A clamp-bearing fungus using stalked adhesive young chlamydospores in capturing amoebae

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With Plates XXXIV—XXXVI.

An amoeba-capturing fungus displaying in its predacious apparatus remarkable convergence as well as an unusual combination of vegetative and reproductive functions came to light in several Petri plates of maize-meal agar which after being overgrown with *Pythium* mycelium had been further planted on March 11, 1960, with pinches of crumbly leaf mold gathered on April 16, 1959, in two locations near Lake Alfred, Florida. The fungus attained only rather limited development, chiefly because in all cultures the durably pelliculate rhizopod on which it mainly subsisted was killed off early by a robust zoopagaceous form that subsequently became recognizable as a species of *Cystopage*. Its growth may have been hampered also by some slime-mold plasmodia which manifestly had originated from spores that survived desiccation in the leaf mold stored for nearly a year in an air-dry condition. Here and there, nevertheless, the fungus was observed to capture and consume an abundance of prey, and in the favorable areas it extended its mycelium for distances of 5 to 8 mm from the deposits of partly decayed material.

Although from resemblances with respect to biological relationship and to production of clamp-connections the Florida fungus would seem kindred with the 7 nematode-destroying forms I described (Drechsler, 1941, 1943, 1946, 1949, 1954 a) as species of *Nematoctonus* the peculiarities shown in its development merit recognition in the establishment of a new genus. One of these peculiarities may appropriately be signalized in a generic term compounded of two words (πᾰ́γίς, genitive παγίδος; σπορά) meaning "trap" and "seed", respectively.

Pagidospora gen. nov.

Mycelium ramosum, incoloratum; hyphae saepius septato-nodosae, hic illic vel saepius praecipue in apice ramulorum brevium chlamydosporas ferentes; chlamydospora in juventute incolorata, membrana tenui circumdata, maximam partem vel paene omnino vel forsitan ex toto in bulla tenaci constans; bulla tenax saepe ad animal inhaerens, id ita capiens, hypham cum ramis assumentibus

(haustorium) in captivum intrudens quae protoplasma exhaurit; chlamydospora in maturitate muro crasso circumdata, saepe aliquid flavida. Typus: *Pagidospora amoebophilla.*

Pagidospora amoebophila spec. nov.

Mycelium exigue expansum, inconspicuum; hyphae repentes vel immersae, incoloratae, mediocriter ramosae, multis nodosis septis et paucis levibus septis divisae, plerumque 1.5—4 μ latae, in apice eorum sed praecipue in apice ramulorum plerumque 1—50 μ longorum et 1.2—2.5 μ latorum chlamydosporas singulatim vel quandoque deinceps ferentes. Chlamydospora juvenis basi septo nodoso semper delimitata, in bulla tenaci et pediculo cylindraceo plerumque 0.5—20 μ longo et 1.2—3 μ lato constans; bulla tenax globosa, vulgo 6—12 μ longa, 5.5—10 μ lata, aliquando brevem fertilem stipulam vel longiorem hypham emittens, saepius ad amoebam inhaerens, ita animal capiens, id primo stricte postea vulgo laxius tenens, mox hypham (interdum 2 hyphas) in captivum intromittens; haec hypha basi vulgo 1.5—2 μ lata, sursum saepius usque 2—3.5 μ latescens, intra animal ramos assumentes emittens itaque haustorium faciens; rami assumentes plerumque 2—2.7 μ crassi, late curvati, saepe in glomum laxum intertexti, protoplasma animalis gradatim exhaurientes. Chlamydosporae in maturitate aliquid flavidae, saepe globosae vel elongato-ellipsoideae, 6—12 μ longae, 5.5—10 μ latae, membrana 0.7—1.3 μ crassa circumdatae, protoplasmatis crasse granulosi cum 1—3 corporibus nitidis circa 1.4 μ latis repletae, pediculo cylindraceo indurato 0.5—20 μ longo et 1.2—3 μ lato et saepius omnino vel magnam partem vacuo praeditae; quandoque praeterea apice vel a latere 1—2 tubulis hypharum vacuis ornatae; plerumque discretae sed quandoque cum 1—3 aliis chlamydosporis conjunctae. Rami assumentes quandoque in corpora perdurantia prave filiformia, saepe 10—30 μ longa, 3—5 μ lata, chlamydosporis aliquid similia transeuntes.

Amoebas duarum specierum capiens consumensque habitat in materiis plantarum putrescentibus prope Lake Alfred, Florida. Typus: Tabulae XXXIV—XXXVI.

When *Pagidospora amoebophila* develops in maize-meal-agar plate cultures that after being planted with slowly decaying materials have become overgrown with bacteria, permeated with various fungi, and infested with protozoans and eelworms, it does not usually become visible to the naked eye. It extends its moderately branched mycelium (Pl. I, A—O; Pl. II, A—J; Pl. III, A—K) somewhat sparingly both on and under the surface of the substratum. For the most part its hyphae, which commonly vary from 1.5 μ (Pl. III, H) to 4 μ (Pl. I, L) in width, are filled with protoplasm of nearly homogeneous consistency. They are divided by cross-walls (Pl. I, A, a—d; B, a—c; H, a—i; I, a—c; Pl. II, B—F; Pl. III, A—I) into segments mostly between 5 and 100 μ long. As by far the larger number of

cross-walls are associated with clamp-connections the fungus at first sight gives the impression that it is wholly devoid of unmodified septa. However, in nearly any considerable tract of mycelium further microscopical scrutiny usually reveals some scattered septa that lack any indication of a clamp (Pl. I, A, b; H, a; Pl. III, J, a). In one observed instance (Pl. I, H, d) formation of a clamp had apparently begun in the usual manner, but through a developmental mishap the elongating lateral process became fused with a filamentous branch nearby rather than with the adjoining segment.

