Some Zoosporic Fungi of New Zealand.

III. Phlyctidium, Rhizophydium, Septosperma, and Podochytrium

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With Plates XII—XIV.

In two previous publications the author (1966, 1967) described the species of the families Olpidiaceae and Synchytriaceae which were collected in New Zealand in 1965 and 1966. The present contribution concern certain genera of the rhizidiaceous species which are quite widespread and numerous. In view of the large numbers observed and identified it is inexpedient to include all of them in one publication, and the present paper will be confined to species of *Phlyctidium, Rhizophydium, Septosperma* and *Podochytrium. The* types of soil and localities from which they were isolated are indicated by alphabetic symbols which were described in the first paper of this series.

Phlyctidium.

So far, only three species, *P. marinum* sp. nov., *P. mycetophagum* and *P. keratinophilum,* of this genus have been found.

Phlyctidium marinum sp. nov.

Saprophyticum. Sporangia ovoidea, globosa vel subglobosa, 16—20 μ diam., pariete hyalino, levi, crassiusculo, persistenti et papillula singulari lata apicali vel subapicali 13—20 μ diam. praedita; zoosporae globosae 2—2.5 μ diam., globulo hyalino refringenti praeditae; flagellum 12—14 μ longum; sporae perdurantes globosae, 10—21 μ diam., plasmate grosse granuloso farctae, pariete 2—2.4 μ crasso, hyalino, levi; germinatio ignota.

Sporangia broadly ovoid to spherical and subspherical, 16—30 μ diam., with a hyaline, smooth, fairly thick and persistent wall, and a broad apical or subapical exit papilla, 13—20 μ diam., subtended by a broad intramatrical peg. Zoospores spherical, 2—2.5 μ diam., with a conspicuous hyaline refractive globule; flagellum 12—14 μ long. Resting spores spherical, 10—21 μ diam., with a 2—2.4 μ thick, hyaline

smooth wall and coarsely granular or globular content; germination unknown.

Saprophytic on dead *Pinus sylvestris* pollen added to a beach sand and sea water culture (ABS), Maurangi Bay, Auckland.

This species was isolated on pollen grains from beach sand which was inundated daily by the tides in Maurangi Bay, and it appear to be a marine saprophytic species. So far, only one other marine species, *P. brevipes* var. *marinum* Kobayasi and Ookubo (1954) on *Bryopsis* sp., has been reported in the literature, and *P. marinum* differs from it by its smaller zoospores and sporangia, larger exit orifices and development of successive sporangia in the initial one. It resembles most closely *P. megastomum* Sparrow (1943), but the latter species has larger zoospores and parasitizes a freshwater blue-green alga.

The development of this species (figs. 1 to 8) is basically similar to that of other *Phlyctidium* members and need not be described in detail. Attention, however, is called to the large apical papilla (fig. 4) which may sometimes have the same diameter as the sporangium, the fairly thick and persistent sporangium wall, and the development of successive sporangia in the initial one (figs. 6, 7). This occurs commonly as in *P. megastomum,* but it is not certain that it represents true proliferation. Possibly, the successive sporangia develop from zoospores which fail to emerge and germinate within, but it is to be noted particularly that the secondary and tertiary sporangia do not develop their own absorbing pegs but seem to "utilize" the one of the initial sporangium. This suggests, at least, that true proliferation occurs. The resting spores (fig. 8) may be of the same diameter as the smaller sporangia with a thick hyaline wall and greyish, coarsely granular or globualr content.

Phlyctidium mycetophagum Karling, 1946 b. Amer. J. Bot. 33: 576, figs. 44—55.

Parasitic on *Chytriomyces hyalinus, C. granulatus* sp. nov. (AKT and ASB), *Phlyctochytrium lagenarium* (ATKF), *Rhizophydium coronum* (CWR and OWL), *R. sphaerothecum* (ORC), *R. globosum* (CWR), *Cladochytrium hyalinum* (ASB), *Rhizidium richmondense, Pythium* sp. (AKT), *Mortierella* sp. (WGB), and aeciospores of a rust (OTAD).

