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SECOND NOTE ON CERTAIN PECULIAR FUNGUS-PARASITES OF LIVING INSECTS[1]

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(WITH PLATES I–V)

Although the examination of mycological novelties possesses a certain fascination, it may have its drawbacks, since in the present, as in numerous other instances that might be mentioned, their interest may be neutralized to a considerable extent by their very novelty, which may be of such a nature as to make it impossible to assign them a satisfactory position among their fellows, or to arrive at any reasonable conclusion as to the true significance of their characteristics. Although from the point of view of the systematic mycologist, and for his greater peace of mind, Nature might well have been better employed than in elaborating organisms which, as far as one can see, are in one way or another interlopers in the scheme of organic life, it seems desirable to assemble them as they appear, since the inevitable accessions to their numbers may ultimately be expected to supply, in a majority of cases, some reasonable explanation of their characteristics, which will make it possible to distribute them satisfactorily in their mycological pigeonholes.

This situation seems to be well illustrated by many of the forms included in these parasites of living insects, which if their isolation were less striking would claim more attention, and have to be put aside until the discovery of similar and related forms

[1] Contribution from the Cryptogamic Laboratories of Harvard University, no. 85.

may serve to make clear their significance. The Laboulbeniales, being a microcosm in themselves, need no apologist; since, despite their unsolved origin, their general position in the fungus series is perfectly clear, except possibly to a few Brefeldians; and, once they have originated, their extraordinary development is quite intelligible. With our present knowledge as a guide, however, the same can hardly be said of the other external fungus-parasites of living insects included in this and in my previous paper[2] on the same subject. Even in the case of genera like *Muiogone* and *Muiaria*, the similarity of which to well known types is manifest, it would be very difficult satisfactorily to explain their manifestly unsuccessful mode of life, the disadvantages of which seem clearly indicated by their rarity, both as regards individuals and species. While such forms may be looked upon rather as outcasts from their proper groups, however, there are others, like *Coreomycetopsis*, the Thaxteriolae, and Enterobryae, which must be regarded as essentially isolated.

This assemblage of species has been obtained from various parts of the world, on insects belonging to numerous different genera of the Coleoptera, Diptera, Orthoptera, and Neuroptera, the most curious forms having been found on Termites, already a classic ground for the parisitologist. Although the first, *Cantharosphaeria*, which is a true ascomycete, may perhaps prove to be, in a sense, saprophytic, with no very definite relation to the vital activities of its host, this can hardly be said of any of the others, the life of which is evidently thus conditioned. *Termitaria*, *Muiogone*, *Muiaria*, and *Aposporella* belong to the Fungi Imperfecti; the first referable in an artificial way to the Leptostromaceae, but quite isolated in its characters; the last, one of the Mucedineae, belonging to a group which includes a number of forms as yet unpublished, having a similar mode of life, and characterized by an absence of differentiated spores, among which the species herewith illustrated is, in some respects, the most striking. *Muiogone* and *Muiaria*, of which species have been previously described, belong to the Dematiae. The position of all the remaining forms, however, is problematical, and, although from its cytological characters

[2] BOT. GAZ. 58:235–253. *pls. 16–19.* 1914.

Enterobryus may be assumed to belong to the Phycomycetes, evident affinities with other members of this class are lacking.

Cantharosphaeria, nov. gen.—Perithecia superficial, scattered, subdimidiate, membranaceous, ostiolate, the ostiole surrounded by a tuft of hairs. Asci 8-spored, aparaphysate; spores hyalodidymous.

Cantharosphaeria chilensis, nov. sp. (figs. 1–5).—Perithecia associated with a rather scanty mycelium of thick-walled, brown, branching hyphae; subhemispherical, blackish brown, slightly roughened, seated on the chitinous integument among the bristles of the host, about 70–80 μ by 40–45 μ; the apical hairs usually closely aggregated about the ostiole, 35×2.5–3 μ, about a dozen in number, rather coarse, irregular, simple, and brown. Asci rather short and stout, sporiferous to the small, short, rather abruptly narrower base, distally rounded, 28×10 μ; ascospores hyaline, the septum median with a very slight constriction, or the basal segment slightly shorter and narrower, subdistichous, 12–14×4.5–5 μ.

On the elytra, legs, etc., of a cucujid beetle found in decaying vegetable material, Corral, Chile.

A single specimen of the peculiar host which bears this fungus was collected in decaying vegetable material at Corral. It is evidently a beetle of somewhat unclean habits, since it bears numerous stalked mites, and is covered with a thin film of foreign matter such as one often sees on species of Silphidae. The perithecia are numerous, and appear under a hand lens as black points scattered irregularly over the surface (fig. 1), the individual perithecia nestling among the peculiar hooked spines of the host as shown in fig. 3, and associated with a variably developed, brown, thin mycelium of thick-walled branching hyphae (fig. 2), which can hardly be called a byssus. The terminal hairs eventually break off, exposing the evident ostiole in old specimens. The surface is slightly roughened, and occasionally a hair may be seen projecting apart from the group about the ostiole.

I have concluded with reluctance to apply a new generic name to this type, yet its close relationship to other genera does not seem at all clear. It probably is not truly entomogenous, deriving its nutriment directly from the living insect, as in all the other types herewith described; and it is not unlikely that it may obtain its necessary materials from the film of foreign matter which covers the surface of its host.