In the design of its predacious organs *Pagidospora amoebophila* shows no close parallelism with the 3 nematode-capturing species I described (Drechsler, 1946, 1949, 1954 a) under the binomials *Nematoctonus haptocladus, N. concurrens,* and *N. compylosporus.* Contrary to expectations suggested by the abundant display of clamps these organs consist of stalked adhesive knobs (Pl. I, A, e; B, d; C—G; H, j—l; Pl. II, B, a, b; Pl. III, D; E, a—d; F, b; G, a) closely similar to the stalked knobs by means of which capture of eelworms is accomplished in several clampless hyphomycetes including *Dactylella ellipsospora* Grove (1886), *Dactylella asthenopaga* Drechsler (1937), *Dactylaria haptotyla* Drechsler (1950), and *Dactylaria sclerohypha* Drechsler (1950). The similarity in design is sustained by notable similarity in dimensions, as the adhesive knobs of *P. amoebophila,* typically of globose or prolate ellipsoidal shape, commonly measure 6 μ (Pl. III, C, g) to 12 μ (Pl. II, B, c) in length and 5.5 μ (Pl. III, C, g) to 10 μ (Pl. II, D) in greatest width, while the stalks supporting them vary mostly from 1.5 μ (Pl. III, E, c) to 60 μ (Pl. I, G) in length and from 1.2 μ (Pl. I, F) to 2.5 μ (Pl. I, G) or 3 μ (Pl. I, L) in width. Sometimes the stalk arises from the crest of a clamp-connection (Pl. I, D, P) but more usually it originates from an unmodified portion of the parent hypha. In some few instances where a line of demarcation, commonly more or less indistinct, appears to delimit the stalk basally (Pl. I, C; Pl. II, D) it remains uncertain whether the line represents merely the contour of the parent hypha or denotes the presence either of an unmodified septum or possibly of a septum accompanied by a small clamp concealed from view on the under side. Each stalk, in any case, is provided with at least one cross-wall that is attended by a clamp-connection. This nodose cross-wall, unlike the unmodified septum which in *Dactylella asthenopaga,* for example, always delimits the adhesive knob accurately in the plane where the globose contour meets the cylindrical contour of the stalk, is variable with respect to its position. It occurs sometimes in the basal portion (Pl. I, D; H, b; I, c; Pl. II, A; B, a; F; Pl. III, C, g), sometimes in the middle portion (Pl. I, A, d;E; Pl. II, B, b, c; C; D; E; G; Pl. III, D; E, a; G, a), and some times in the distal portion (Pl. I, B, c; F; H, i; Pl. III, E, c, d) of the stalk, so that proximally the adhesive

knob remains continuous with a cylindrical part mostly 0.5—20 μ long and 1.2—3 μ wide. This cylindrical part accordingly is treated in the diagnosis as constituting a basal "pediculus", or pedicel, of the young as well as of the mature chlamydospore, while the proximal portion of the stalk is treated as the sporiferous branch. Consonant with the interpretation underlying such disposition, the stalk supporting the adhesive knob shown in Plate I, G, is held to consist of a spore pedicel 10 μ long and of a sporiferous branch 50 μ long. In stalks that contain 2 nodose septa the proximal one would seem to have no greater significance either in the earlier (Pl. I, G) or in the later (Pl. III, B) development of the predacious organ than any similar partition in the parent hypha.

An *Amoeba* surrounded by a firm membranous pellicle and measuring 30—55 μ across when drawn into a rounded shape was most frequently found serving as prey of *Pagidospora amoebophila.* Within its protoplast *Pythium* oospores (Pl. I, I, e, f) in various stages of digestion were often visible. Following its capture this animal usually continues for hours to operate its contractile vacuole (Pl. I, I, v; J, v; Pl. II, B—E: v) in proximity to the single elongated-ellipsoidal nucleus (Pl. I, I, n; J, n; Pl. II, B—E: n), 12—15 μ long and 4—9 μ wide, which encloses a slightly darker endosome, mostly 5—7 μ long and 3—4.5 μ wide. The fungus meanwhile proceeds with its attack by extending from the globose knob broadly adhering to the animal's pellicle an infection tube (Pl. I, I, d) often about 1.7 μ in diameter proximally. This tube usually widens as it penetrates farther into the protoplasm of the captive (Pl. II, B), with the result that on reaching a length of 15—25 μ it has commonly attained a diameter between 2.5 and 4 μ. Thereupon it usually gives off a branch at a wide angle and in a manner often rather strongly simulating dichotomy. In continuing growth the 2 terminal elements commonly describe divergent curves. After some elongation each puts forth a branch, again usually at a wide angle and with an appearance of dichotomy (Pl. I, J; Pl. II, C—E). The same sequence of elongation and branching may then be repeated, though owing to the depth of the overlying protoplasm the development of the infection tube into a somewhat elaborately ramifying system is nearly always badly obscured. Later when the animal's protoplasm has been largely absorbed (Pl. II, F) some branching of a third order can often be made out. The completed assimilative system, or haustorium, with its curving hyphal elements intertangled into a loose clew, bears most resemblance to that of *Zoopage thamnospira* Drechsler (1938), a zygomycete wholly alien with respect to taxonomic affinity but similar in subsisting through capture of amoebae. On exhaustion of the animal's fleshy substance all the protoplasm in the ramified haustorium is, as a rule, gradually withdrawn backward through the

