former apparently does not. 4. The filament of *Spirogyra*, in the species examined and in those with lateral conjugation, is homologous with the sporophyte of higher plants. The species examined showed some of the characteristics of *S. inflata*, but differed from it in certain particulars. It may therefore be a new species.

Dictyosiphon fœniculaceus.†—C. Sauvageau writes on a new type of alternation of generations in Brown Algæ, as exemplified by *Dictyosiphon fœniculaceus*. More than forty years ago Areschoug described a conjugation between germinations of zoospores in *D. hippuroides*, but his work has never been either confirmed or contradicted. The material of *D. fœniculaceus* for the present research was sent by M. Corbière from Cherbourg to the author in September 1916, and he then started some cultures. Some of the filaments fruited after more than five months of culture, at the end of February, and these were the gametophyte of *Dictyosiphon*. Dehiscence takes place at all hours of the day. The zoospores, about $7\ \mu$ by $4\ \mu$, having a single chromatophore and a red spot at the insertion of the cilia, become fixed on the side opposite to the window, and round themselves off with a diameter of about $4.5\text{--}5\ \mu$. The germination of the embryospores is general and almost immediate. Twenty-four hours later a creeping tube is produced, one to three times as long as the diameter, and $2\ \mu$ wide. This prothallus elongates rapidly; after three days it has already one or two cross-walls. At no period does conjugation take place, as described by Areschoug. Three weeks later the prothallus measures $100\text{--}300\ \mu$, and it has emitted here and there creeping branches in various directions. Some of its cells are long and slender, others are short and stumpy. The embryospore remains distinct, or enlarges and produces a branch. Growth and ramification continue, and towards the fifth week there appear long sessile colourless hairs, $3\text{--}4\ \mu$ wide. The

* Bot. Gaz., lxiii. (1917) pp. 486-500 (3 pls.).

† Comptes Rendus, clxiv. (1917) pp. 829-81.

largest prothallia attain a diameter of about 1 mm.; their long cells are $5\ \mu$ wide; the short cells, which have become torulose, are $6\text{--}10\ \mu$ wide. Each possesses one or two chromatophores, a nucleus, one or two droplets of oil, and some very small globules of fucosan. At the end of February appeared narrow plurilocular gametangia, cylindrical, obtuse, preferably on the torulose cells. They are composed of two to twelve uniseriate locules, often three or four, the lower one sometimes belonging to the filament itself. Each locule encloses a single gamete, with superior or lateral chromatophore, and very distinct red spot. The walls separating the locules disappear before dehiscence, and the gametes round themselves off. Dehiscence is terminal and fairly slow. The gametes, scarcely differing from zoospores, measure about $6\ \mu$ by $4\ \mu$. Thus the prothallus of *Dictyosiphon* resembles a *Streblonema*. While examining the prothalli the author has often watched dehiscence. Most of the gametes hardly escape from the network of filaments. An hour later they come to rest, become rounded, and disaggregate. In cellular cultures they move away from the window, but the small number in each gametangium and their dehiscence at any hour of the day are not favourable factors for the observation of fecundation. Some are destroyed, others, parthenogenetic, become enclosed in a membrane, and then measure $4\ \mu$. Among the latter, certain rounded globules, rather larger and possessing a nucleus, two chromatophores and two red spots, can be nothing but zygotes; isogamy takes place, no doubt, as in *Ectocarpus siliculosus*, between a stationary and a motile gamete.

The germination of the zygotes and the parthenogenetic gametes, preceded by an increase of diameter which soon prevents the distinguishing of one from the other, takes place shortly. A creeping filament is emitted, and, at the extremity of the same diameter, a long colourless erect hair. The filament elongates, branches, produces hairs, and resembles a small prothallus. Towards the end of April, certain cells divide, and produce a small projecting piliferous mass which soon takes the form of a narrow pyramid of cells with external rounded wall. When this pyramid reaches $100\text{--}150\ \mu$ its uniseriate summit elongates by means of its terminal cell, and shows the characteristic division of *Dictyosiphon*. The germination of the zygotes on the parthenogenetic gametes provides therefore a protonema, which bears plantlets. The cycle of vegetation of *Laminaria* round our coasts comprises a heterogamous dicecious gametophyte, and a sporophyte or true *Laminaria*. That of *Dictyosiphon* comprises an isogamous gametophyte, probably monœcious, a microscopic protonema, and a sporophyte or true *Dictyosiphon*. Nothing similar has been recorded for the Brown Algæ.

Dumontia filiformis.*—G. A. Dunn has made a special study of *Dumontia filiformis* which she found at South Harpswell, Maine, in 1913. She describes the plant fully in all details, externally and internally, and finally summarizes her results, for which in full the original paper must be consulted. The vegetative structure is of a type occurring in many families of the Floridæ. Growth is apical throughout the entire thallus.

* Bot. Gaz., lxiii. (1917) pp. 425–67 (4 pls.).

The development of the tetraspores and spermatia is described. The carpogonial branch arises as a lateral outgrowth of a large subcortical cell. A mature carpogonial branch consists of six or seven cells and a trichogyne. The basal cell sometimes divides to form a lateral cell. Each carpogonial branch which has been fertilized produces two or three sporogenous filaments, all of which arise from one cell. It is thought that the nuclei in these filaments are descended from the fusion nucleus in the carpogonium. The sporogenous filaments grow out towards the auxiliary cell branches. The auxiliary cell branches in origin, distribution, structure, and mode of development are very similar to the carpogonial branches. Only about one auxiliary cell-branch is initiated to every seven carpogonial branches. The time of initiation of the former is a little later than that of the latter. The mature auxiliary cell-branch consists of four to seven cells. The second or third cell of the branch is the auxiliary cell. The original nucleus in the auxiliary cell takes no part in the formation of the carpospores. The nuclei in the carpospores are descended from the nucleus which enters the auxiliary cell from the sporogenous filament. In the development of the carpospores and cystocarps three or four gonimoblast filaments arise from the auxiliary cell. Every cell of these filaments forms a spore. There are about twenty carpospores in each cystocarp. Mature carpospores are usually uninucleate, well filled with a cytoplasm, and contain chromatophores, which are similar to those of the vegetative cells. In the resting nucleus of *Dumontia* all the chromatin is in the nucleolus. The nucleolus often contains a vacuole. The chromatin in preparation for mitosis passes out of the nucleolus, and in the form of small granules becomes distributed along the linin net. The net disappears and the granules become massed together to form larger units, chromosomes. The number of chromosomes was not definitely determined, but was apparently about seven. No spireme or spindle was seen. After division, the chromatin is again found massed in the nucleolus.

Calcareous Algæ from Malta.*—C. Samsonoff-Aruffo describes certain calcareous algæ collected from the Upper Coralline Limestone in Malta. The first of these, *Lithophyllum Destefanii*, a new species, is described in detail. The thallus forms numerous thin laminæ, which are superposed and united by small bands of cemented sand. The hypothallus and perithallus are clearly to be distinguished, and show the characters of *Lithophyllum*. The thallus is sterile. It is most closely allied to *L. lichenoides* and *L. Fostiei*. Another species was collected in the Lower Coralline Limestone. It forms part of a mixture of incrustations and of very short swollen branches closely united by a basal calcareous mass. When separated out, the alga shows a hypothallus which is but slightly developed, though always present, and of the type of *Lithothamnium*. The perithallus is more developed, very compact and regular, composed of vertical cellular columns of very small cells. The structure is described in detail. The alga, which is most closely allied to *L. compactum*, is called by the author, *L. miocenum*, a new

* Atti (Rend.) R. Accad. Lincei Roma, xxvi. (1917) pp. 610-6.

species. Other species recorded are *L. intermedium* Kjellm., *Goniolithon Martellii* Sam., *Lithothamnium* sp., and *Archæolithothamnium* sp.