Termitaria, nov. gen.—General habit disciform, applanate or hysterioid, orbicular or variously elongated according to position of growth, sessile; consisting of a basal pseudocellular layer,

from which firmly coherent, simple, parallel sporogenous elements arise vertically, forming an even hymenial surface, the contents of the upper portion of each element becoming separated to form a single row of endogenous, simple, hyaline spores, which are discharged through a terminal perforation; the peripheral elements sterile, dark, indurated, forming a well defined rim or exciple; the margin in contact with the substratum slightly spreading and lichenoid.

This structure, which characterizes the mature condition of this very remarkable type, two species of which have been examined from living Termites, appears to be a secondary development, which results from the vertical proliferation of a primary stage similar to that represented in figs. 6 and 13. This primary condition may be more or less elongated or orbicular, varying to some extent according to the position of growth; it is formed by a continuous layer of slightly brownish cells, the whole reducible to a copiously branched and septate filament, the branches of which are in lateral contact, the ultimate branchlets forming a radiate lichenoid margin. As the cells mature and enlarge, there may be more or less displacement, as a result of which the fundamental arrangement of the cells in branching filaments may be obscured or obliterated. The general appearance of this stage, as represented in the figures cited, recalls that of some species of *Asterina* or of a young *Aglaozonia* or some species of *Coleochaete*, the resemblance to the latter being rendered more realistic by the presence of the projecting bristles of the host, which are completely surrounded by the advancing margin and are left projecting from the thallus without displacement. Of the cells which form this primary incrusting layer, many usually become characteristically modified (fig. 13), assuming the appearance of chlamydospores, which are clearly differentiated from the unmodified cells about them by their greater size, thicker walls, more rounded outline, and deep brown color. Whether these bodies are ever separated and become functional spores it has not been possible to determine, although various instances have been seen in which they appear to have been dislodged.

The preliminary stage just described has been seen in only a few cases, and a complete series, showing the transition from this to the

mature condition, has not been obtained. From such young specimens as have been examined, however, it is evident that a proliferation takes place over the surface of the primary stage, which results in the development of the structures distinguishing the genus. The primary thallus thus forms a thin substratum, more or less firmly coherent to the surface of the host, on which the secondary stage is seated, and which is clearly distinguishable both in crushed specimens and in sections; the brown chlamydospore-like cells persisting *in situ*, singly or in groups.

A section of the mature fungus, which under a hand lens has the appearance of a black *Hysterium* when growing on the legs (fig. 7), or of a small discomycete with pale hymenium and black margin on other portions of the host (figs. 8, 9), shows a differentiation into several distinct regions. The first is a thin dark layer of cells, in which many or few of the chlamydospore-like bodies may be visible at intervals, and which, in a favorable section, may include the primary attachment of the fungus, an indentation, associated with a group of dark cells (fig. 14) opposite which the hypertrophied cells of the host are usually somewhat brownish. No indication has been seen of any actual penetration of the parasite through the integument of the host; but these primary attachments are readily distinguished, and usually appear as a limited dark area which shows through the sporogenous region when the fungus is viewed vertically, as in fig. 9.

Above this primary layer, and derived from it by vertical proliferation, is a region of irregularly polygonal, hyaline cells, the origin of which, as components of a series of branching hyphae, is obscured or quite obliterated through unequal growth and mutual pressure, and is only indicated by a tendency of the lower cells to retain an arrangement in vertical rows. The thickness of this region is somewhat variable, the cells becoming smaller and numerous above; the uppermost giving rise to the straight, erect, tubular, and apparently always simple filaments which compose the sporogenous layer or region. In this layer, which is four or five times as thick as that from which it is derived, two regions are again recognizable, the limits of which may be very clearly indicated. In the lower of these regions the continuous protoplasmic content

of the individual filaments is more dense, and stains more deeply; although this distinction becomes less marked in older individuals, in which, however, the limits of the zone may be even more clearly marked (fig. 14) through the often deep distal suffusion of the walls. Above this line of demarcation in the upper zone, which simulates an ascigerous hymenium, the walls of the upright tubes become somewhat thicker, gelatinous, and tenaciously coherent; while the protoplasm of each is segmented to form a series of short cylindrical spores, which is constantly renewed and pushed upward by the activities of the denser contents of the lower zone. The spores separate from one another as they pass into a somewhat paler region below the surface (fig. 12), becoming slightly rounded at the extremities, with a few sometimes conspicuous granules. The discharge of these endogenous spores through the terminal perforation of the tube has not actually been observed, but is doubtless effected with some violence, the thickened walls around the opening, and the mutual pressure of the gelatinous hymenial elements, combined with the constant pressure from below, affording an effective mechanism for this purpose. The dimensions of the sporogenous elements are very small, and owing to their gelatinous nature it is usually only with the greatest difficulty that the limits of single tubes can be distinguished with exactness in sections, or in crushed specimens; in fact no outlines are clearly defined in this region, and even after staining, the minute spores are often recognized with difficulty under high magnifications. The spores do not seem to possess a wall, or if they have one it is so thin as to be hardly demonstrable. Isolated spores are seldom recognizable on the hymenial surface of healthy individuals, but when the host is confined for a considerable period under somewhat unfavorable conditions, the normal discharge seems to be interfered with, and it may become whitish with a coating of extruded spores.