adhesive knob into the parent hypha (Pl. I, K, b). The emptied assimilative branches vanish from sight within the minutely wrinkled collapsed pellicle (Pl. I, H, N; Pl. II, G, H, I; Pl. III, B), but the membrane of the stalk-like part — originally the infective tube — having become markedly thickened and indurated, often remains clearly visible as a distal appendage of the adhesive knob. Adjacent portions of assimilative apparatus that fail to become emptied in the general withdrawal of haustorial contents may form hyphal cysts (Pl. III, C, h; X, a) or give rise to chlamydospores (Pl. III, C, b).

In one of my maize-meal-agar plate cultures *Pagidospora amoebophila* was observed capturing and destroying also a conspicuously globuliferous *Amoeba* that was surrounded by an ectoplasmic mantle about 0.4 μ thick rather than by the thinner yet firmer membranous pellicle of familiar type. The animal in question was evidently conspecific with the one earlier found utilized as prey by *Stylopage ischnospora* var. *pleacra* Drechsler (1959). In captured individuals of this protozoan, too, the fungus forms a rather luxuriant haustorium whose curving assimilative branches are intertwined into a loose clew. Soon after attaining full development the haustorium here usually becomes exposed to alien microorganisms as a result of complete disintegration of the animal's peripheral mantle (Pl. I, K, a; Pl. III, A). Owing probably to such exposure the ensuing withdrawal of contents from the assimilative branches is often less thorough (Pl. I, L) than where a membranous pellicle remains as an unbreached protective sheath long after the captive has succumbed to invasion. Partly because some portions of its assimilative system that fail to become emptied of their protopolasm manage to survive through encystment, *P. amoebophila* incurs less degeneration of haustorial contents than is incurred by *S. ischnospora* var. *pleacra* in preying on the same animal.

Sometimes 2 neighboring adhesive knobs (Pl. III, A, a, b) of *Pagidospora amoebophila* are found instrumental in capturing and invading the same individual amoeba, just as in the clampless hyphomycetes 2 or more adhesive knobs, or, for that matter 2 or more constricting rings, sometimes are found to operate jointly in capturing and invading the same eelworm. An adhesive knob of *P. amoebophila* not infrequently intrudes 2 infection tubes into a captured protozoan, though similar double invasion of an eelworm from an adhesive knob of a clampless hyphomycete (Drechsler, 1950, p. 52, Fig. 13, D, e) would seem to occur only rarely. No instance appears to have been recorded wherein an adhesive knob of a clampless hyphomycete served in capturing more than a single eelworm, but in *P. amoebophila* it is not unusual to find adhesive knobs that have extended separate infection tubes into 2 captive amoebae, which may or may not (Pl. I, K, a, b) be of the same species. The greater

predacious capabilities are associated with a curious difference in the manner of holding prey. When an eelworm has been captured through adhesion to a knob of *Dactylella asthenopaga,* for example, the animal remains closely affixed to the globose cell, which thereby becomes much less accessible to other nematodes. An amoeba captured by *P. amoebophila* is in the beginning likewise kept directly affixed to the adhesive knob, but very often this affixture is later discontinued, being then superseded by an adhesive attachment to the infection tube. Consequently the animal, and finally its empty pellicle or other residual material, is often found tethered on the filamentous tube in a position 2 to 20 μ away (Pl. I, H; K, b; L; M; Pl. II, F—I; Plate III, A, a, b; B; C), leaving the adhesive knob exposed to encounter with other amoebae suitable as prey. Even in instances where the knob, besides, has put forth a hypha bearing one (Pl. I, H, l) or more new predacious organs its capabilities for further capture of animals would not seem seriously impaired.

While the adhesive knobs by means of which several clampless hyphomycetes capture nematodes can apparently function only as predacious organs, those of *Pagidospora amoebophila* serve very importantly, besides, as reproductive structures, since they consistently undergo conversion into the spores characteristic of the fungus. The conversion takes place sooner or later, whether the individual knobs have succeeded or have failed in securing prey. As the conversion entails no noticeable change in size the resulting spores (Pl. I, P—Y; Z, a, b; Pl. II, J, a; K—X; Pl. III, A, b; B; C, a—f; E, e—m; F, a, c; G, b; H, a, b; I a—c; J, b; K, a—d; L—U) have generally the same outward dimensions as the adhesive organs from which they were formed, and like them include a basal cylindrical part, or pedicel, of variable length. In mature spores, which are nearly always yellowish, the globose cell is surrounded by a wall mostly 0.7—1.3 μ thick and contains protoplasm often crowded with granules about 0.5 μ wide. Among these coarse granules 1—3 round lustrous bodies, about 1.4 μ in diameter, are often discernible. Where the basal pedicel is short (approximately 0.5—2 μ long) it usually is present as a solid protuberance of the wall (Pl. I, U—X; Pl. II, O, P, S; Pl. III, B; C, c, e; E, f, g, l; F, a; G, b; H, a, b; I, b, c; K, a, b), but where it is longer (approximately 2—20 μ in length) it usually retains a tubular character, though its narrow lumen is often largely or wholly empty of protoplasm. Whatever partition may be present between the chamber of the globose cell and the lumen of the empty pedicel, usually is only indistinctly visible, especially with respect to its proximal contour.