This is a ubiquitous species so far as its host range is concerned (see Karling, 1946 b), and occurred in great abundance in New Zealand. In the AKT soil sample some of the obpyriform sporangia on *C. hyalinus* were unusually large, 50 μ high by 37 μ in broadest diameter, and the filament of attachment to the host was 35 μ long. However, the sporangia of the specimens on the aeciospores of a rust were only 8 to 10 high by 6—8 μ in greatest diameter.

Phlytidium keratinophilum Ookubo and Kobayasi, 1955. Nagaoa 5: 1, fig. 1.

Saprophytic on human hair from soil sample ARVAT, Auckland Province.

This identification is made of a saprophyte which occurred abundantly on human hair floated on top of a watered soil sample. The sporangia and zoospores were similar to those described by Ookubo and Kobayasi, but no resting spores were formed by the New Zealand specimens. Accordingly, the identification of this fungus is tentative.

Rhizophydium.

Species of this genus are numerous and widely distributed in New Zealand, and up to the present time 23 species have been identified. In addition to those described and listed below several others were observed but they could not be identified with certainty from the meager material available.

Rhizophydium macroporosum sp. nov.

Saprophyticum, gregarium; sporangia globosa, 30—140 μ diam. subinde ovoidea, 21—40 × 30—60 μ vel late piriformia, plerumque papillulis 2—8 tholiformibus vel conicis, ad basim 8—25 μ latis et 13 μ altis ornata, raro etiam unipapillata; pariete usque ad 2 μ crasso, hyalino, pallide succineo vel brunneolo, levi; rhizoidea e sporangii basi orta, usque ad 280 μ extensa, interdum inflata et instar apophyses; zoosporae globosae, 3—4.2 μ diam., globulo 0.6—0.9 μ diam., hyalino, refringenti instructae e papillulis 2—5 paulatim simulque emergentes et massam primo muco obvolutam efformantes; flagellum 16—18 μ longum; sporae perdurantes ignotae.

Sporangia predominantly spherical, 30—140 μ diam., ovoid, 21—40 × 30—60 μ, broadly pyriform, usually with 2—6 dome-shaped or conical, 8—25 μ broad at base and up to 13 μ high, exit papillae, rarely only one papilla present. Wall up to 2 μ thick, hyaline to light-amber or light-brown and smooth. Rhizoids arising from base of sporangium, main axes usually coarse, up to 9 μ diam., and extending for distances up to 280 μ; occasionally inflated and apophysis-like, constricted and beaded in appearance. Zoospores spherical, 3—4.2 μ diam., with a minute, 0.6—0.9 μ, hyaline refractive globule; flagellum 16—18 μ long; emerging slowly from 2—5 exit papillae simultaneously and surrounded en masse at first by a slimy layer. Resting spores unknown.

Saprophytic on snake skin and bleached corn leaves from soil samples AO, HBJF2, GBTF, WT8, WKI, and OAL.

This species occurred in great abundance in several localities, and is characterized primarily by its large sporangia, conspicuous broadly conical to dome-shaped exit papillae and the slow emergence of the

zoospores simultaneously from several papillae. Its development is similar to that of other *Rhizophydium* species, and it is not necessary to describe the early stages. Accordingly, only mature thalli and sporangia with their exit papillae and the emergence of the zoospores will be illustrated and described. As noted in the diagnosis, the rhizoidal axis may vary considerably from relatively straight and branched (fig. 9, 18) to constricted and bead-like (figs. 10, 20). Occasionally, the main axis may be inflated, up to 15 μ diam. and apophysis-like (fig. 11).