At the periphery of the hymenium the sporogenous tubes become sterile, thickened, and blackened, forming the inner portion of the well defined, deep black-brown rim or exciple; while a narrow, radiate, lichenoid margin spreads out externally from the base (figs. 7, 8), in close contact with the surface of the host.

As far as can be determined from the series of specimens examined, there seems to be no continuous increase of the fungus in diameter after the original proliferation of the primary stage, which gives rise to the sporogenous region. This is indicated by the fact that this region, as soon as spore formation has begun, is surrounded completely by sterile indurated structures, incapable of radial extension, and also by the fact that the bristles of the host, which are surrounded by the filaments of the preliminary stage, are not bent down as by an advancing margin, but retain their normal position, and may even be seen projecting beyond the hymenial surface of mature individuals, as in fig. 10.

Although each individual must produce an enormous number of spores, this very curious type does not appear to have been very successful in propagating itself effectively; for although its hosts are densely gregarious and live under conditions which should be very favorable for the communication and development of such parasites, hardly more than 1 per cent of the individuals in an infected nest appear to bear the fungus. SNYDER, who was the first to observe the type species of this parasite and to whom I am greatly indebted for the original material examined, informs me that he has found this ratio of infection more or less constant in material from a number of different sources, and SMULGAN, who has also kindly communicated material from the Boston region, makes a similar estimate. In the case of the second species, described from the Island of Grenada, I have also found almost exactly the same percentage of diseased individuals among the several thousand hosts examined.

It does not appear seriously to inconvenience the insect on which it grows, and the only indication of injury is a slight browning of the tissue immediately opposite the primary attachment, as shown in fig. 14, although all the cells of the tissue lying immediately below the integument are hypertrophied, wherever the fungus is in contact with the host, often assuming a rather regular palisade-like structure, similar to that shown in fig. 10. It is most conspicuous when growing on the abdomen (fig. 9), where it is likely to assume a more regular and rounded form, being suborbicular, or more often transversely elongated, with an even or sometimes

slightly irregular outline (fig. 8); but it may also attack the thorax and head, and very often occurs on the legs, where it assumes a long fusiform outline, like that of a hysterium (fig. 7). Individuals of the latter type which have developed on the tibia, from a point of infection near the terminal claws, are sometimes connected with the original point of infection by a narrow primary thallus which remains unchanged on the intervening joints of the leg, spreading out and producing the secondary stage only on the broader and more nutritious tibia.

The relationships of this fungus are quite obscure. The general characters of its primary stage might suggest a resemblance to some Asterinae, or to a similar incrusting type. Its mature condition, however, evidently a Fungus Imperfectus, seems to give it a formal place among the Leptostromaceae. Its method of sporulation, which in certain respects recalls that of the Chalareae, or of *Sporochisma* or *Endoconidium* among the Hyphomycetes, would seem to make its position in this group an isolated one.

Termitaria Snyderi, nov. sp. (figs. 13–17).—Characters of the genus. Sporogenous filaments with blunt or flat perforate terminations forming an even hymenium. Total thickness of sporodochium 70–80 μ; basal region including primary thallus 18–20 μ; sporogenous region 55–65 μ, the upper zone 25–28 μ; sporogenous hyphae a little over 3 μ in diameter; free spores about 3.5×2 μ. Sporodochium on abdomen 400×400–1000 μ.

On workers and soldiers of *Reticulitermes flavipes* and *R. virginicus*, Washington, D.C., the former also vicinity of Boston. On *Reticulitermes*, nov. sp., California. On *R. lucifugus*, Sardinia. A specimen on *Rhinotermes marginalis* from Turkeit, British Guiana, kindly communicated by NATHAN BANKS, does not appear to differ from the type. The material, however, is too scanty for a satisfactory determination.

This form, which is evidently widely distributed, was first observed by SNYDER, to whom I take pleasure in dedicating it, and who has figured its gross appearance in *fig. 9c*, p. 29, Bull. 94, Part II, Bureau of Entomology. It was first sent me at his request by A. D. HOPKINS with an inquiry as to its possible fungus nature, and has also been brought to my laboratory by both SNYDER and SMULGAN from the Boston region.

Termitaria coronata, nov. sp. (figs. 6–12).—Sporogenous hyphae bearing distally a crown of several, more often four, brown-tipped,

minute, pointed prolongations which form a minutely echinulate hymenial surface. Total thickness 80–100 μ; basal region including primary thallus 16–20 μ; sporogenous region 70–78 μ, its upper zone 45–50 μ; sporogenous hyphae ×2.5 μ; spores about 3.5×2 μ.

On *Eutermes morio* var. *St. Luciae*, Grand Etang, Grenada, B.W.I.

The two species described, although hardly distinguishable in general appearance, seem to be clearly separated by the minute, dark, toothlike projections which terminate the sporogenous hyphae in *T. coronata*, and give to the surface of its hymenium a finely punctate appearance which is suggested with sufficient exactness by the stipple in figs. 7, 8, and, under a high power, has the appearance represented in fig. 11. In *T. Snyderi*, on the other hand, the corresponding terminations are unarmed, blunt, and when viewed from above show clearly their rounded ends, slightly polygonal from mutual pressure, and having a readily distinguishable central pore (fig. 15).