When on slight disturbance the mature spore of *Pagidospora amoebophila* becomes detached at the base of its pedicel it sometimes remains connected with a portion of infection tube, which, though

usually empty (Pl. I, Z, a; Pl. II, X), is found in scattered instances to have retained some protoplasm and formed a hyphal cyst (Pl. III, X, a). Usually the more crooked hyphal cysts (Pl. III, Y, Z), mostly 10—30 μ long and 3—5 μ wide, that are formed mainly from distal portions of the haustorium (Pl. I, M) no longer have any visible connection with the spore from which they originated. A rather more durable connection is sometimes found between two catenated spores (Pl. I, Z, b; Pl. II, Y, Z; Pl. III, V; W), of which one, while in the thin-walled predacious stage, gave rise to the other on a short hyphal outgrowth (Pl. I, O; Pl. II, J, b; Pl. III, C, a, c; E, a, f; K, c, d).

As *Pagidospora amoebophilus* has hitherto not been found producing basidia and basidiospores, or, indeed, any other propagative bodies except hyphal cysts and the spores resulting from maturation of the stalked adhesive knobs, opinion concerning its taxonomic relations can be based only on similarities to imperfect stages of various basidiomycetes. Its reproductive apparatus shows striking parallelism, certainly, with the figures given by Davidson, Campbell, and Vaughn (1942, p. 24, Fig. 4, F, a, c; p. 32, Fig. 5, H, a, c) to illustrate hyphae and chlamydospores formed in malt-agar cultures of *Polyporus compactus* Overh. and of *Polyporus spraguei* Berk. & Curt. Despite the wide difference in biological habit between the microscopic organism subsisting through capture of protozoans and the two fungi causing decay of living oaks, the close morphological correspondence here would seem to reveal a true homology. In conformity, therefore, with the usage of Davidson, Campbell, and Vaughn as well as that of Nobles (1948) the spores of *Pagidospora amoebophilus* are considered in the diagnosis as mature chlamydospores, and the adhesive knobs are considered as young chlamydospores. There is good reason to believe that while the adhesive knobs of *Dactylella asthenopaga,* for example, obviously represent purely vegetative organs wholly without reproductive function, the outwardly similar knobs of *Pagidospora amoebophila* are in a basic sense reproductive bodies, which, during the protracted period when they are full-grown but still immature, operate habitually as predacious organs. A somewhat similar combination of functions has elsewhere come under observation only in a clampless septate nematode-capturing fungus whose adhesive networks ultimately are often transformed into mycelial complexes of distended indurated cells. In this clampless fungus, however, the dual-purpose structures are manifestly designed primarily for a predacious function, and their later utility as durable propagative apparatus — at no stage can they be regarded as typical spores — appears as a supplementary feature.

The resemblance shown by *Pagidospora amoebophila* to the asexual reproductive apparatus of at least 2 members of the Polyporaceae is not shared by any of the 7 clamp-bearing predacious or

parasitic fungi described as species of *Nematoctonus*. While in 2 of the 7 species, namely *N. tylospora* Drechsler (1941) and *N. pachyspora* Drechsler (1943), chlamydospores are formed, these are elongated-ellipsoidal in shape rather than globose, aerial rather than procumbent or submerged, verrucose or echinulate rather than smooth, thin-walled rather than thick-walled, and slenderly rather than sturdily attached at the base. For capturing nematodes *N. haplocladus, N. concurrens,* and *N. campylosporus* employ a medially constricted glandular cell that is enveloped in a droplet of adhesive secretion and is borne slightly aloft on an upcurved hyphal tip or on a short erect hyphal spur — a distictive predacious organ markedly different from the young chlamydospore of *P. amoebophila.* The aerial conidia produced by all 7 known species of *Nematoctonus* have no counterpart in *P. amoebophila.* Resemblance to the conidia of *Corticium incurustans* Hohn. & Litsch. as figured by Lyman (1907) and by Nobles (1937) was noted earlier (Drechsler, 1941) in the conidia of *N. tylosporus* and is evident also in those of the 6 congeneric species. The general similarity in conidial morphology here might be held to suggest kinship of *Nematoctonus* with the Thelephoraceae, just as similarity in respect to chlamydospore morphology might be held to suggest kinship of *P. amoebophila* with the Polyporaceae.