The regions where the exit papillae occur may be recognized fairly early by the clearing of the protoplasm underneath (fig. 12). As this continues a clear zone gradually develops, and the incipient papillae begin to bulge out (fig. 12, 13). After they have attained considerable height the outer wall apparently deliquesces (fig. 14) and an almost hyaline conical mass protrudes outward. As this occurs the edge of the outer wall may occasionally be folded back to form a collar-like band at the base. In other papillae the edge of the outer wall may be frayed or jagged (fig. 15). The sporangia may remain in this state for a considerable period of time, but by the time the zoospores are mature and ready for discharge the conical masses gradually become less opaque and disappear. The initial masses of zoospores emerge quite slowly and are enveloped by a layer of slimy matrix or substance (fig. 18) which at times appears to exert some restraining pressure. At least, this is suggested by the fact that a mass of zoospores at one orifice may reenter the sporangia if the matrix does not disperse, and emerge through another orifice. After the initial masses of zoospores have dispersed and the pressure within the sporangium is apparently reduced, the zoospores remaining in the sporangium swarm violently, usually emerge singly, and dart away and about like those of other species of *Rizophydium*. Occasionally, only one exit papilla is present (fig. 20), and in such sporangia the papilla may be unusually broad. *Rhizophydium macrosporosum* resembles most closely *R. stipitatum* Sparrow (1957) by its fairly large number and great size of the exit papillae, but it has smaller zoospores and non-stipitate sessile sporangia.

Rhizophydium clavatum sp. nov.

Saprophyticum; sporangia plerumque clavata, 18—33 × 10—17 μ vel subovoidea, papillula lata, apicali praedita; pariete tenui, hyalino, levi; rhizoidia e sporangii basi orta, plerumque tenuissime filiformia, parce ramulosa, usque ad 120 μ extensa; zoosporae globosae, 2—2.6 μ diam., globulo minuto refringenti praeditae; flagellum 10—13 μ longum; sporae perdurantes ignotae.

Sporangia predominantly clavate, 18—33 μ high by 10—17 μ in greatest diameter, or narrowly ovoid, with a thin smooth hyaline wall and a broad apical exit papilla. Rhizoids attached at base of sporangium,

usually consisting of a fine, straight, sparingly branched filament which may extend for a distance of 130 μ. Zoospores spherical, 2—2.6 μ diam., with a minute refractive globule; flagellum 10—13 μ long. Resting spores unknown.

Saprophytic on purified shrimp chitin from soil sample OWR.

This species is charaterized by predominantly clavate sporangia (figs. 21—24) with a broad apical papilla, small zoospores, and sparingly branched, rather stiff-looking rhizoids. Superficially, it resembles *Rhopalophlyctis sarcoptoides* Karling (1945) except for its smaller inoperculate sporangia and zoospores and the lack of a foot or holdfast. It occurred only on chitin, although snake skin, hair, cellophane and corn leaves had been added to the same culture.

Rhizophydium polystomum sp. nov.

Saprophyticum. Sporangia plerumque globosa, 20—115 μ diam., papillulis usque ad 28 inconspicuis praedita; pariete tenui, hyalino, levi; foramina sporangiorum vacuorum ovalia, 3—4 × 5—6 μ; rhizoidia e sporangii basi orta, usque ad 125 μ vel etiam magis extensa; zoosporae e papillulis compluribus simul emergentes, globosae, 2.4—2.8 μ diam., globulo minutissimo hyalino refringenti praeditae; flagellum 12—15 μ longum; sporae perdurantes ignotae.

Sporangia predominantly spherical, 20—115 μ diam., with a thin hyaline smooth wall and up to 28 low, barely perceptible, exit papillae; exit orifices in empty sporangia oval, 3—4 × 5—6 μ. Rhizoids arising from base of sporangium, main axes coarse, up to 10 μ diam., often constricted at intervals, and extending for distances upto 125 μ or more. Zoospores emerging from several papillae simultaneously, spherical, 2.4—2.8 μ diam., with a very minute hyaline refractive globule; flagellum 12—15 μ long. Resting spores unknown.

Saprophytic on bleached corn leaves from soil samples, AK, ATRC, and CGB.