The dimensions of the two species, although they are variable in either case, are usually somewhat different; the sporogenous hyphae of *T. coronata* being slightly larger in diameter and length, the relative length of the portion included in the upper zone always being greater. The extremities of these hyphae in this species are quite hyaline and gelatinous, and so tenaciously coherent that I have been unable either to distinguish clearly the terminal pore, or to trace definitely to their bases the characteristic terminal toothlike prolongations shown from above in fig. 11, and laterally in fig. 12. While within the tubes the spores are evidently compressed, and when free increase in diameter, becoming more rounded at the extremities.

Muiogone Medusae, nov. sp. (figs. 18–25).—Sporophores about as long as the spores, rather closely septate, densely crowded so that the whole forms a cushion-like mass on the surface of the host. Spores somewhat irregular, subpyriform, distinctly broader distally, uniform pale dirty brownish, consisting of 10–12, more often 11, more or less regular tiers, the numerous cells of which may be slightly misplaced, those of the basal and distal tiers often slightly larger than the rest, but otherwise indistinguishable from them; a variable number of the distal ones proliferating while still quite young to form a terminal group of tapering, spirally coiled, simple or sometimes once branched appendages which may bear minute secondary spores at their pointed extremities or on short, pointed, subterminal branchlets. Spores 38–45×20–24 μ; terminal appendages 28–30×4 μ at base; stalks, maximum, 38×6 μ.

On the under surface of the abdomen of *Chromopterus* sp., Kamerun, West Africa.

The fly on which this curious form grows is closely related to, if not identical with, *C. delicatulum*, which bears the type species of *Muiogone*. It is quite unexpected that a genus, which has not been seen on any of the numberless genera and species of flies from the tropics that I have examined, should be represented on the same, or on two at least very closely related hosts, by two such clearly distinguished species, of which but one specimen in each instance is known. The present form, although it has exactly the same gross habit, and occurs in the same position on the underside of the abdomen, is clearly distinguished by its uniform pale brown color, the sometimes total absence of any suggestion of a distinction between basal distal and median regions in the somewhat more irregular cell-tiers, and especially in the terminal, spiral, septate, tapering appendages which replace the short spines of the type species, and the resemblance of which to a Gorgon's head has suggested the specific name. These appendages are not formed after the spore has matured, but begin to appear some time before it has attained its full size (fig. 22), although most of the cell divisions have been completed. There is some variation in the spirals, which may be quite regular, or rather indeterminate; and although they usually end in a pointed apex, they may be somewhat blunt. The minute secondary spores are only recognizable here and there in spores which are still *in situ* (figs. 23, 24). The primary spores become detached, together with an adherent portion of the stalk, and there seems to be no definite mechanism for abjunction. After having been broken thus, the base of the stalk, which remains in position, proliferates as shown in figs. 18 and 19, so that the spore mass is constantly renewed. Owing to the presence of the terminal appendages, as well as the lack of any clear differentiation between the basal, terminal, and middle regions, the original generic diagnosis should be slightly modified.

Muiaria curvata, nov. sp. (figs. 26, 27).—Sporophores and sterile elements springing in small numbers from a compact blackened base. The spores 2 or 3 in a group; the stalks short, of 5 or 6 cells; the termination rather slender, strongly curved, or characteristically recurved distally; the body of the spore rather clearly distinguished, marked by large, very irregular, more or less longitudinal patches, separated by fine light lines and slightly roughened, the 4 tiers of functional cells rather well defined, including the broadest portion and with convex margins, the cells relatively large; the lower of the 3 cells above, and usually the upper of the 2 or sometimes 3 cells below, showing one longitudinal septum; rather pale yellowish olive brown, the concave side of the termina-

tion darker. Body of spore about 52–60×20 μ, the termination 65–70×8, the stalk 50–65 μ.

On the superior tip of abdomen and wing of a small drosophilid fly, Bocas del Toro, Panama (*Rorer*), no. 2525.

This species is perhaps more nearly allied to *M. repens* and the succeeding species. From the former it is distinguished by its 4 clearly defined functional tiers, its much longer, slender, curved termination, and the absence of an appendage from the stalk; while from the latter it differs in its smaller size and quite differently shaped spores. One other American species, also allied to *M. repens*, is known from Trinidad, but more material is desirable before it can be described.

Muiaria fasciculata, nov. sp. (figs. 28, 29).—Tufts compact, the spores and rather numerous sterile elements arising from a usually well defined black base; the stalks relatively long, the termination relatively slender, and usually curved, but somewhat variable, the body of the spore blackish brown, roughened by very irregula intricate darker markings, the 4 functional tiers well defined, relatively short, paler, and rather abruptly narrower than the cells immediately below, of which two are usually flattened, and one or both longitudinally septate; the cells above 3 or 4, the lower usually septate. Body of spore 85–100×24–28 μ, the stalk 100–210 μ, the distal termination 50–64×8 μ.

On a dull brown drosophilid fly, no. 2749, Kamerun, West Africa.