Marine Algology.*—A. Mazza continues his studies of Marine Algæ, and finishes the genus *Lithothamnium*. He treats of the following genera, which also belong to the Corallinaceæ, and discusses their morphology and structure :—*Choreonema* (1 sp.), *Melobesia* (4 sp.), *Goniolithon* (1 sp.), *Dermatolithon* (2 sp.), *Lithophyllum* (6 sp.), *Tenarea* (1 sp.), *Mastophora* (2 sp.)

Marine Algæ of California.†—N. L. Gardiner publishes the first of a series of papers on New Pacific Coast Marine Algæ, and describes two genera, eight species and two forms all new to science. *Arthrospira maxima* is a special filamentous green alga, remarkable for thriving in sea-water which several times a day becomes heated to 60° C., being employed for condensing steam in an electric power-house. *Chlorochytrium Porphyræ*, an endophytic unicellular green alga, occurs in myriads within the thick gelatinous walls of *Porphyra*; its structure, life-history and affinities are discussed at length. *Gayella constricta* grows associated with *Prasiola*, but is certainly not a metamorphosed form of the latter, despite the views of some authors. Of the brown algæ, *Sargassum dissectifolium* is demonstrated to be distinct from the Japanese *S. piluliferum*, to which it had been referred. *Cystoseira neglecta* had previously been known by floating fragments only, and has now been traced to Santa Catalina Island. The limits and distinguishing characters of the genera *Cystoseira* and *Cystophyllum* badly need to be critically revised. The red algæ are of much interest. *Petrocelis franciscana* is the most abundant rock-encrusting alga on the Californian coast, and has been wrongly referred to *P. Middendorffii*, of the Ochotsk Sea. *Hildenbrandtia occidentalis* is also an encrusting alga widely distributed along the coast; and the ample fruiting material that has been collected permits it to be adequately described; but there is still some question whether it be generally distinct from *Besseyia* Setchell (1912). *Coriophyllum expansum* is an encrusting alga of leathery texture, forming a new genus placed provisionally in the Squamariaceæ until its sexual organs are discovered. *Cumagloia Andersonii* has hitherto been regarded as a species of *Nemalion*, but is now made the type of a new genus owing to the method of origin and the structure of the cystocarp. Structural details of the various species are figured in the five plates.

Japanese Marine Algæ.‡—K. Yendo publishes the sixth part of his Notes on Algæ new to Japan, and clears up many doubtful points concerning the species therein recorded. Among these are two species of *Liagora*, of which specimens are in the Dublin Herbarium, examined by the author. Under *Gymnogongrus leptophyllus* the differences between that species and *G. japonicus* are pointed out, the two having been often confused. Two varieties of *Iridæa laminarioides* are described (three are figured), with the synonymy of each, and important notes and

* La Nuova Notarisia, xxviii. (1917) pp. 176-239.

† Univ. California Publications, Botany, vii. (1917) pp. 377-416 (5 pls.).

‡ Bot. Mag. Tokyo, xxxi. (1917) pp. 75-95 (figs. in text).

criticisms. In Japan, species of *Iridæa* are used for sizing textiles and other purposes. *Iridæa pulchra* is shown to be a valid species. Critical and illuminating notes of the highest value are given in the following species:—*Sarcodia Montagneana*, two species of *Hypnea*, *Chrysomenia Enteromorpha* (which is also figured), *Laurencia heterocladia*, *Pleonosporium venustissimum*, *Schizymenia Dubyi* (= *S. Binderi* J. Ag.), *Nemastoma laciniata*, and others.

Fungi.

(By A. LORRAIN SMITH, F.L.S.)

Peronospora on Hemp.*—Vittorio Peglion found a fine growth of this parasite on hemp plants in Ferrara. He therefore made a thorough study of its life-history. He notes the method of attack and the sequence of leaves to succumb to the parasite; and he discusses the stages at which infection takes place.

Cultivation of the spores revealed the fact that these on germination produce zoospores, about three zoospores in each conidium; they swarm for an hour or two, then lose their cilia and become more spherical, after which germination by a tube takes place. Peglion has therefore placed the fungus in the genus *Peronoplasmopara*.

Study of Mucor.†—A. H. W. Povah is studying the genus *Mucor* with a view to determining the species with more certainty, having regard to their morphological characters and their cultural reactions. He gives an account of work done by others and of the methods used by them, and also gives a sketch of the taxonomic problems and of the systems adopted by previous fungologists.

An account is then given of his own methods of study, the collection of material, the herbarium material consulted, and the cultures undertaken. He found that, on the whole, complex substances such as bread formed the most suitable media.

In a second paper‡ the author takes up the question of classification. He rejects the method of arrangement according to branching of the sporophores, as the spores themselves give more satisfactory characters. Eighteen species are described, several of them new to science.

Studies of Rhizopus nigricans.§—U. E. Stevens and L. A. Hawkins have studied this mould in its relation to the "leak-rot" it causes on strawberry fruits. In accounting for the loss of juice occurring in strawberries attacked, the authors seem to think that "the fungus so affects the protoplasm of the cell, perhaps by secreting some toxin, that it is no longer capable of functioning as a semi-permeable membrane."

* Atti Real. Accad. Lincei, cccxiv. (1917) pp. 618–21.

† Bull. Torrey Bot. Club, xlv. (1917) pp. 241–59.

‡ Bull. Torrey Bot. Club, xlv. (1917) pp. 297–313 (4 pls.).

§ Phytopathology, vii. (1917) p. 178–84.

The cell walls are seldom pierced, and the protoplasm is only slightly altered in appearance; the nuclei remain unaltered until the cells are crushed.

L. A. Hawkins * has also published an account of "leak" in potatoes due to the same fungus and to *Pythium de Baryanum*, the latter being the most common origin of the disease. It is of considerable importance in California, and appears soon after harvesting in warehouses, etc. At first there is a small discoloration round a wound which spreads over the whole surface, and the tissues soon soften and shrivel.

Microthyriaceæ.†—G. Arnaud continues his study of this family of microfungi. He maintains that there is frequently a mycelium produced external to the perithecium which creeps on the surface of the leaf of the host-plant and pierces it in places. He describes this mycelium and the manner of attack. Incidentally he states that *Trichothyrium* is simply a *Microthyrium* adapted to parasitism on another superficial fungus, generally *Meliola*. On the various characters Arnaud establishes two new genera, *Hariotula* and *Patouillardiana*.

Development of Yeast.‡—Kendo Saito has experimented with several yeasts on a large number of different culture media in order to test the chemical substances that influence the formation of spores, etc. He gives an historical sketch of similar work done in other groups of fungi. He explains his own methods and gives full details of the culture of each species. He also discusses fully the formation of spores in the genus, their importance in correct diagnosis, and the conditions that further or retard their growth.

Notes on Discomycetes.§—J. Bayliss Elliott records *Orbilbia curvatispora*, new to Britain, and found by her in Warwickshire and Hampshire. The ascomata are pale when young, but become pale apricot when older. On pine logs she found another Discomycete, evidently identical with *Sarea pinea* Bon., which she now places in *Belonidium*, and publishes a complete description. Two species of *Ombrophila* were found on alder catkins in December, and accompanying one of them, *Ombrophila alniella*, she discovered a pycnidial form hitherto undescribed. The pycnidium is excipuliform and forms the type of a new genus, *Acleistia alniella*. The spores are simple and colourless, and, when mature, stream out in a gelatinous mass.