This species occurred in great numbers on corn leaves from hydrothermally altered silt (ATRC), and in several instances hundreds of thalli were present on small bits of leaves. By its large number of exit papillae it resembles somewhat *Rhizophydium halophilum* Uebelmesser (1956), but it differs by its smaller zoospores and freshwater habitat. It also resembles *Phlyctochytrium kniepii* Gaertner (1954) and *P. spectabile* Uebelmesser (1956) by the large number of exit papillae, but it is readily distinguishable from these species by its nonapophysate sporangia and smaller zoospores. The exit papillae are low and inconspicuous and in mature sporangia filled with zoospores they are barely perceptible as such. In median outline, however, the wall appears as if interrupted or thinner at intervals (fig. 26). In other sporangia they

may be slightly raised. In empty sporangia (fig. 29) the exit orifices appear as oval openings in the wall with radiating wrinkles or striations around them. The wall is quite thin, and within a few hours after dehiscence it may collapse to some extent and appear deeply wrinkled.

Several of the papillae may deliquesce simultaneously and discharge zoospores (fig. 27), and after some of the zoospores have emerged those within the sporangium become actively mobile and rotate *en masse* in one direction. Usually, some zoospores fail to emerge and germinate within so that old sporangia may be filled with young thalii.

Rhizophydium globosum (Braun) Rabenhorst, 1868. Fl. Europ. alg. 3: 280.

Chytridium globosum Braun, 1855. Monatsber. Berlin. Akad. 1855: 381; 1856, Abhandl. Berlin. Akad. 1855: 34, pl. 2, figs. 14—18.

Phlyctidium globosum (Braun) Sorokin, 1883. Arch. Bot. Nord. France 2: 19, fig. 12.

Weakly parasitic in dying oogonia of *Vaucheria* sp. and saprophytic on pollen of *Pinus radiata* from a culture of *Vaucheria* at Taita (WT 8), Wellington Province, and soil sample HBGFl.

Rhizophydium pollinis-pini (Braun) Zopf (pro parte), 1887. Abhandl. Naturf. Gesell., Halle 17: 82, pl. 1, figs. 16—20.

Chytridium pollinis-pini Braun, 1855. Monatsber. Berlin. Akad. 1885: 40, pl. 3, figs. 1—15.

Chytridium vagans Braun, 1856. Monatsber. Berlin. Akad. 1956: 588.

Phlyctidium vagans (Braun) Rabenhorst, 1868. Fl. Europ. alg. 3: 278.

Phlyctidium pollinis (Braun) Sorokin, 1883. Arch. Bot. Nord. France 2: 19, fig. 13.

Phlyctidium pollinis-pini (Braun) Schroeter, 1855. Cohn's Kryptogamenfl. Schlesiens 3 (1): 190.

Saprophytic on dead pollen of *Pinus sylvestris* in soil samples AR, AW, WRFJ 1, WRFJ 2, AOTH, and AMH.

Rhizophydium sphaerocarpum (Zopf) Fischer, 1892. Rabenhorst Kryptogamenfl. 1 (4): 95.

Rhizidium sphaerocarpum Zopf, 1884. Nova Acta Acad. Leop.-Carol. 47: 202, pl. 19, figs. 16—27.

Saprophytic on dead pollen of *Pinus sylvestris* in soil samples AAB, ABS, AW, AO, ASJD, HBW, BHJF 1, MPR, OHR, OHT, OBC, OKF, and OTAD.

Rhizophydium carpophilum (Zopf) Fischer, 1892. Rabenhorst Kryptogamen-Fl. 1 (4): 95.

Rhizidium carpophilum Zopf, 1884. Nova Acta Acad. Leop.-Carol. 47: 200, pl. 20, figs. 8—16.

Parasitic on oogonia of *Achlya* sp., *Aphanomyces stellatus*, and *Saprolegnia* sp. in soil samples AMA, ASB, ATK, and HBW.

This species attained epidemic proportions on the oogonia of *A. stellatus* in soil sample ATK, with the result that only a few oospores were formed.

Rhizophydium sphaerotheca Zopf, 1887. Abhandl. Naturf. Gesell. Halle 17: 92, pl. 2, figs. 33—41.

Soprophytic on dead pollen of *Pinus sylvestris* in soil samples AGB, ASJD, OHR, OKF, OD, OHT, OBC, OTAD, OW ODGB, OCR, OFLS and CHT.