This species occurs on the wings, especially on the veins, of its host, a rather large smoky drosophilid, several specimens of which have been found to bear it. It is clearly separated from the preceding species by its greater size and different shape. From *M. Lonchaeana*, which is the only other form with which it might be confused, it is distinguished by the fact that the stalk and distal portion of the spore are not roughened, as well as by its different form.

Aposporella, nov. gen.—Mucedinaceous, aposporous, entomogenous, a well defined septate axis attached by a blackened foot and bearing short branches at the septa, which separate short undifferentiated segments distally that are constantly renewed.

Aposporella elegans, nov. sp. (figs. 30, 31).—Axis stout, erect, straight, or but slightly curved, tapering, simple, the superposed cells but slightly longer than broad, hyaline, the black foot clearly defined; the branches short, simple, one to several in an irregular whorl from all but the terminal cells; somewhat appressed, or but

slightly divergent, externally edged with blackish brown, except at the tips; the termination of the axis hyaline, slender, projecting, without branches. Total length 200–540×8 μ near the base, where the cells are 10–14 μ long. Branches before breaking, longer, 50×4.5 μ.

On the wings of a small fly, Kamerun, West Africa, no. 2645.

Sufficient material of this graceful form has been examined to convince me that the individuals figured are fully matured, and that there is no abjunction of definitely differentiated spores, a character in which it agrees with a small assemblage of aposporous Hyphomycetes of which I have half a dozen or more species from Africa and the East and West Indies that are reserved for future consideration, and to which reference was made in my former paper (*loc. cit.*, p. 237).

In this connection it may be mentioned that SPEGAZZINI has recently (*loc. cit.*) described certain Argentine forms which he refers to *Chantransiopsis*, several dubious examples of which, from Africa and the West Indies, I have myself encountered since the genus was established. One of the forms described by SPEGAZZINI under this name, but which seems to me not closely related to it, is a problematical type which I have examined on Forficulae and Staphylinidae from the East and West Indies, and from Argentina. It consists of a deep brown, several-septate body, resembling a spore of *Hendersonia* for example, elliptical in outline, convex above, and flat below, where it is in contact with the substratum. From usually the end cells of this body are developed a group of simple, straight, septate, hyaline hyphae. I have never seen these hyphae producing anything in the nature of a spore, although SPEGAZZINI figures one which appears to be developing as a terminal proliferation. The position and history of this singular form must, I think, remain somewhat doubtful. Although I have examined hosts well covered with the brown, septate, primary structures described, I have never seen any that suggested their origin and development, which has led me to suspect that they might after all prove to be spores of some fungus, not entomogenous, which develop in situations frequented by the hosts, and adhere to them as the spores of agarics and other Basidiomycetes adhere to Endomychidae and Erotylidae. The peculiar form of these bodies, however, and their almost universal germination in the manner described, make such a supposition doubtful.

In the same paper SPEGAZZINI has described a true species of *Chantransiopsis* which he refers to a new subgenus *Asteronycha*, based on a slight difference in the form of its dark attachment. In his comments on these plants he appears to have misunderstood my expressed opinion in regard to their position, or at least overlooked my statement, on page 230 of my former paper, that the genus "comprises species belonging to the Hyphomycetes," and on page 247, where I mention, in connection with the suggestion that they may be related

to the Florideae or the Laboulbeniales, that "there seems not the most remote possibility that such is actually the case."

Coreomycetopsis, nov. gen.—Axis consisting of an indeterminate series of superposed cells, the basal one modified to form a characteristic foot attached to the host; the distal portion transformed into a sporogonium, its successive septa being destroyed, or absorbed, through the upgrowth of sporophores which spring endogenously from numerous divisions of an intercalary cell, and abjoint terminally simple hyaline spores; which, after being set free in the sporogonium, are discharged through a terminal perforation.

Coreomycetopsis oedipus, nov. sp. (figs. 32, 36).—Nearly hyaline or faintly yellowish, the foot large, strongly concave externally, pointed below, its insertion flattened, wholly concolorous with the remaining cells. Axis usually bent strongly outward above the foot, consisting of 10–15 cells, including the latter; the sixth or seventh from the apex becoming proliferous, after dividing to form a central subpyriform cell and numerous small lateral ones, which are obliquely separated, and grow up through the lumina of the 5 or 6 cells above, abjointing terminally long oval spores somewhat pointed at the base; the cells above, and including the proliferous cell, transformed into a straight symmetrical sporogonium, clearly differentiated, and fusiform or obclavate in outline, broader than the 4–6 subequal stalk-cells which connect it with the foot. Total length 100–135 μ. Sporogonium 45–60$\times$12–15 μ; stalk 10 μ; foot 25$\times$12–15 μ; spores 8–9$\times$2–2.5 μ.

On the tips of the legs of *Eutermes morio* var. *St. Luciae*, Grand Etang, Grenada.

This form is usually solitary, attached to the terminal joints of the legs, and from its pale color is not readily seen, although it is larger than many Laboulbeniales. Its remarkable analogy to *Coreomyces* is suggested by the generic name selected, and if the spores were formed in asci, instead of being abjointed, it would be placed near that genus, since the history of development of its sporogonium, and that of the perithecium in *Coreomyces*, is remarkably similar. The destruction of the upper cells to form the common cavity of the sporogonium does not appear to be due wholly, at least, to the upward pressure of the traversing sporogenous elements, since these cells evidently begin to disorganize as soon as the first intercalary divisions appear

(figs. 33, 35), and the uppermost septa are not reached by the sporiferous filaments themselves.