Observations on the Oak Oidium.||—F. W. Neger had declared his opinion that the *Oidium* from *Rubus* might be identical with that on the oak, but by cultures, etc., he has become convinced that they are distinct, though it is possible to cultivate *Oidium Ruborum* on the oak.

* Journ. Agric. Research, vi. (1916) pp. 627-40 (1 fig.). See also Bull. Agric. Intell. Rome, vii. (1916) p. 1711.

† Comptes Rendus, clxiv. (1917) pp. 888-90.

‡ Journ. Coll. Sci. Tokyo, xxxix. (1916) pp. 1-73.

§ Trans. Brit. Mycol. Soc., v. (1917) pp. 417-21 (1 pl.).

|| Naturwiss. Zeitschr. Forst. Landw., xiii. (1915) pp. 544-50 (2 figs.). See also Bull. Agric. Intell. Rome, viii. (1917) pp. 803-5.

He has also established that the fungus very rarely winters on the oak buds, but the few conidia that survive are sufficient to start again a serious epidemic in the spring. The first shoots of the new growth suffer only slightly, as there are not sufficient conidia to infect them, but the leaves of the second shoots are more seriously affected by wind-borne conidia, which have immensely increased, and the disease is at its height from the middle to the end of July.

Oidium lactis.*—G. Linossier has carried out experiments to test the relationship of *Oidium lactis*, a saprophytic fungus, with a parasite of the human organism known by the same name. He has concluded that though fundamentally the two fungi resemble each other strongly they are not identical, and that therefore bronchial mycosis is not due to infection by the saprophytic *Oidium*. They differ in some morphological points on the various cultures.

British Species of Phomopsis.†—W. B. Grove has revised the genus *Phoma*, and has followed Saccardo and other fungologists in placing a number of species described as *Phoma* under the genus *Phomopsis*. It is distinguished by the form of the pycnidium, which is generally lens-shaped, conical or pustular, but rarely subglobose, and sometimes opening by a slit or irregular orifice. There are also two spore forms, the second form including long filiform curved or arcuate spores somewhat like those of the genus *Phlyctæna*. A descriptive list of these is appended, nearly all of them transferred from the genus *Phoma*. There are two new species.

Uredinæ.‡—G. Gustav has studied the hibernation and spread of cereal rusts in sub-tropical climates, chiefly as concerns the Eastern portion of South America (Uruguay, Argentine, South Brazil), where the rusts appear regularly every year. He finds that *Puccinia triticina* and *P. coronifera* winter by means of their uredospores; fresh infections may be observed all through the winter. This is impossible in the case of *P. Maydis*, and has not been observed in *P. graminis*, and he concludes that these two species pass the winter in another country, and the spores are transmitted every year by air-currents.

A. Trotter§ records biological observations on *Ræstelia cancellata*, a rust attacking the pear. This rust has an alternative stage, *Gymnosporangium Sabinae* on *Juniperus Sabina*. This latter teleutospore form appears from January to April. The teleutospores germinate and produce sporidioles, and it is by the dissemination of the sporidioles that infection of the pear follows. He proved that there is no hibernation of mycelium in the pear, and that reinfection must take place every year.

A number of Uredinaceæ have been determined by W. B. Grove|| on

* C.R. Soc. Biol. Paris., lxxx. (1917) pp. 283-6.

† Kew Bull., 1917, pp. 49-73 (2 pls.).

‡ Zeitschr. Pflanzenkr., xxvi. (1916) pp. 329-74. See also Bull. Agric. Intell. Rome, viii. (1917) pp. 160-3.

§ Riv. Pat. Veg., viii. (1916) pp. 67-76. See also Bull. Agric. Intell. Rome, viii. (1917) pp. 161-3.

|| Kew Bull. No. 10 (1916) pp. 263-72 (5 figs.).

plants from East Africa (Uganda and Nairobi). There is one species of *Uromyces*, *U. Polygalæ*, on the sori of which he found pycnidia of *Darlucia filum*; the other species belong to *Puccinia*. Of the six species listed one only had been previously described.

Ed. Fisher* records the results of various infection experiments. He placed the teleutospores of *Thecospora sparsa* from *Arctostaphylos alpina* on new young shoots of *Abies pectinata* and some other conifers. After a time æcidia were observed on the *Abies*; they are very similar to those of other *Thecosporæ*; the spores become orange-coloured.

The writer also inoculated successfully *Pucciniastrum Circææ* on the same plant, the teleutospores having been collected from *Circæa lutetiana*. Both are cases of new infections.

J. C. Arthur† writes on the orange rusts of *Rubus*. It had been demonstrated by Kunkel that, in the United States, there existed two types of such rusts on *Rubus*: one a long cycle form identical with *Gymnoconia interstitialis*, and the other a short cycle form first named by Schweinitz as *Æcidium nitens*. These forms are alike morphologically; there is no difference between the æcidium of the one and the teleutospore sorus of the other, except in the process of spore-germination. Arthur accepts Kunkel's decision, and proposes a new generic name, *Kunkelia*, for the new genus, diagnosed as being composed of sub-cuticular pycnidia and sub-epidermal teleutospore sori. The teleutospores are cafenulate, globoid, or, in some cases, elongated, one-celled, the episporium colourless or pale and verrucose. There are no paraphyses or peridium. A list is given of host-plants, but it is necessary to germinate the spores in order to determine the genus of the rust present. Arthur suggests with some assurance that the rose *Cœoma* of Northern California may prove to be a species of *Kunkelia*.

A study of North American species of *Puccinia* on *Carex* has been made by Frank D. Kern‡. Telia and teliospores do not afford good diagnostic characters, but the uredospores are more distinctive and of more value in classification, and have been chiefly used in the synoptic tables drawn up by the author. The æcidia are to be found on a wide variety of hosts; in only one case is the host monocotyledonous. Kern describes nineteen species, a few of them being new to science.

G. G. Hedgcock and N. Rex Hunt§ publish some new species of *Peridermium*:—*P. Ipomeæ* on *Pinus echinata*, etc., the æcidial form of *Coleosporium Ipomeæ*; *P. terebinthaceæ*, also on several species of *Pinus*; and *P. Helianthi*, which has been collected on *Pinus virginiana*. Two other species, *P. fragile* and *P. minutum*, have not been associated with their *Coleosporium* stages.

M. Savelli|| has published a list of Uredineæ from Tuscany, many of them new to that province. He has added not only new localities but new hosts for a number of species. Biological observations are given as well as numerous morphological and bibliographical notes.

* Centralbl. Bakt., xli. (1916) pp. 333-4. See also Bull. Agric. Intell. Rome, viii. (1917) pp. 660-1. † Bot. Gaz., lxii. (1917) pp. 501-15.

‡ Mycologia, ix. (1917) pp. 205-38.

§ Mycologia, ix. (1917) pp. 239-42.

|| Nuovo Giorn. Bot. Ital., xxiii. (1916) pp. 235-59.

British Thelephoraceæ.*—E. M. Wakefield continues her work on resupinate fungi, dealing mainly with the genus *Hypochnus*, in which are included only species with coloured warted spores, and to which are referred all species hitherto classified under *Lomentella*, a genus of later date. There is one new species described, *Hypochnus cyaneus*, which varies in colour from “deep dull violaceous blue” through “Eton blue” to “glaucous green.” It was found at Kew on wet coniferous logs. Another new fungus, *Corticium coprophilum*, is also recorded and described; it grew on old horse-dung in a flower-bed; it is distinguished by the habitat and by the minute globose spores.