It seems possible that the unnamed fungus I earlier found (Drechsler, 1954 b, p. 780, Fig. 6, D—K; p. 781) capturing a species of *Amoeba* by means of sessile adhesive knobs may have been a close relative of *Pagidospora amoebophila.* The protoplasm in its mycelial hyphae as well as in its knobs appeared of even more pronouncedly homogeneous texture than the hyphal contents in members of the clampless series of predacious hyphomycetes; and in some instances a captured rhizopod was found not closely affixed to the globose knob, it being fastened instead to a proximal portion of the infection tube. No clamp-connections were seen in the fungus, but as has been pointed out by various authors, including Lyman as well as Davidson, Campbell, and Vaughn, the production of clamps is in some species an inconstant feature. In the small tract of mycelium, again, no conversion of globose knobs into chlamydospores was observed, but it is possible that my observations were not carried on long enough to include the final stages of development. Accordingly some little consideration was given to the unnamed fungus in framing the diagnosis of the genus *Pagidospora.*

As the scanty material of *Pagidospora amoebpohila* deposited under the number 71635 in the National Fungus Collections, Plant Industry Station, Beltsville, Maryland, is in several respects unsatisfactory, it has appeared advisable to designate as type the accompanying figures, which were prepared from living structures in

sufficient numbers to allow some scope for random selection. Pure cultures of *P. amoebophila* have not become available, for owing to lack of aerial conidia all attempts to isolate the fungus were unsuccessful.

Zusammenfassung

Ein septierter und mit Schnallen versehener Fadenpilz der sich durch den Fang zweier Amoeben-Arten ernährt, ist unter den Namen *Pagidospora amoebophila* neu beschrieben. Als Fang-Organe dienen wohl die gestielten kugligen Chlamydosporen des Pilzes, aber nur solange als sie sich, mit dünner klebriger Membran umgeben, in verlängertem unreifem Zustand befinden. Diese unreifen Sporen sind von den aufrechten klebrigen Drüsenknöpfen der mit Schnallen versehenen Nematoden-fangenden *Nematoctonus*-Arten recht verschieden, aber den klebrigen Knöpfen etlicher schnallenloser Nematoden-fangenden Hyphomyceten der Gattungen *Dactylella* und *Dactylaria* auffallend ähnlich. Weil überdies die Sporen im unreifen wie auch im reifen Zustand den Chlamydosporen der holzzerstörenden Arten *Polyporus compactus* und *Polyporus spraguei* sehr ähnlich sind, scheint es möglich, dass der Pilz zu den Polyporaceen gehört.

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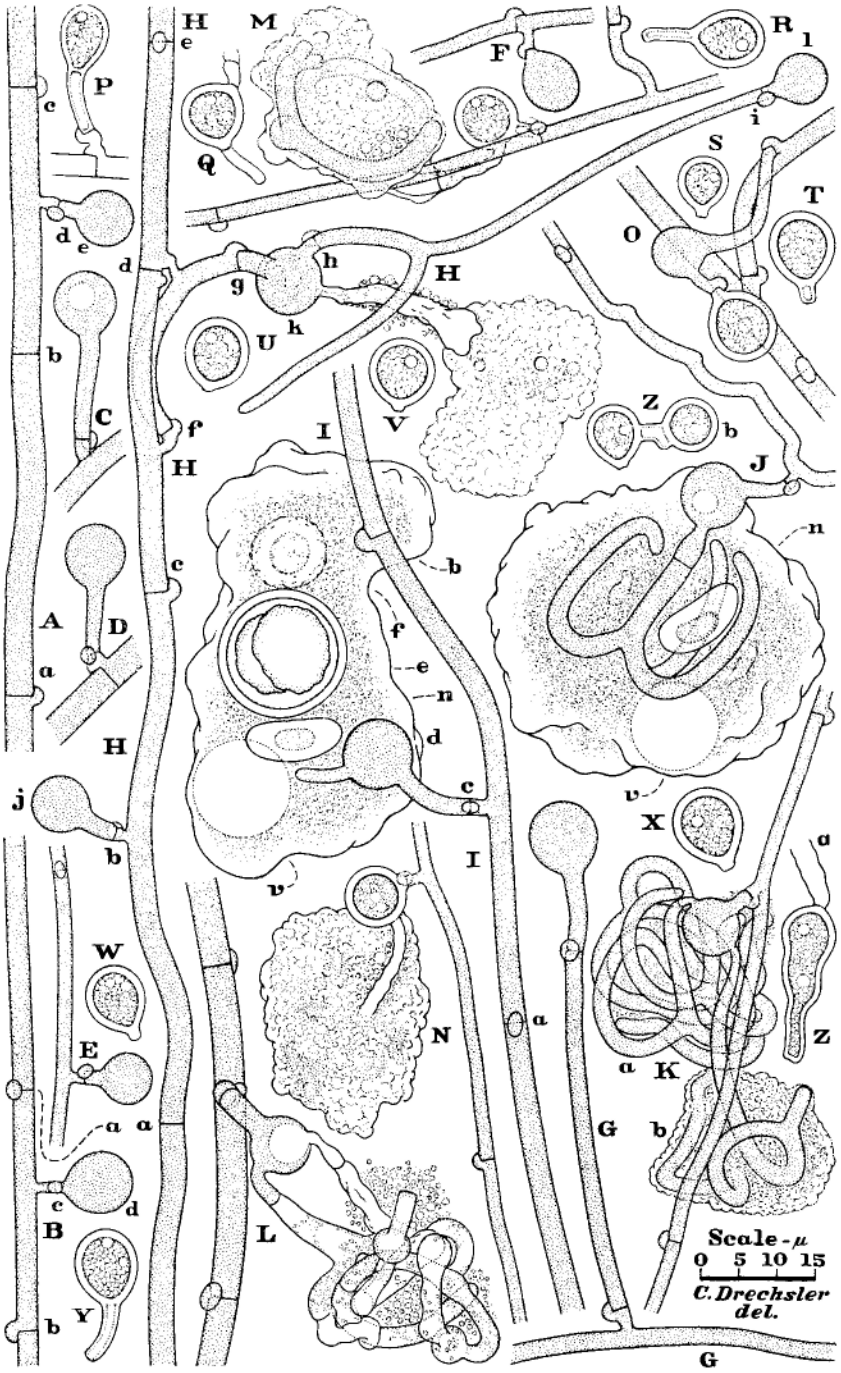
Explanation of Plate XXXIV—XXXVI.