In general appearance this plant is so like some of the Laboulbeniales that at first I was inclined to believe that it might prove to be the male individual of some ascigerous form characterized by an entirely new type of antheridial structure. Its development, however, is so widely different from anything hitherto known among the Laboulbeniales that there seems to be no good reason to suppose, in the present condition of our knowledge of such parasites, that it is even remotely related to them, an opinion which is supported by the fact that a careful search has failed to bring to light individuals of a different nature. Since, however, its relation to other types of fungi is equally problematical, it will have to await further developments in the limbo "genera incertae sedis," in company with its companion *Laboulbeniopsis* on the same host described below, to which, despite a superficial similarity, it seems also quite unrelated.

THAXTERIOLA Spegazzini.—This name has been used by SPEGAZZINI (Ann. Soc. Nat. Arg. **85**:314) in a paper entitled "Observaciones Microbiôlógicas," under the caption "Anforomorfideas Argentinas," to designate a series of very minute and simple forms common on various insects, especially Staphylinidae, two species of which were figured in my former paper (*loc. cit.*, figs. 30–31), and referred to in the text (p. 250), no name being used to designate them, owing to a lack of any complete knowledge of their history and to their general insignificance. These organisms consist primarily of two cells, the lower attached by a well defined black foot, corresponding entirely with that of most Laboulbeniales; while the upper, having become prolonged to form a necklike termination, and having previously separated, at its base, a smaller cell from which it is more often obliquely distinguished, produces minute, naked, sporelike bodies formed in a single series and discharged through the perforate extremity. These plants closely resemble male individuals of *Amorphomyces*, among the Laboulbeniales; but their occurrence in large numbers, and under no other form, precludes the possibility that they may be conditions, or stages, of any member of this family. Whether, as in the sperm cells of *Amorphomyces*, the spores produced by *Thaxteriola* are formed continuously, as seems most probable, or cease to be produced after the protoplasm of the sporogenic cell has been exhausted, I have not been able to determine satisfactorily. SPEGAZZINI, how-

ever, since in his generic diagnosis he says that "articulum supremum sporis amoeboidëis repletum," appears to assume that the latter supposition is correct. I have not seen the sporogonium "sporis repletum," and the usual appearance of the individuals examined has been that shown in figs. 37, 38, the spores occupying the upper portion of the cell and being arranged in a single series, not irregularly disposed as in SPEGAZZINI'S fig. 5, and similar to that which occurs in the closely related *Endosporella* described later. It should be pointed out, however, that in the genus *Laboulbeniopsis*, a description of which follows, and which appears to be otherwise similar, a simultaneous formation of irregularly distributed spores appears to take place.

In order to facilitate a direct comparison between this type and the others here considered, I append a description of a Javan form that seems sufficiently distinct for ready recognition. Since they are now known to occur on such diverse hosts as gamasid mites, Forficulae, Hemiptera, and Coleoptera, it may be assumed that numerous species of this group exist, none of them too well defined; and it is probable that by the time systematists have finished with them, posterity will have become burdened with a horde of these uninteresting little plants.

Thaxteriola nigromarginata, nov. sp. (figs. 37, 38).—Subsigmoid, pale brownish, except the clear hyaline base and apex; the distal half edged with deep blackish brown, the suffusion broader toward the middle. The basal cell including half the total length; its extremity slightly broader than the distal half, the lower cell of which is very obliquely distinguished from the upper, and is distinctly concave on its longer side, being also free from any blackish suffusion. Total length 62–68 μ; greatest width (distal portion of basal cell) 8–8.5 μ.

On the hairs of a minute staphylinid, no. 2082, Samarang, Java.

I am indebted to JACOBSON for the host bearing this species, which was found among a few beetles collected at Samarang. It seems sufficiently well distinguished from the types usually common on Staphylinidae by its slightly sigmoid outline, more slender distal half, the lower cell of which is distinctly concave on one side when viewed laterally, by the very oblique separation between this and the sporogenous cell, and by the well defined and rather clearly circumscribed black marginal suffusion of the latter, which contrasts strongly with the adjacent hyaline areas.

Two species of this genus have been described by SPEGAZZINI, to one of which, *T. infuscata*, he refers the form represented in fig. 31 of my former paper, which represents an individual found on *Labia minor* in Cambridge, and is distinguished by the fact that the two upper cells are not separated by an oblique septum. His second species, *T. subhyalina*, which occurs on *Aphodius*, is said to be distinguished by the fact that it is always hyaline, the neck more strongly curved, and the basal cell relatively shorter.

A second genus of a similarly nondescript type has been named *Entomocosma* by the same author (*loc. cit.*, fig. 7, pp. 312–315). Although possibly related to the present genus, its essential characters are not at all clear. It seems in some respects similar to a problematical type, of which I have material collected at Waverly, Massachusetts, in 1893, on *Tachinus pallipes*, and which I have not subsequently observed.