***Sparassis radicata* sp. n.†**—James R. Weir has described this new member of the genus; it is distinguished by its thin lobes and by an unusually large perennial rootstalk of the nature of a sclerotium, from which new sporophores are developed from year to year. He also discusses the systematic position of the genus, which he thinks should be placed in the family Thelephoraceæ.

The new fungus is generally found growing at the base of coniferous trees; it is 12–22 cm. broad and 10–16 cm. high, dilated above and whitish, becoming creamy yellow with age. The most important feature is its parasitism on the roots of conifers to which the long rootstalk is attached. The mycelium attacks the bast of the roots, later the wood, producing a yellow or brown carbonizing rot. Up to date only four trees, all conifers, have been found to have succumbed to the action of the fungus.

Contribution to the Study of *Coprinus*.‡—A. Sartory publishes microscopic details of a series of *Coprinus*, with especial reference to the form, size and exact coloration of the spores, the form of the cells composing the gills, and the form and disposition of the gills themselves. The cystidia when present are also described.

Critical Notes on *Coprinus*, etc.§—A. H. E. Buller publishes some results of his long study of the genus *Coprinus*. He gives seven points in connexion with the production and liberation of spores that are peculiar to *Coprinus*, and that are all inter-related; they consist of the structure of the gills, the position of the maturing spores from below upwards, and auto-digestion of the gills. The author then proceeds to discuss the systematic position of *Psathyra urticæcola*, which he judges to be a true *Coprinus*. *Coprinus plicatilis* is considered and found to be also a true *Coprinus*, though it has lost one of the *Coprinus* characters, namely, auto-digestion. *Psathyrella disseminata* has recently been transferred by Lange to *Coprinus*, but Buller finds that it lacks all the decisive *Coprinus* characters, and considers that there is no good reason for changing its systematic position.

* Trans. Brit. Mycol. Soc., v. (1917) pp. 474–81.

† Phytopathology, vii. (1917) pp. 166–77 (5 figs.).

‡ C.R. Soc. Biol. Paris, lxxx. (1917) pp. 347–8.

§ Trans. Brit. Mycol. Soc., v. (1917) pp. 482–9.

Edibility of Fungi for Rodents.*—Somerville Hastings has made observations on this subject for a number of years. The notes refer mainly to squirrels and rabbits, and to fungi eaten in the late summer and early autumn; but it is not until frosts begin, and other foods become somewhat scarce, that they are consumed to any large extent. Hastings gives many data, both of fungi found to be nibbled, and of experiments by feeding rabbits with various fungi. Those that were more or less palatable are indicated; species 'poisonous to man, such as *Amanita muscaria* and *Russula emetica*, were eaten, the former on six occasions, the latter once. One fact he noticed was the immediate sureness with which the animal either ate or rejected fungi offered to it; selection was made almost certainly by the sense of smell, and in no instance did the creature change its mind. The paper is well illustrated by photographs.

Montana Forest-tree Fungi.†—James R. Weir has for some time been collecting these fungi, and in the present paper he gives a list of the Polyporaceæ, a very long series, though he does not think that it is yet complete. Probably some have not been found, and of those collected a number have not been identified.

"Owing to the wide extension of the State of Montana to the east and west of the Continental Divide, the fungous flora includes many species of the central as well as of the Pacific Coast States. The heavily-wooded section in the north-western part has practically the same fungous flora as British Columbia." The genera dealt with are *Merulius*, *Polyporus*, *Poria*, *Polystictus*, *Fomes*, *Trametes*, *Dædalea*, *Lenzites*, and *Favolus*.

Notes on Australian Fungi.‡—J. B. Cleland and E. Cheel have taken up the study of Australian fungi, especially of the larger Basidiomycetes. They begin with a fairly long list of *Coprini*, one of which, *C. sclerotianus*, is a new species; the specimens were developed from sclerotia collected under cow-dung. Other genera are also dealt with—*Thelephora*, *Stereum*, *Clavaria*, etc. A number of species were identified for the writers by C. G. Lloyd.

Nutritive Value of Edible Fungi.§—In a paper on this subject it is concluded that the available protein in fungi is less than has been frequently estimated, and mushrooms can in no case be regarded as flesh-forming foods, such as meat. The total nutritive value of the mushroom which is richest in proteid substances is no higher than that of cabbage or potatoes, and really inferior to the latter on account of the poorer carbohydrate content. The value of mushrooms is more one of flavouring, by which other food is rendered more palatable.

New Japanese Fungi.||—Tyôzabirô Tanaka has begun a series of notes and translations of newly discovered and described fungi from

* Trans. Brit. Mycol. Soc., v. (1917) pp. 364-78 (12 figs.).

† Mycologia, ix. (1917) pp. 129-37 (1 pl.).

‡ Proc. Linn. New South Wales, xli. (1916) pp. 853-70.

§ Journ. Board Agric., xxiv. (1917) pp. 416-9.

|| Mycologia, ix. (1917) pp. 167-72.

Japan. The species described so far are all microfungi and are parasites on trees or herbs.

In a later paper* he gives a second series which includes two species of *Phytophthora*, one on leaves and flower stalks of *Allium fistulosum*, and the other on a *Solanum*. There are also several Pyrenomycetes described. All are new species.

New or Rare Fungi.†—A. Lorrain Smith and J. Ramsbottom publish a list, with descriptions and notes, of the microfungi that have been determined during the year as new, or new to Britain. Most of the new finds are leaf-fungi and belong to the Ascomycetes or to the Fungi Imperfecti.

A similar descriptive list‡ dealing mainly with the larger fleshy fungi is supplied by Carleton Rea. Three species are new to science: *Marasmius pruinatus*, with a densely pruinose pileus and stem; *Cortinarius fusco-tinctus*, in which the pale ochraceous pileus and stem become reddish, then blackish or fuscous, when touched; and *Lasiobolus macrotrichus*, distinguished by the very long hairs on the ascoma.

Mycological Notes.§—These, issued by C. G. Lloyd, contain illustrations and observations on various rare or unusual forms of the larger fungi received by him from all quarters of the globe. Species of *Polyporus*, *Guepinia*, *Favolus*, *Cantharellus*, etc., are passed in review. There is an extended note on *Lentinus Tuber-regium*, which is developed from a large sclerotium and has been renamed several times.

Two other pamphlets, also by Lloyd,|| have been received. They deal in a similar way with recently collected material. One deals wholly with species of *Radulum*, several of them, such as *R. Balouii*, evidently new species. The genus comprises resupinate fungi the hymenium of which is studded with "blunt tubercular teeth." The second "letter" pamphlet discusses "some lost Xylarias." Some of these exist in figures only such as *Xylaria Geoglossum* figured by Schweinitz, but which is probably a *Geoglossum*.

British Mycology.¶—An account is published of the annual foray of fungologists in the autumn of last year. The meeting of the British Mycological Society was held at Lyndhurst, and various excursions were made in the New Forest. Over five hundred species of fungi and fifteen mycetozoa were collected during the week. Three species of *Hypochnus* new to Britain, one of them new to science, were collected. A full list of the fungi obtained is appended; many of them had not previously been found in the New Forest.

The presidential address was given by E. W. Swanton (in absence), who dealt with "Education in Mycology." He urged the great economic importance of the study, and outlined the position of mycological teach-

* Mycologia, ix. (1917) pp. 249-53.

† Trans. Brit. Mycol. Soc., v. (1917) pp. 422-33.

‡ Trans. Brit. Mycol. Soc., v. (1917) pp. 434-40 (1 pl.).

§ Cincinnati, Ohio, No. 47 (1917) pp. 653-68 (figs.).

|| Cincinnati, Ohio (1917) 12 pp. (figs.); and Letter No. 64, 4 pp. (figs.).