Rhizophydium gibbosum (Zopf) Fischer, 1892. Rabenhorst Kryptogamen-Fl. 1 (4): 102.

Rhizophyton gibbosum Zopf, 1888. Nova Acta Acad. Leop.-Carol. 52: 344, pl. 20, figs. 8—20.

Parasitic on *Spirogyra* sp. in a pond near Cascade Creek in the Eglinton Valley, southern Otago.

Rhizophydium chaetiferum Sparrow, 1937. Occ. Papers Boston Soc. Nat. Hist. 8: 295; 1939, Mich. Acad. Sci. Arts, Letters 24, pt. 1: 122, pl. 2, figs. 1—13.

Parasitic on *Coleochaete* sp., Lake Ohau, Canterbury Province.

Rhizophydium coronum Hanson, 1944. Torreya 44: 31; 1945, Amer. J. Bot. 32: 389—393, 31 figs.

Saprophytic on cellophane and corn leaves from soil samples AKT, OWL, and ORC.

This species occurred in great abundance in peaty acid soils and debris whose pH varied from 4.3 to 4.7.

Rhizophydium chytriomycetis Karling, 1946 a. Mycologia 38: 105, figs. 1—8.

Parasitic on *Chytriomyces hyalinus* and *C. aureus* from soil sample ATK.

Rhizophydium amoebae Karling, 1946 a. Amer. J. Bot. 33: 331, figs. 5—8.

Weakly parasitic on *Amoeba* sp. from soil sample WK 2.

Rhizophydium keratinophilum Karling, 1946 b. Amer. J. Bot. 33: 753, figs. 1—43.

Saprophytic on dead human hair and snake skin from soil samples AMBP, ACH, WHR 1, and CBJ.

Rhizophydium mycetophagum Karling, 1946 a. Amer. J. Bot. 33: 329, figs. 17. 18.

Parasitic on the sporangiophores of *Mortierella* sp. and sporangia of *Chytriomyces hyalinus* from soil sample AKT.

The author is identifying as this species a parasitic whose sporangia are broadly pyriform, 6—8 × 10—12 μ, subspherical, 10—13 μ diam., and form one apical exit papilla. Resting spores were not observed and it is, accordingly, impossible to identify this parasite with certainity. The smaller sporangia bore as few as 4 large zoospores. It is to be noted that the mycelium of *Aphanomyces stellatus* in close proximity to infected *Mortierella* filaments was not parasitized.

Rhizophydium chitinophilum Antikajian, 1947. Mycologia 39: 613, figs. 1—20.

Saprophytic on bits of purified shrimp chitin from soil samples AAB and MP.

Rhizophydium nodulosum Karling, 1948. Mycologia 40: 328, figs. 1—10.

Saprophytic on dead human hair from soil sample WT8.

Rhizophydium bullatum Sparrow, 1952. Mycologia 44: 762, fig. 1 h—l.

Saprophytic on dead pollen of *Pinus sylvestris* and snake skin from soil sample ASB.

Rhizophydium racemosum Gaertner, 1954. Archiv. f. Mikrob. 21: 125, fig. 7.

Saprophytic in dead pollen of *Pinus sylvestris* from soil samples AO, ATRC, and AWRKF.

Rhizophydium utriculare Uebelmesser, 1956. Arch. f. Mikrob. 25: 314, fig. 3.

Parasitic in dead pollen of *Pinus sylvestris* from soil sample ATRC.

Rhizophydium elyensis Sparrow, 1957. Trans. Brit. Mycol. Soc. 40: 525, figs. 2 I—2 M.

Saprophytic on snake skin, corn leaves, and pollen grains from soil samples ATRC, AK, WW1, OWL, OWR, ORC, CFC, AIRF, WFG, and AIPT.