Plate XXXIV. *Pagidospora amoebophila* in maize-meal-agar plate cultures that had been planted with crumbly leaf mold 29 to 38 days earlier: drawn with the aid of a camera lucida at a uniform magnification; x1000 throughout. A, Portion of hypha with 3 cross-walls, a—c, among which one, b, is not accompanied by a clamp-connection; a fourth septum, d, which has a clamp, delimits a young chlamydospore, e, from its supporting branch. B, Portion of hypha with 2 septa, a and b, each with a clamp-connection; a third nodose septum, c, delimits basally a young chlamydospore, d. C, D, Young chlamydospores, each with a relatively long pedicel delimited basally by a nodose septum from a short branch. E, F, Portions of narrow hyphae, each with a nodose septum and bearing a short branch surmounted by a young chlamydospore. G, Portion of hypha with a long sporiferous branch containing 2 septa with clamps. H, Portion of mycelial hypha with a sporiferous branch; a—i, nine septa, including two, a and d, that are without clamp-connections; j—l, three immature chlamydospores, one of which, k, has extended a hypha after capturing an amoeba and expropriating its contents. I, Portion of hypha with 2 nodose septa, a and b; a third nodose septum, c, delimits basally a young chlamydospore, d, that has been operative in capturing an amoeba surrounded by a firm membranous pellicle within which are shown 2 partly digested *Pythium* oospores, e and f, as well as an elongated-ellipsoidal nucleus, n, and a contractile vacuole, v. J, Portion of hypha bearing a short branch surmounted by a young chlamydospore that has been operative in capturing an amoeba enveloped in a firm membranous pellicle and has intruded into the animal 3 recurving assimilative branches; n, nucleus of animal; v, contractile vacuole. K, Portion of hypha with a short branch bearing a young chlamydospore from which a separate haustorium has been extended into each of 2 captured amoebae, a and b; the soft thickish pellicle of one captive, a, has disintegrated, leaving exposed a clew of haustorial branches, while the wrinkled membranous pellicle of the other captive, b, continues to protect the assimilative branches still in process of being evacuated. L, Portion of hypha with a short branch bearing a young chlamydospore from which 2 haustoria were intruded into a captured amoeba whose soft thickish pellicle disintegrated early, so that the contents of the assimilative branches were only incompletely withdrawn backward through the infection tube and adhesive knob. M, Portion of mycelium showing a mature chlamydospore with an empty infection tube to which is attached a shrunken membranous pellicle that surrounds isolated living portions of 2 assimilative branches. N, Portion of hypha with a short branch bearing a mature chlamydospore from which extend an empty membrane of an infection tube and an empty wrinkled membranous pellicle. O, Portion of mycelium showing a young chlamydospore that has put forth a short hypha bearing a mature chlamydospore; the pedicel of the young chlamydospore is of unusual length. P, Mature chlamydospore with empty pedicel attached to empty branch. Q, Detached mature chlamydospore with empty pedicel and proximal portion of empty infection tube. R—Y, Detached chlamydospores, showing usual variations in size and shape. Z, Mature chlamydospores: a, one showing unusual shape, extension of protoplasm to base of pedicel, and empty apical appendage representing proximal portion of infection tube; b, two closely connected mature chlamydospores.

Plate XXXV. *Pagidospora amoebophila* in maize-meal-agar plate cultures that had been planted with crumbly leaf mold 29 to 38 deys earlier;

drawn with the aid of a camera lucida at a uniform magnification; x1000 throughout. A, Young chlamydospore with pedicel of moderate length supported on short branch. B, Portion of mycelium showing 15 septa with clamp-connections and 3 young chlamydospores, a—c; from one of the young chlamydospores, c, an infective hypha has been extended into a captured amoeba that is surrounded by a firm membranous pellicle; n, nucleus of animal; v, contractile vacuole. C—E, Smaller portions of mycelium, each showing an immature chlamydospore from which an infection tube has been extended into a captured amoeba surrounded by a firm membranous pellicle; within each captive the infection tube has ramified in forming a haustorium with 4 assimilative branches; n, nucleus of animal; v, contractile vacuole. F, Portion of mycelium showing a young chlamydospore from which an infection tube has been extended into a captured amoeba surrounded by a firm membranous pellicle; within the captive a branched haustorium has been produced. G, Portion of hypha with a young chlamydospore bearing an empty infection tube to which is affixed the wrinkled membranous pellicle of an amoeba. H, I, Portions of hyphae, each with a mature chlamydospore bearing an empty infection tube to which is affixed the wrinkled membranous pellicle of an amoeba. J, Portion of hypha on which is borne a discrete mature chlamydospore, a, and also 2 rather firmly conjoined chlamydospores, b. K—X, Detached mature chlamydospores showing usual variations in size and shape. Y, Z, Pairs of connected mature chlamydospores.