¶ Trans. Brit. Mycol. Soc., v. (1917) pp. 351-64, 381-407.

ing facilities in our country and in the various colonies; finally, he indicated some of the ways in which that teaching could be improved here and our knowledge extended. A contrast is also drawn between what we have achieved and mycological education in other countries.

Economic Mycology.*—W. N. Cheesman has treated this subject in his presidential address to the members of the Yorkshire Naturalists' Union. He gives an historical and general sketch of fungi and describes the properties of certain fungi that makes them valuable as food. He discusses the plans for making such food more generally available and acceptable, emphasizing especially the need of education.

The other side of the question is then dealt with: the fungi that cause disease to the organisms and immense material loss, the world's annual loss being estimated to exceed 300,000,000*l.* Several of the more prevalent pests are discussed along with questions of immunity and remedial measures. Finally, the study of fungi is strongly recommended.

Notes on Fungus Development.†—M. E. M. Johnson gives the results of observations on some minute fungi which appeared on blocks of *Panus stypticus* which were being experimented with in the laboratory. In *Botrytis pyramidalis* she found a frequent change of colour; the tufts of the fungus growing in the light became a deep blue-green, those in the shade remained white; she also noted that when mature the conidiophore fell with the conidia attached.

Another fungus, *Sphæronea cornutum*, also appeared on the wood on which the *Panus* grew, and it was found to be constantly associated with *Haplographium olivaceum*, the latter fungus even appearing to spring from the pycnidium of the *Sphæronea*. The constant association of the two fungi suggested some connexion between them, as stages in the life cycle possibly.

Cytology of Fungus Reproduction.‡—J. Ramsbottom has reviewed the work done on this subject during the year. The papers he quotes deal with members of the Phycomycetes, Ascomycetes, Uredineæ, Basidiomycetes, and Hyphomycetes. Important research has been carried out in these different groups, more especially in the Basidiomycetes, and much of it is intimately related with systematic work.

Fungus Folk-lore.§—E. W. Swanton contributes notes on this subject:—*Daldinia concentrica* has been used as a safeguard against cramp; puff-balls have been frequently used as styptics; *Fomes pomaceus* has a reputation as a poultice for a swollen face; razor-strops were quite frequently made from *Polyporus betulinus*, and that fungus was also used as tinder by Surrey and Sussex villagers.

* Naturalist, 1917, pp. 185-200.

† Trans. Brit. Mycol. Soc., v. (1917) pp. 414-6 (1 pl.).

‡ Trans. Brit. Mycol. Soc., v. (1917) pp. 441-61.

§ Trans. Brit. Mycol. Soc., v. (1917) pp. 408-9.

Witches-brooms on Hickory Trees.*—F. C. Stewart describes these brooms as consisting of compact clusters of short upright branches. They measure up to two-thirds of a metre when bare, and are larger when in foliage. The writer has found the fungus *Microstroma Juglandis* on the leaves of the brooms, and he concludes that their presence is due to that fungus.

Fungi Toxic to Bees.†—Göte Turesson has been studying the cause of bee paralysis, and has come to the conclusion that it is due to moulds. These infest hives that are poorly constructed, and the bees wintering in them are very liable to the disease. The author has proved his contention by culture methods, securing his fungi from the intestines of dead bees and mixing the material with honey. The moulds used were *Penicillium* sp., *P. stoloniferum*, *P. conditaneum*, *Mucor mucedo*, and *Cladosporium herbarum*. There was an equal degree of toxicity in *Penicillium* sp., *P. stoloniferum*, and *Cladosporium herbarum*; *Penicillium conditaneum* was the most virulent, and next in degree *Mucor mucedo*.

The harm to the bees is not caused by parasitism, but by the toxic substances of the hyphæ, phenol, or phenolic acids. The action is at first stimulating, and later comes paralysis of the nerves and the death of the bees. Bees fed with pure honey were used in control experiments which confirmed the finding from the mould material.

Diseases of Plants.‡—B. A. Rudolph describes disease spots on cherry-leaves which he has diagnosed as due to *Alternaria Citri* var. *Cerasi*. This is a wound parasite and may produce spots on various plants. Many culture experiments were undertaken and are fully described.

H. T. Güssow§ publishes some notes on the pathogenic action of *Rhizoctonia* on potato. He notes the absence of fine rootlets in plants that have been attacked, and considers that the destruction of these rootlets is the main injurious action of the fungus.

A report of the Horticultural Branch of the Board of Agriculture|| deals with the prevalence of various serious diseases. Gooseberry mildew (American) has declined, the favourable result being due to spraying methods which have been perfected. Another method of counteracting the disease is to tip the tender shoots which are affected; lime-sulphur and Bordeaux washes have also proved effective. Wart disease of potatoes has spread, but energetic means are being taken to deal with the trouble. Immune varieties of potato are strongly recommended, and seed from infected soil should not be used, as the soil attached to the healthy potato may carry the disease. Corky scab of potato (*Spongospora subterranea*) has also been frequently notified. It is found that weather conditions, such as a wet season, greatly increase the disease.

* Phytopathology, vii. (1917) pp. 185-7 (1 fig.).

† Svensk. Bot. Tidskr., xi. (1917), pp. 16-38.

‡ Phytopathology, vii. (1917) pp. 188-97 (3 figs.).

§ Phytopathology, vii. (1917) pp. 209-13 (1 fig.).

|| Journ. Board Agric., xxiv. (1917) pp. 146-52.

J. B. Rorer* gives some account of "pink disease" of *Cacao* due to *Corticium salmonicolor*, which covers the branches on the lower side with its incrustations. It is not a disease that reaches any serious proportions, but if the larger branches are reached much harm may be done. Bordeaux mixture and other fungicides are recommended.

Some diseases of forage plants in South Africa† have been investigated by Van der Bigl: on *Chloris* he records *Tolyposporium Chloridis* and *Epichloe* sp.; on *Sporobolus* he finds *Helminthosporium crustaceum*. *Paspalum* is seriously attacked by the ergot *Claviceps Paspali*; and growers are warned against disseminating Ustilagineæ by feeding cattle with diseased straw. All cereals so diseased should be burned.

Pole Evans‡ records a disease caused by *Sorosporium Simii* sp. n. (Ustilaginales) on *Sorghum halepense*. As the host is perennial Evans argues that the inflorescence may be infected by the fungus; usually it is the seedling that is first attacked.

T. Westerdijk§ has reported a new disease of tobacco in Sumatra due to a fungus identified as *Sclerotium Rolfsii*. The disease shows itself by the withering of the leaves, a white felt of mycelium on the roots, and by the brown sclerotia some few millimetres wide. The same fungus causes disease on *Hibiscus* and on *Canavalia* in Java. Methods of dealing with the trouble are discussed.

A disease attacking the shoots and fruit of fig-trees in England has been diagnosed by W. B. Brierley|| as due to the fungus *Botrytis cinerea*. The fruit is usually entered by the pore and soon is completely destroyed. When a shoot is inoculated the mycelium spreads on all sides and kills the shoots. All diseased portions should be removed.

James Johnson¶ has published a list of plants that are liable to attack of the parasite *Thielavia basicola*. Many of these were ascertained by infection experiments. There is a very long list, but the families that suffer most are the Leguminosæ, Solanaceæ, and Cucurbitaceæ. There are no specialized races. Infection occurs mainly or only on the roots or on the base of the stem just at, or below, the soil.