This is one of the most abundant species of *Rhizophydium* observed in New Zealand, and it occurred in peaty soil, pH 4.2, as well as in pumice and other types of soil. Frequently, the sporangia on corn leaves were so numerous and crowded that they formed almost a continuous layer on the substratum. Isolated sporangia were up to 60 μ in greatest diameter, and in old (?) ones on snake skin the exit papillae vere filled or surmounted by a subspherical to ovoid refractive plug or body (figs. 30, 33). In a rare and exceptional ovoid sporangium (fig. 31) the plug or body was unusually large, 4 × 6 μ. The exit papillae varied from 1—12 per sporangium, and although low, they were more conspicuous than reported previously in the literature. Sometimes, they occurred in pairs (fig. 32). Frequently, the refractive bodies or plugs did not deliquesce at dehiscence of the sporangium but were pushed aside by the emerging zoospores (figs. 33, 34) as a refringent body at or near the exit orifices. Such bodies or plugs have not been reported by previous workers, and when the author first observed them, he believed that he was seeing a new species. However, a careful study over an extended period has convinced him that such bodies are not uncommon in the exit papillae of *R. elyensis* on snake skin.

The initial diagnosis of this species was quite brief, and no measurements of the zoospores and the presence of resting spores were recorded. The discovery of additional characteristics in the New Zealand specimens makes emendment of the original diagnosis essential.

Sporangia sessile, almost spherical at first but soon becoming irregularly polygonal, 18—60 μ diam., with a smooth, thin hyaline, persistent and fairly rigid wall and 1 to 12 low, 2—3 μ high by 3—4 μ broad at base, exit papillae, which sometimes may be filled by a spherical to oval persistent refractive body or plug. Rhizoids delicate or fairly coarse, branched, arising from the base of the sporangium or a short axis. Zoospores spherical, 2.6—3.5 μ diam., with a minute hyaline, refractive globule: emerging usually from several papillae simultaneously and darting rapidly away; flagellum 14—16 μ long. Resting spores ovoid, 17—22 × 25—28 μ, spherical, 16—25 μ diam., irregular or somewhat polygonal with a fairly thick, smooth brown wall and filled with coarse granules or angular bodies; germination unknown.

Rhizophydium stipitatum Sparrow, 1957. Trans. Brit. Mycol. Soc. 40: 527, fig. 1 A—C.

Saprophytic on corn leaves and snake skin in soil samples AKT and OWL.

The New Zealand specimens of this species differed from those reported in England and Scotland by their predominantly sessile sporangia and the presence of up to 13 exit papillae. In other respects, however, they were similar to those of *R. stipitatum* and they are, accordingly, identified as such.

Rhizophydium collapsum Karling, 1964. Sydowia 17: 285, figs. 1—15.

Saprophytic in dead pollen of *Pinus sylvestris* from soil samples AMPB, OD and on dead oogonia of *Vaucheria* sp. in culture WT8.

Septosperma

Septosperma rhizophydii Whiffen, 1942. Mycologia 34: 552, figs. 28—52.

Parasitic on *Chytriomyces hyalinus* from soil sample AKT.

Whether or not this fungus is identical with *S. rhizophydii* is not certain because it did not parasitize a species of *Rhizophydium* which was present in the same culture of *C. hyalinus*. Furthermore, no spherical sporangia occurred; only clavate ones, 9.2—11.8 μ in greatest diameter by 21—31.5 μ high, were observed, and these lacked a bulbous base or haustorium. The zoospores and resting spores, however, were similar in size and shape to those of *S. rhizophydii*. The resting spores were filled with numerous refractive angular bodies instead of one or more globules, and had a small pointed peg which extended down into the empty basal cell (fig. 41). This fungus occurred in great abundance, and frequently as many as 45 parasites were present on a host sporangium whose content gradually disintegrated as a result of the parasitism.

Podochytrium

Podochytrium emmanuelense Sparrow and Paterson, 1955. Mycologia 47: 274.

Rhizidopsis emmanuelense Sparrow, 1933. Trans. Brit. Mycol. Soc. 18: 216.

Parasitic on *Melosira* sp. from pond near Cascade Creek, Eglinton Valley, southern Otago.

Podochytrium chitinophilum Willoughby, 1961. Trans. Brit. Mycol. Soc. 44: 590, figs. 2, pl. 38.

Saprophytic on purified shrimp chitin in water from Lake Ohau, Canterbury Province.