Plate XXXVI. *Pagidospora amoebophila* in maize-meal-agar plate cultures that had been planted with crumbly leaf mold 29 to 38 deys earlier; drawn with the aid of a camera lucida at a uniform magnification; x1000 throughout. A, Portion of mycelium on which are borne a young clamydospore, a, and a mature chlamydospore, b; infection tubes extended from the 2 spores into an amoeba surrounded by a soft thickish pellicle gave rise to haustoria whose assimilative branches became intertangled into a loose clew, which has been left unprotected on disintegration of the pellicle. B, Portion of hypha with a branch whereon is borne a mature chlamydospore bearing distally the thickened membrane of an empty infection tube to which is attached the wrinkled membranous pellicle of a captured amoeba. C, Portion of mycelium with a branch supporting a mature chlamydospore, a, which on one side bears a tubular membrane terminating in a hyphal cyst, h, and a conjoined mature chlamydospore, b, while on the other side it bears 2 successively formed mature chlamydospores, c and d; to the hyphal cyst is affixed the wrinkled pellicle of a captured amoeba; on a secondary hyphal branch are borne 2 mature chlamydospores, e and f, and a young chlamydospore, g. D, Portion of hypha with branch bearing young chlamydospore. E, Terminal portion of branched hypha bearing 4 young chlamydospores, a—d, and 9 mature chlamydospores, e—m, two of which, f and g, originated laterally from the immature but older spore a. (Owing