B. Peyronel** has found on the roots of *Lupinus albus* a parasitic fungus which spreads in reddish-brown patches, destroying the very young plants. The disease is caused by *Chalaropsis thielavioides*, gen. et sp. n. The fungus has an almost colourless branching mycelium which gives rise to macroconidia (or chlamydo-spores) and to microconidia. The macroconidia are brown with very thick walls, and look like black powder in the mass; the microconidia are colourless and are

* Bull. Dept. Agric. Trinidad and Tobago, xv. (1916) pp. 86-9 (1 pl.). See also Bull. Agric. Intell. Rome, vii. (1916) pp. 1548-9.

† Agric. Journ. and Small Holder, South Africa, iv. (1916) pp. 37-9 (6 figs.). See also Bull. Agric. Intell. Rome, vii. (1916) pp. 1854-5.

‡ South African Journ. Sci., xii. (1916) pp. 542-3. See also Bull. Agric. Intell. Rome, vii. (1916) p. 1855.

§ Med. Delim. Proefst., x. (1916) pp. 30-40 (2 pls.). See also Bull. Agric. Intell. Rome, viii. (1917) p. 309.

|| Kew Bull., No. 9 (1916) pp. 225-9 (2 pls.).

¶ Journ. Agric. Research, Washington, vii. (1916) pp. 289-300 (2 pls.). See also Bull. Agric. Intell. Rome, viii. (1917) pp. 476-9.

** Le Staz. Sperim. Ital. Modena, xlix. (1916) pp. 588-96 (5 figs.). See also Bull. Agric. Intell. Rome, viii. (1917) pp. 479-80.

borne in chains on conidiophores. The disease is very easily cultivated on artificial media from either type of spore.

P. J. O'Gara* describes a new leaf-spot disease on *Polygonum Persicaria* due to a species of *Septoria* (*S. Persicariæ* sp. n.). The spots on which the pycnidia are borne are less than 1 cm. in diameter, grey or brown with a narrow limiting purple line; the spores are filiform, long and narrow.

T. H. Watson† has described as diseases of the spruce (*Picea excelsa*) in Scotland; *Trametes radiciperda*, a root fungus very common; *Chrysomyxa Abietis*, which is confined to old mature trees; and *Lophodermium macrosporum*, which attacks the needles and has caused the death of many trees. *Cucurbitaria Piceæ* was also observed on the buds of spruces seventy years old.

A. Lendner‡ describes two parasitic diseases: *Pestalozzia Briardi*, which was found at the base of a vine-shoot inducing cancerous formations; and *Lophionema Chodati*, which occurs as small black pustules on the cones of *Pinus sylvestris*.

Storage Rots of Economic Aroids.§—The corms and tubers of various Aroids (*Colocasia*, *Alocasia*, *Xanthosoma*) are used for food in America, and in storage are largely liable to rot. L. L. Harter has examined these rots, and gives an account of the fungi mainly responsible. They are:—Java black-rot, due to different species of *Diplodia*; powdery grey-rot, caused by *Fusarium Solani*; Sclerotium-rot, by *Sclerotium Rolfsii*; and a soft-rot caused by *Bacillus cartovorvus*. The writer describes the attack and the effect of these diseases, and gives suggestions as to prevention and cure.

Research on Plant Diseases.—E. Gaumann|| has conducted a research on the distribution of *Peronospora parasitica*, a parasite of cruciferous plants, in which specialization is carried to a very high degree. Infection experiments on various hosts within the family were carried out, and careful morphological observations were made on the variations in conidia, conidiophores, and oospores. The author has proved a very high degree of specialization.

O. A. Pratt¶ has experimented with disease-free potato tubers on virgin soil in Idaho. He found that the crops were by no means free from disease. Several species of fungi—*Fusarium*, *Rhizoctonia*, and scab due to *Actinomyces*, were of common occurrence. A smaller percentage of disease occurs, however, on land previously sown with barley and lucerne.

* Mycologia, ix. (1917) p. 248 (1 pl.)

† Trans. R. Scott. Arbor. Soc., xxxi. (1917) pp. 72-3.

‡ Bull. Soc. Bot. Genève, viii. (1917) pp. 181-5. See also Bull. Agric. Intell. Rome, viii. (1917) pp. 809-10.

§ Journ. Agric. Research, Washington, vi. (1916) pp. 549-71 (4 pls.). See also Bull. Agric. Intell. Rome, vii. (1916) pp. 1852-4.

|| Centrabl. Bakt., xlv. (1916) pp. 575-7. See also Bull. Agric. Intell. Rome, vii. (1916) p. 1851.

¶ Journ. Agric. Research, Washington, vi. (1916) pp. 573-5. See also Bull. Agric. Intell. Rome, vii. (1916) pp. 1851-2.

P. Kropoulos * has investigated seedling blight, with special reference to *Brassica* plants. He finds a fungus which exactly corresponds with *Moniliopsis Aderholdii* in the young plants. If these are attacked before the first leaves are formed death ensues; but if the leaves have already developed the plant may recover.

A. A. L. Rutgers† has investigated a *Peronospora* disease of maize, known in Java as "Omo Lyer." Plants attacked at an early stage die off; if the infection takes place at a late stage the leaves become striped with yellow; with some, ripe seeds may be produced. The host-plants when young may be infected by conidia.

A. J. Lobik‡ publishes a study of the effect of various diseases on clover. He includes four parasites in his table of calculations:—*Phyllachora Trifolii*, *Erysiphe Polygoni*, *Glaeosporium caulivorum*, and *Uromyces Trifolii*. Thus, according to approximate calculations, the average crop of clover should be 36 cwt. per acre, but if attacked by *Glaeosporium* it is only 21·4 to 23 cwt. per acre. In the case of the rust, *Uromyces Trifolii*, the production is higher than in healthy plants. The attacked plants were actually taller, more bushy, and had more abundant flower-heads.

Rubber Diseases.—J. F. Dastur§ reports on *Phytophthora* sp. as the cause of Black-thread Disease of *Hevea brasiliensis* in Burma, which causes a very great loss of rubber. The fungus grows mainly on the fruit, but passes to the stem to the wounds left on tapping for rubber. Light and air are essential agents in checking the disease.

J. G. C. Vriens|| has described the action of *Stilbella Heveæ* and of *Ustilina zonata* on rubber-trees. The mycelium of *Stilbella* spreads over the young shoots and leaves, which soon lose their colour and die. *Ustilina* attacks the wood through wounds probably caused by insects. The destruction of infected material is recommended in both cases, and care should be exercised not to leave dead wood about that would harbour insects.

Tuber-rot in Potatoes.¶—O. A. Pratt finds that *Fusarium radiculicola* gives rise to two types of rot:—1. Dry- or black-rot, characterized by the blackening of the tissues, ensues when the fungus enters the tuber by the stem-end or point of the branch where the swelling of the tuber begins, by the lenticels, and by the eyes. In these different infections the fungus reaches somewhat different tissues, but in all cases the infected tubers show a sunken brownish-black region. 2. Soft-rot, when the

* Centralbl. Bakt., xlv. (1916) pp. 244-56. See also Bull. Agric. Intell. Rome, vii. (1916) pp. 1855-6.

† Med. Lab. Plantenz., No. 22 (1916) 30 pp. (7 pls.). See also Bull. Agric. Intell. Rome, viii. (1917) pp. 305-6.

‡ Bull. Phytop. Stat. Bot. Gard. Petrograd, 1915, pp. 115-30. See also Bull. Agric. Intell. Rome, viii. (1917) pp. 307-8.

§ Dept. Agric. Burma, Bull. No. 14 (1916) pp. 1-4 (1 pl.). See also Bull. Agric. Intell. Rome, vii. (1916) pp. 1547-8.

|| Med. Adors. No. 5, Médan (1916) pp. 66-8. See also Bull. Agric. Intell. Rome, vii. (1916) pp. 1712-13.