It is to my mind very doubtful whether any close relationship exists between these genera of "Thaxteriolae," to which two others are added below, and the "Anforomorfas" with which SPEGAZZINI associates them, and of which the *Amphoromorpha entomophila* of my former paper may be taken as the type. As in the case of *Coreomycetopsis*, however, their relationships to other groups are equally obscure, and they must remain among the "genera incertae sedis" until the discovery of further types which may possibly throw some light on their affinities.

Endosporella, nov. gen.—Axis consisting of 4 superposed cells, the basal attached by a well differentiated foot; the terminal one spinose, separating uniseriate endospores distally, which escape through a terminal pore.

Endosporella Diopsidis, nov. sp. (figs. 39–41).—Foot small, black, and pointed; basal cell abruptly narrower and hyaline below, the upper half becoming much broader and somewhat inflated distally, obliquely suffused with blackish brown. Second and third cells much shorter, subequal, or the upper usually slightly longer and broader; terminal cell a sporogonium, sometimes as long as the rest of the individual, deeply tinged with blackish brown, except the hyaline tip, which is primarily spinose and becomes perforate, the upper half or more becoming filled with a simple

series of flattened superposed naked spores, which are successively separated from the protoplasmic mass below. Apex opening irregularly beside the large terminal spine, which seldom persists. Total length 100–150×10–13 μ. Sporogonium 50–60×10–12 μ.

On the terminal claws of the legs of *Diopsis* sp., nos. 2716, 2717, Kamerun, West Africa.

This type is most nearly allied to *Thaxteriola*, from which it differs in being 4-celled, the sporogonium having no differentiated efferent neck, and discharging broad flat spores. A majority of the individuals examined are comparatively young, and only a few are beginning to form spores, so that in this instance it is also impossible to say whether sporulation is a continuous process or ceases after all the primary contents has been used.

Laboulbeniopsis, nov. gen.—Axis simple, consisting of a differentiated foot, a 2-celled stalk, and a well defined terminal sporogonium, at the base of which two cells are distinguished, the rest of the cavity being filled with numerous minute hyaline spores, which escape through a terminal perforation.

Laboulbeniopsis Termitarius, nov. sp. (figs. 42, 43).—Foot and sporogonium pale brownish, the stalk nearly hyaline. Foot large, externally strongly convex, a portion of its flat insertion deeply blackened, more or less pointed below; the stalk much narrower, its upper cell shorter and broader than the lower. Sporogonium as long as or longer than the stalk, straight, subsymmetrical, slightly inflated below, tapering distally to the rather broad, slightly flaring terminal pore, which is subtended by a scarcely distinguishable constriction; the basal cells occupying the lower fourth or less of the cavity, lying side by side, one slightly larger than the other. Total length 100–130 μ; sporogonium 45–50×12 μ; stalk ×8–10 μ; foot 25×12 μ; spores 3.5–4×2.5 μ.

On tips of legs of *Eutermes morio* var. *St. Luciae*, Grand Etang, Grenada, B.W.I.

This form occurs very rarely, associated with *Coreomycetopsis*, of which it was at first believed to be a stage or condition. The two, however, do not seem to be related, although their general appearance is so similar. There is not sufficient material available to determine the complete history of its sporulation. As far as can be determined from the material available, the spores develop simultaneously, filling the whole cavity of the sporogonium above its two basal cells, and there is no evidence in the specimens examined that successive periods of spore-formation occur, after the first are discharged.

In several cases the sporogonium has emptied itself, leaving a few residual spores, and in such individuals the basal cells, as shown in fig. 42, are already more or less disorganized, while the spores may be considerably swollen and rounded, measuring even as much as $6\times3.5\ \mu$, having surrounded themselves with more or less evident walls.

Despite the apparently simultaneous formation of the spores, however, and their irregular distribution throughout the cavity of the sporogonium, it seems best, at least provisionally, to associate this type with *Thaxteriola* and *Endosporella* in a group of "Thaxteriolae," to which the genus *Entomocosma* Speg. may possibly be added.

AMPHOROMORPHA Thaxter.—The type of this genus, *A. entomophila*, was described and figured in my previous paper (*loc. cit.*, p. 251, figs. 26–28), having been observed on species of *Labia* and *Diochus* from the Philippines. It has since been noticed on a carabid allied to *Platynus* from Jamaica, on a species of *Pachyteles* from Verdant Vale, Arima, Trinidad, and on a host allied to *Ardistomis* from Hayti. Although the specimens obtained from these sources correspond in all respects with the original types, the more abundant material thus made available furnishes certain additional information which is of interest and tends to harmonize the characters of this species with those of other related forms which are not distinguished by the same striking specific peculiarities.

An examination of specimens removed *in toto*, so as to include the whole individual, including its attachment, and viewed anteriorly or posteriorly, shows that the foot, which, when viewed sidewise, usually appears to be black and quite opaque and would naturally be assumed to correspond to that of most Laboulbeniales, or of the Thaxteriolae, is of quite a different nature. This is due to the fact that its main mass consists of a secretion which spreads over the surface of the host, and, when viewed in the position indicated, is translucent, and may be transparent enough to show the actual termination of the organism. This termination is very clearly a short, abruptly distinguished rhizoid (fig. 45), which is held firmly against the host by the indurated secretion just mentioned, and suggests the somewhat analogous rhizoidal attachments of some of the Rhizideae among the Chytridiales.