to lack of space E is shown in 2 parts whose proper connection is indicated by a broken line.) F, Portion of hypha with 3 chlamydospores, a—c; the immature spore b, was presumably produced later than the mature spore a. G, Portion of hypha bearing a young chlamydospore, a, and a mature chlamydospore, b. H. Portion of hypha with a rather long branch bearing 2 mature chlamydospores, a and b, probably formed in succession. I, Portion of mycelium with 3 mature chlamydospores, a—c, J, Empty portion of hypha showing a clampless septum, a, and a mature chlamydospore, b. K, Portion of hypha with a distally ramified branch bearing 2 discrete, successively developed mature chlamydospores,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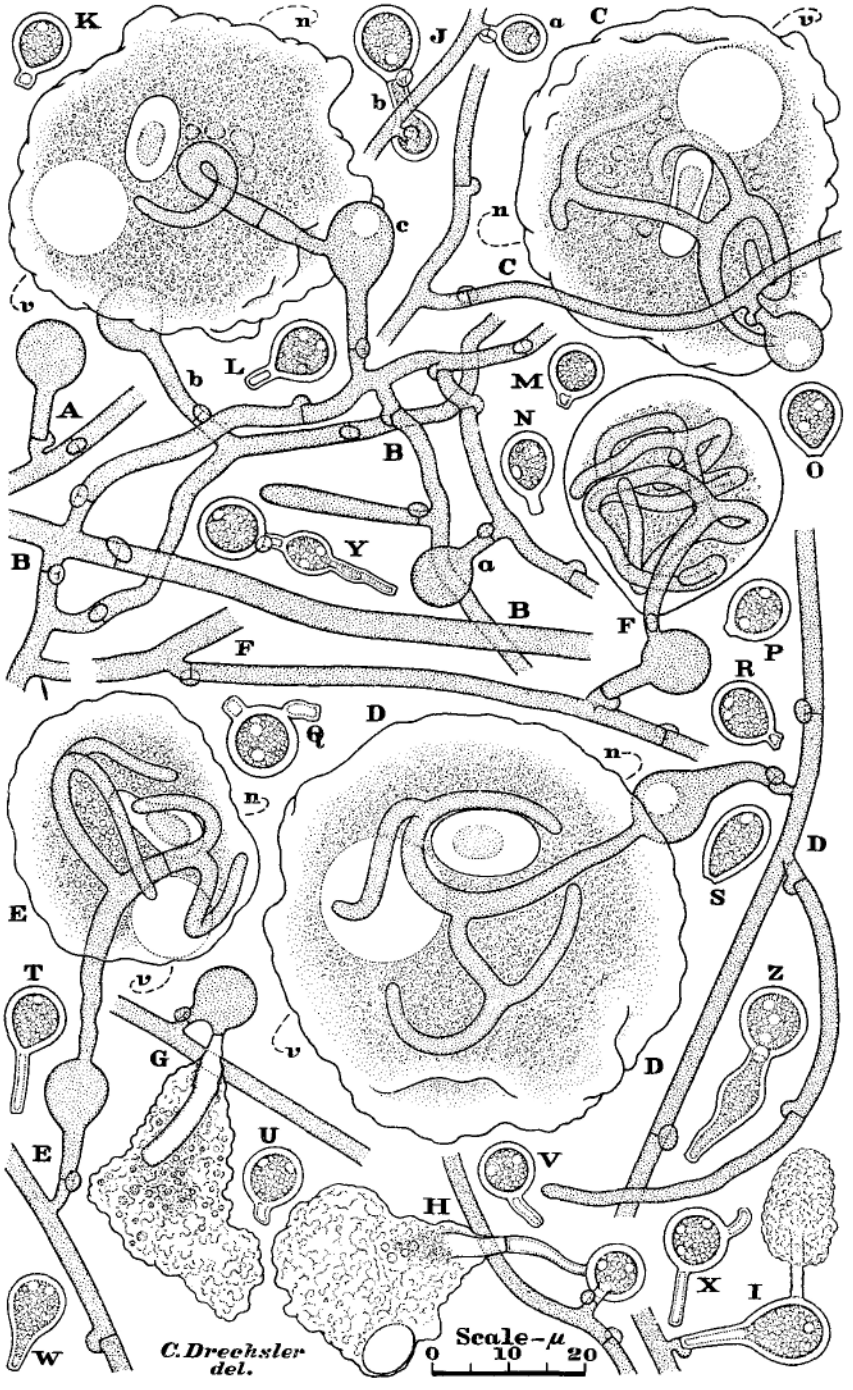
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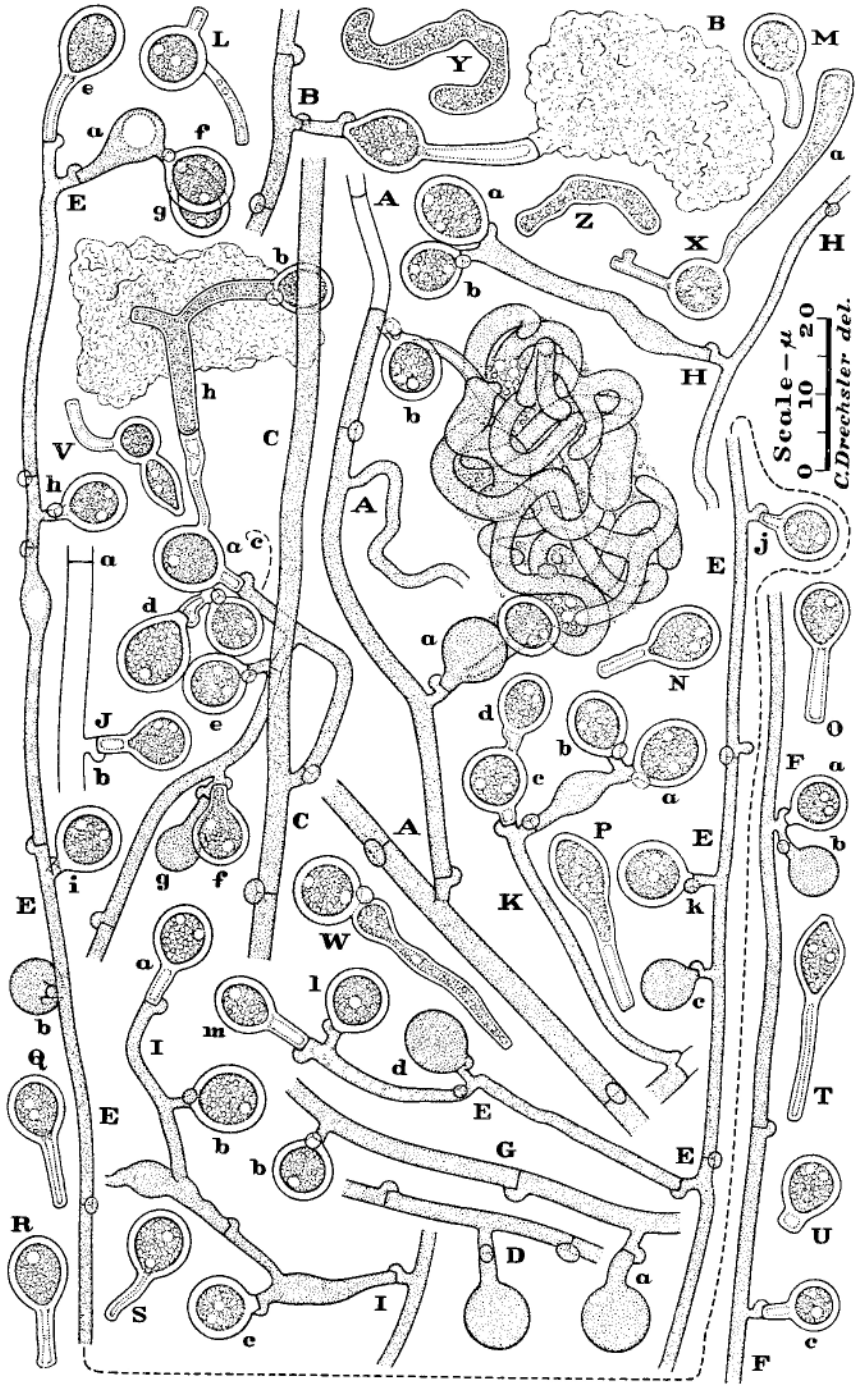
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a and b, as well as 2 closely connected mature chlamydospores, c and d. L—U, Detached mature chlamydospores, showing usual variations in size and shape. V, W, Pairs of closely connected mature chlamydospores. X, Mature chlamydospore connected with hyphal cyst, a, formed from distally widened portion of infection tube. Y, Z, Crooked hyphal cysts formed from assimilative branches.

Correction:

References to plates No. I—III in the text should be replaced by numbers XXXIV—XXXVI. (XXXIV instead of I etc.)!

The references in the explanation to the plates however are correct!