Summary

Three species of *Phlyctidium*, 23 species of *Rhizophydium*, 1 of *Septosperma* and 2 of *Podochytrium* were collected and identified in

New Zealand. Of these *Phlyctidium marinum*, *Rhizophydium macrosporum*, *R. polystomum* and *R. clavatum* are described as new species. In addition, several other specimens of *Rhizophydium* were observed, but it was impossible to identify them from the meager material available.

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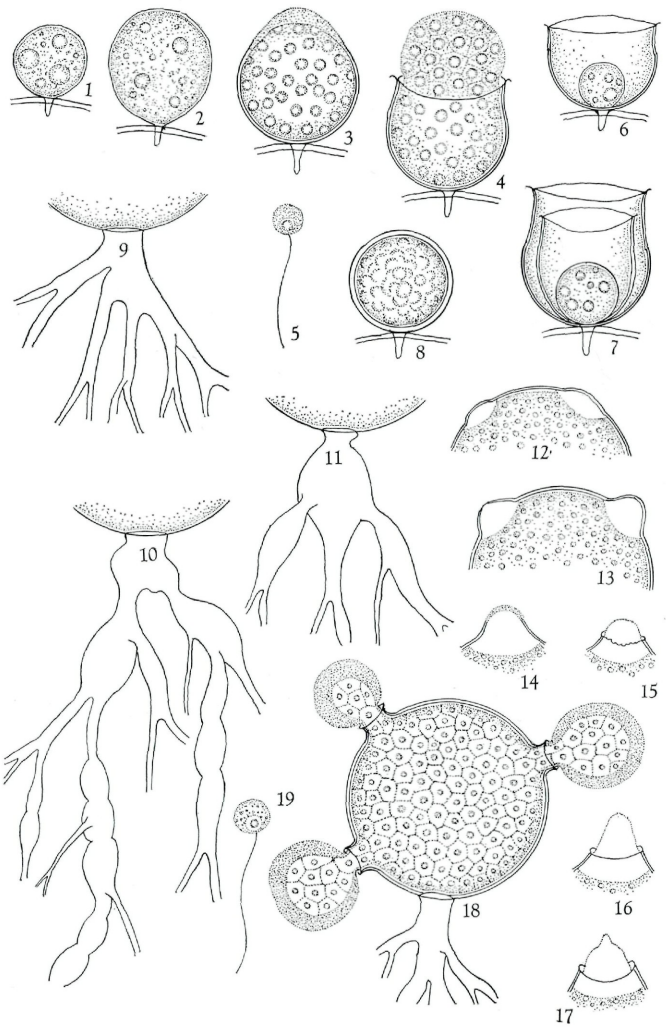