¶ Journ. Agric. Research, Washington, vi. (1916) pp. 297-309. See also Bull. Agric. Intell. Rome, vii. (1916) pp. 1546-7.

fungus penetrates the tuber at the point of its formation and the infection spreads inwards, the diseased parts becoming brown; this latter disease is probably due to the association of *F. oxysporum*.

Problems of Plant Pathology.*—F. L. Stevens writes on this subject with regard to the fungi that form diseases. He quotes a previous author as to the conception of three categories of plant diseases:—1. Those in which the parasites kill the living cells. 2. Those in which it lives in association with them, feeding on their products. 3. Those in which the parasites invade the vessels and live in the sap. Stevens has divided parasites into a more detailed series, which he has shortly summarized as:—1. The parasite living in the sap or in parts devoid of protoplasm. 2. The parasite drawing its nutriment from living cells. 3. The parasite living in cells that it has just killed. Stevens points out the various aspects of plant pathology that are imperfectly understood and that require to be studied.

Lichens.

(By A. LORRAIN SMITH, F.L.S.)

African Lichens.†—Carlo Zanfrogini has published a descriptive list of lichens collected by Guido Paoli in Somali Land. Very full notes of structural and other peculiarities are given. Eighteen species or varieties have been thus fully described; none of them are new nor peculiarly African. Graphidineæ are well represented.

Chænotheca melanophæa var. flavocitrina.‡—R. Paulson, who discovered this new variety, found it covering large areas of the trunks of various trees in Bricket Wood, Herts. It develops first under the bark, and later emerges on the surface where the somewhat long-stalked fruits are formed. The presence of salazinic acid—as is the species—is proved by the purple reaction with potash. The host-cells in contact with the lichen are mainly affected with the stain.

Rate of Growth and Spreading (Ecesis) in Lichens.§—Bruce Fink gives us a series of observations made over a period of eight years as to the rate of growth of lichen thalli, and also as to period of time required to re-establish a lichen on areas from which the plants had been removed. Numerous results are given as to the rate of growth, most of them about 1 cm. per year, or somewhat under. The greatest rate seems to have been recorded for a plant of *Peltigera canina* growing on "a mossy rock along a brook in a low moist wood, well-shaded." A plant,

* Bot. Mag., lxiii. (1917) pp. 297-306.

† Nuova Notarisia, xxviii. (1917) pp. 145-75.

‡ Journ. Bot., lv. (1917) pp. 197-8.

§ Mycologia, ix. (1917) pp. 138-58.

measuring 10 by 14 cm., was deprived of several large apothecia. The lobes all pointed in the same direction, and the plant increased 1·75 cm. in one year. Two other plants, deprived of their lobes, regenerated and increased from 2 and 5 cm. respectively to 3·5 and 6 cm. No other measurements are quite so high as these, though a plant of *Parmelia caperata* (sterile), measuring from 1·2 cm. across, reached in eight years a dimension of 10 by 13 cm. Other plants of the same species gave much slower rates of increase. A section of railing was marked bearing minute scattered squamules of *Cladonia pityrea*. After two years the squamules had attained normal size and podetia were formed 2 to 4 mm. long.

Several areas of *Verrucaria muralis* were marked and after ten months were again measured; the largest plants, measuring 2·12 by 2·4 cm. across, had somewhat altered in dimensions and gave the measurements 2·2 by 3 cm.

A quadrat of limestone rock was scraped bare of moss and of *Leptogium lacerum*, except for bits of the moss and particles of the lichen which adhered to the rock, especially in depressions of the surface. After four years the moss was colonizing many small areas, and many of the patches bore specimens of the lichen 2 to 10 mm. across. Very little change occurred during the next four years.

The results as far as possible are summarized and opinions hazarded as to methods of migration to denuded areas. The general rate of increase is given for a varied series of lichens. Some crustose species become established and produce thalli and apothecia in two to eight years. Foliose lichens increase in diameter from 0·3 to 3·5 cm. per year (the latter observation not verified in the text). So far as external appearance goes apothecia are produced in one to eight years; it is concluded that these require four to eight years to attain maturity in their natural habitats.

Mycetozoa.

(By A. LORRAIN SMITH, F.L.S.)

Observations on *Badhamia utricularis*.*—W. T. Elliott has been experimenting with the plasmodium of *Badhamia* and its food supply. He holds the view that *Badhamia* and other mycetozoa do not live solely on bacteria but also on fungi, that they probably assimilate the fungus mycelium so abundant in the dead wood they occupy. He tested the plasmodium on a series of fleshy fungi, and he has observed the partial disappearance of the fungus, and the changes in the plasmodium according to the colour of the fungus on which it was feeding. Elliott looks on mycetozoa as parasites more animal than vegetable; they assimilate or consume the tissue of the living fungus, withdrawing nutrient substance, including proteids, from the host.

* Trans. Brit. Mycol. Soc., v. (1917) pp. 410-13.

Schizophyta.**Schizomycetes.**

Spirochæta morsus muris.*—K. Futaki, I. Takaki, T. Taniguchi and S. Osumi report the discovery of a new species of spirochæte in the blood, skin and lymph glands of four patients suffering from rat-bite fever. The spirochæte is smaller than *S. recurrentis*, but larger than *S. pallida*; it is very motile, stains well, and shows a single flagellum at each end, and does not possess an undulating membrane. The curves are regular and range from two to nineteen, generally three or four. The larger forms are found in the tissues, the smaller in the blood. This spirochæte is found in the blood of 3 p.c. of the house-rats in Japan, and is considered by the author as the cause of Japanese rat-bite fever. Mice are best for experimental inoculations, white rats next, while guinea-pigs and monkeys often fail to become infected. The type of fever produced in monkeys is not typical of the human condition. Salvarsan cleared the blood of the monkeys in fourteen days, but relapses then occurred.

Streptothrix in Broncho-pneumonia of Rats.†—Ruth Tunnicliff has examined a series of sixty white rats which showed evidence of acute or chronic broncho-pneumonia, and in fifty-six a long, fine, straight, wavy filamentous organism was found. This organism was not observed in a series of twenty-four normal rats. It was Gram-negative, non-acid-fast, and stained with difficulty, the best results being obtained with Giemsa and carbol-fuchsin, and also by Levaditi's method for tissues. The organism was isolated in pure growth on thirteen occasions, the greatest success being obtained when the lesions were acute and when other bacteria were present. The production of anti-bodies in infected rats was demonstrated by the presence of specific opsonins and agglutinins. The organism was pathogenic to white rats, but not to rabbits or guinea-pigs, and but slightly to monkeys. As white rats are not known to cause rat-bite fever, twenty-eight wild rats were examined, and the same organisms and lesions in the lungs were found in one of them as in the white rats. The organism is probably the same as that described by Schottmüller and others as *Streptothrix muris rattii*.

Serotherapy in Gas Gangrene.‡—Wm. Weinberg and P. Séguin have given a mixed antitoxic serum (anti-perfringens, anti-V. septique, and anti-cedematiens) in cases of gas gangrene with apparently beneficial results. Rapid local and general amelioration of symptoms was observed in most cases. They claim that the serum not only neutralizes the toxin circulating in the organism and arrests the septicæmia, but also favours the local defensive mechanism against infection and stimulates phagocytic

* Journ. Exper. Med., xxv. (1917) pp. 33-44.

† Journ. Infect. Diseases, xix. (1916) pp. 767-71.

‡ Comptes Rendus, clxv. (1917) pp. 199-201.

activity. The initial dose recommended is 60–90 c.cm. of an equal mixture of the three sera. The serum may be given intravenously or subcutaneously, the former method being especially recommended. If there be time to demonstrate which organism plays the principal rôle in infection, the dose of the serum corresponding to the particular anaerobe may be augmented with advantage.

Ropy Bread.*—J. M. Beattie and F. C. Lewis have carried out a series of observations as to the cause of the condition known as “ropiness” in bread. The work was originated some years ago in the University of Liverpool, under the direction of the late Sir Rubert Boyce. The causal organism appears to be a member of the *mesentericus* group of organisms, and has been described by Vogel as *Bacillus viscosus panis*. The bacillus is Gram-positive, spore-bearing, and aerobic. When grown on agar the appearance of an early colony is characteristic. It looks like a small drop of thick, transparent, colourless oil, and when touched with a needle is shown to be extremely viscid. If an attempt be made to remove the colony, it will be found that the growth follows the needle and can be drawn upwards, if handled gently, until a strand, one or two inches in length, reaches from the agar to the end of the needle. It is therefore very difficult to detach a portion of the colony. As the colony develops, the clear oil-like character disappears, and a ground-glass opacity is assumed, giving rise later to a dry, wrinkled, typical mesenteric appearance. But the viscosity of the growth is seldom entirely lost, the fresh growing edges invariably showing this characteristic. The organism is non-motile, and forms, in pepton water, a thick, transparent mucilaginous film, very different from the “greyish-white film, which is not broken up by shaking,” of *B. mesentericus vulgaris*. If a “ropy” loaf of bread be cut or broken, small glistening masses may be found. These are colonies of the “rope” organism, and the silken strands which may be seen when portions of the bread are drawn gently apart are, in fact, only the viscid colony stretching from crumb to crumb. When the growth in the loaf is well advanced, then the whole mass may become viscid.

The causal organism, *B. viscosus panis*, is present naturally in the husk of the grain, and the infection is more likely to occur where the flour used contains a greater proportion of husk. There is no doubt that the development of the organism in the bread is greatly favoured by moisture and heat, conditions which would be established by storage, after baking, without proper ventilation. The conditions should be eliminated by using proper methods and standards in the production of flour.

Morphological Studies in the Life-histories of Bacteria.†—E. C. Hort endeavours to show in this communication that simple binary fission is not the only method of reproduction amongst bacteria, and that only a fraction of what appears to be a highly complex life-cycle can be studied by cultivation in, or on, synthetic media. In his experiments organisms

* Lancet, cxci. (1917) pp. 211–2.

† Proc. Royal Soc., lxxxix. (1917) pp. 468–80 (5 pls.).

of the typhoid-dysentery group were used principally, and all possible sources of contamination were rigorously excluded. By using broth + 20 to phenolphthalein, and by sub-culture from this to agar or to MacConkey's medium, thence back again to ordinary broth + 10 to phenolphthalein, a great increase in the size of the organisms is obtained, but the bacilli still give the classical cultural, fermentative and serological reactions.

In all the broth cultures studied, reproduction by simple binary fission was still the predominant feature, and in studying the "aberrant" types of reproduction of single living organisms on the warm-stage on solid media, such as gelatin-agar, ordinary binary transverse fission was found to hold the field mainly, though not absolutely to the exclusion of other forms of reproduction. Reproduction by gemmation occurs freely, in conjunction with ordinary binary fission, only so long as growth proceeds in the thin layer of broth on the cover-slip, and largely comes to an end when colonies are beginning to form on the solid medium. Some of the buds observed were very minute, and when examined by the dark-ground illumination method were found to be minute bacilli undergoing binary fission. Not unfrequently these appear as coccoid bodies if binary fission has not begun. The presence of these minute forms is probably the explanation of the apparent filterability through Chamberland filters of such relatively large organisms as *Bacillus bronchisepticus*, and is perhaps responsible for the general view that even well-made Berkefeld filters are not suitable for bacteriological work.

Bacteriology in Plant Pathology.*—F. L. Stevens gives an interesting account of recent advances in the study of plant pathology. "It appears that the bacteria involved in plant disease are pre-eminently of the genera *Pseudomonas* and *Bacillus*. The Cocci, Bacteria and Spirilli, so prominent in animal pathology, sink to a very minor position." Some of the more important organisms are included in the following list:—

Bacillus amyloverus (host, Pomes), the cause of the pome blight, is widespread and the cause of immense pecuniary loss.

Pseudomonas radiclea (host, Legumes) occupies the anomalous position of being a beneficial disease.

P. solanacearum (host, *Solanaceæ*) is very wide-spread and destructive, as are also *P. camprestris* (host, Crucifers) and *B. tracheiphilus* (host, Curcubs). *B. carotovorus* is the cause of soft rot of parenchyma on many hosts and the loss of much produce during storage.

The bacterial leaf-galls of the *Rubiaceæ*, originally described by Zimmermann, are of particular interest as possibly cases of symbiosis rather than parasitism.

P. tumefaciens, the cause of crown-gall on numerous hosts, has been shown to furnish an example of an unsuspected type of plant disease, in many respects analogous to human cancer.

B. avenæ with *P. avenæ* (host, Oats) present an unique case of symbiosis, in that the latter organism is, according to the work of Manns, much more productive of disease when accompanied by the former organism.

* Trans. Amer. Micr. Soc., xxxvi. (1917) pp. 1-12 (1 chart).

B. coli as the cause of a very destructive bud-rot of the cocoanut is especially interesting. One is loath to accept the conclusion, but the work upon which it is based is well done. The experimental evidence is that the bud-rot organism is in all ways indistinguishable from animal *B. coli*, and that *B. coli* from animals will cause the typical rot.

P. citri is one of the latest to attract attention as the cause of the very serious *Citrus* canker which bids fair to make destructive inroads upon fruit culture in the Gulf States.

A group of diseases of distinct type, the "wilts" are found to be largely bacterial and are due to a plugging or embolism brought about by the growth of bacteria within the vessels of the plant. Infection has been shown to occur in a variety of ways, notably through wounds which break down the outer protective plant coverings, or through natural openings such as stomata, water-pores or nectaries. Apart from the important rôle played by insects in the transmission of plant diseases, surface soil water is in some cases responsible for extensive distribution of the parasite. Continued growth and multiplication of parasitic bacteria in the fallen plant parts, or even in the manure pile, offer an additional explanation of disease dispersal in some instances. In other cases it has been demonstrated that the causal bacteria remain alive upon the outside of the seed-coats and thus lead to infection of the ensuing crop.

Action of *Bacillus fluorescens liquefaciens* on Asparagin.*—

A. Blanchetière finds that *Bacillus fluorescens liquefaciens* flourishes on a medium in which the sole source of carbon and nitrogen is asparagin. This medium is particularly favourable to the production of pigment. After a cultivation of suitable length, about 90 p.c. of the total nitrogen is converted into ammonia, and after a further lapse of time part of this nitrogen undergoes a retrograde metamorphosis.

Fermentable sugars have a retarding action if the medium be rendered alkaline by the addition of calcium carbonate. If the saccharated media be acidified, hydrolysis of the nitrogenous groups is limited to the amido group, and the hydrolysis is much retarded. The manner in which asparagin behaves alone or in the presence of sugars and of ammonia salts leads us to think that the attack on the aspartic molecule when alone is not due to a necessity of microbic development. This molecule is attacked as strongly in the presence of sources of energy more easy to utilize when the chemical conditions necessary to the action of ferments are realizable.

* Ann. Inst. Pasteur, xxxi. (1917) pp. 291-312.