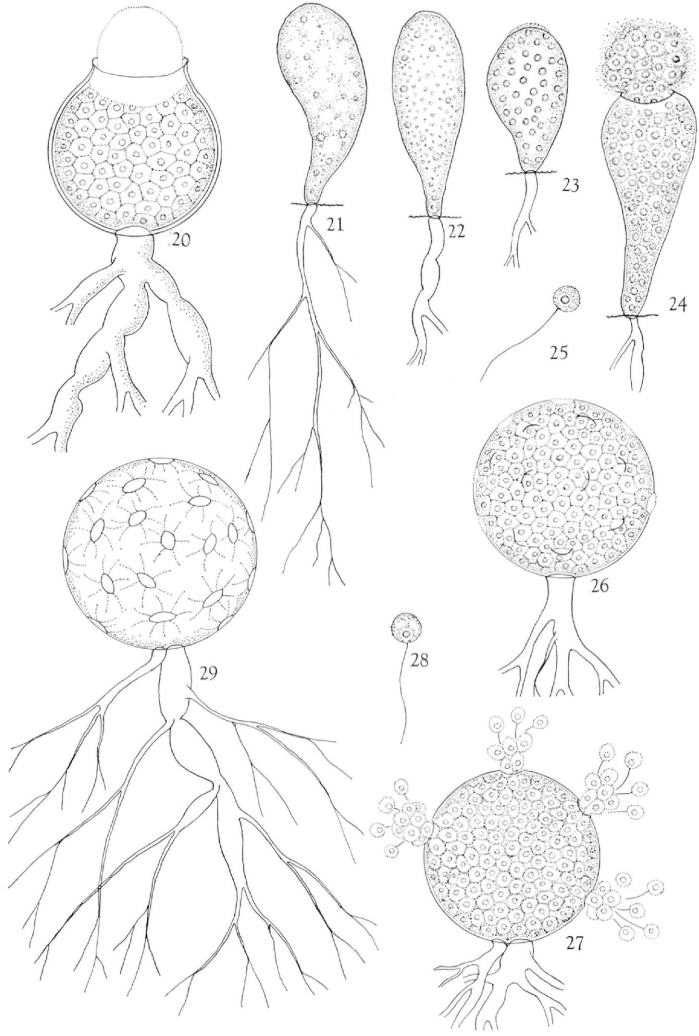

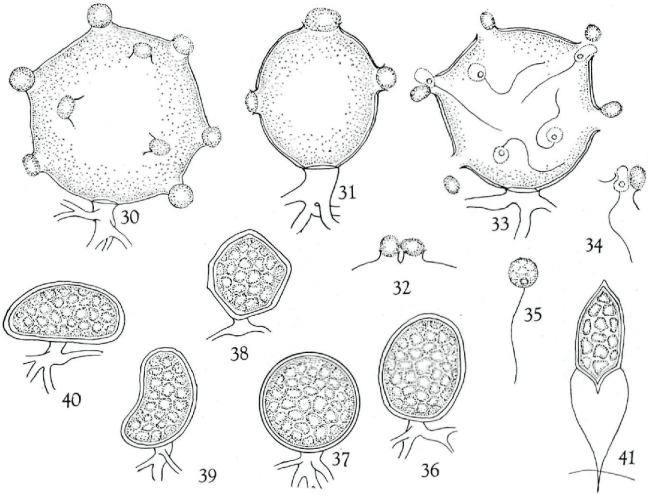

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Explanation of Figures.

Figs. 1—8. *Phlyctidium marinum.* Figs. 1, 2. Young sporangia with endobiotic peg. Fig. 3. Sporangium with broad apical papilla. Fig. 4. Discharge of zoospores. Fig. 5. Zoospore. Figs. 6, 7. Development of secondary and tertiary sporangia, respectively, in the primary one. Fig. 8. Resting spore.

Figs. 9—20. *Rhizophydium macrosporosum.* Figs. 9—11. Variations in main rhiziodal axes. Figs. 12, 13. Stages in development of exit papillae. Fig. 14, 15. Deliquescence of outer wall of papilla and protrusion of the hyaline mass. Fig. 16, 17. Variation in shapes of protruding masses. Fig. 18. Simultaneous discharge of zoospores from 3 exit papillae. Fig. 19. Zoospore. Fig. 20. Sporangium with one broad apical papillae.

Figs. 21—25. *Rhizophydium clavatum.* Figs. 21—23. Variations in sizes and shapes of sporangia and rhizoidal axes. Fig. 24. Discharge of zoospores. Fig. 25. Zoospore.

Figs. 26—29. *Rhizophydium polystomum.* Fig. 26. Mature sporangium with numerous barely perceptible exit papillae. Fig. 27. Simultaneous discharge of zoospores from several papillae. Fig. 28. Zoospore. Fig. 29. Thallus with empty sporangium; oval exit papillae with radiating lines.

Figs. 30—40. *Rhizophydium elyensis.* Fig. 30. Sporangium on snake skin with hyaline refractive bodies in exit papillae. Fig. 31. Sporangium with 3 exit papillae; apical papilla filled with an unussually large body. Fig. 32. Closely adjacent papillae. Fig. 33. Almost empty sporangium with hyaline bodies lying at or near the exit papillae, Fig. 34. Zoospore pushing past hyaline body at exit papillae. Fig. 35. Zoospore. Fig. 36—40. Variations in sizes and shapes of resting spores.

Fig. 41. Resting spore of *Septosperma rhizophydii.*