An identical condition is seen in the other species of this type, two of which are illustrated in figs. 44 and 46. The character of

the wall, its general appearance and texture, are also very like some of the Chytridiales, and unlike that of the Thaxteriolae, with which I was at first inclined to associate them. My present impression, however, is that they have little if any relationship to one another. There seems no reason to believe that they are not, like the Chytridiales, strictly unicellular. Although their developmental history is not, as yet, exactly known, it seems probable, from an examination of the stages available, that the sequence of events may be very similar to that seen in the temporary sporangia of *Cladochytrium Alismatis*, for example. On the basis of this supposition the original cell may be assumed to divide completely into spores, as has been the case in the individual of *A. entomophila* (fig. 45). Figs. 26, 27, and 29 of my former paper, on the other hand, may well be interpreted as illustrating different periods in the spore discharge, which may be, in part at least, effected by pressure exerted as the result of an intrusion into the sporogonium of a new sporogenous cell, which may be assumed to fill the cavity after the spores have effected their exit, and to become transformed into another spore mass to be discharged in a similar fashion. As there is no indication that cilia are present on the spores, it is not easy to see how otherwise the sporangium could be completely emptied through so narrow an orifice. However this may be, it is evident from the condition shown in fig. 45 that the generic diagnosis must be modified, no sterile basal cell being clearly distinguished.

It is also evident, however, that the true position of this type, as well as the exact sequence of events in its development, have yet to be accurately ascertained. I should not be reluctant even to turn it over to the zoologists, although E. G. RACOVITRA, who has figured a more simple type observed on crustaceans (Arch. Zool. Exp. 1907–1908. pl. 10. fig. 26; 1908–1909. p. 272. fig. 2), speaks of it as "une Laboulbeniacea parasite." Further references of this nature, if they have occurred within the past few years, have escaped my notice, with the exception of the account given by SPEGAZZINI in the paper already cited, in which he described under the name *Amphoropsis* three species: *A. minuta* on *Hister*, said to be the same as that represented in fig. 29 of my previous paper; *A. subminuta* on *Echiaster*, represented as somewhat more pointed

and sessile; and *A. media*, which is somewhat larger and more distinctly stalked. A second genus, *Myriopodophila*, is also created, with a single species, *M. argentina*, the only basis for which appears to be a slender habit. All of these 4 species are represented in the figures as octosporic, although this character is not mentioned in the text. I should personally be reluctant to separate either of these forms from *Amphoromorpha*, and the species of *Amphoropsis* are certainly congeneric with the types illustrated in figs. 44 and 46. Since the material of the species represented in fig. 44 is sufficiently abundant and has been observed on two different genera of roaches, it seems worth while to append a description, although all the individuals examined are at the same point of development, the sporogonia being completely filled with spores.

Amphoromorpha Blattina, nov. sp. (fig. 44).—Yellowish, sessile, with a large dark foot. Form elongate oval, somewhat broader distally, the apex rounded. Spores between 50 and 100, about 5 μ in diameter. Total length of sporogonium 55–70 × 18–20 μ, exclusive of the foot, which is 18–22 × 18 μ, seen in front view.

On the axis of the antennae of a dark wingless and a pale winged blattid, nos. 2938 and 2939, Grand Etang, Grenada, B.W.I.

This species is similar to *A. media* in size, but differs in its form, its sessile habit, and its much more numerous, smaller spores. It is apparently confined to the axis of the antennae, where it grows among, but not on, the hairs. A second species inhabiting the hairs, and not the axis, was found in the same locality on a different host, and is represented in fig. 46. This form is characterized by a somewhat different shape, its smaller size, and transparent, hardly suffused, foot.

ASTREPTONEMA Hauptfleisch, Ber. Bot. Gesells. **13**:83. *pl. 8.* 1895.—In a paper entitled "*Astreptonema longispora*, n.g., n. sp., eine neue Saprolegniaceae," HAUPTFLEISCH has described a peculiar organism which grows attached to the chitinized end of the rectum of *Gammarus locusta*, consisting of a simple, unicellular, multinucleate filament, attached at its base, and distally producing a series of successively formed spores, or rather of spore mother cells, within which single definitely walled spores are formed, at first uninucleate, and later containing as many as 8 nuclei. These spores are formed in large numbers and are eventually freed by

the disorganization of the mother cell walls. The filament is attached at the lower end, the wall of which is at first thickened, the thickening organizing a well developed and peculiar sucker-like structure, which forms a definite organ of attachment. The walls of the filament mother cells and spores are comparatively thin, although well defined. As the title indicates, this type was regarded by HAUPTFLEISCH as unquestionably belonging to the Saprolegniaceae, with a possible relationship to *Aphanomyces;* the mother cells, despite the absence of any signs of antheridia or of zoosporangia, being regarded as oogonia, and the contained spores as oospores, a comparison being drawn between them and the seriate oogonia, of *Saprolegnia monilifera* DeBary. The author's conception of the type is summed up in his "kurze lateinische Diagnose für diese neue Saprolegniaceae," which reads as follows: "Thallus non racemosus. Una tantummodo ovospora in ovogonio nata, quasi explens ovogonium. Ovosporae plurium nuclearium oblongae, 2–2.6×7–10 μ. Ovogonia terminalia semper simplici serie adnexa, aliud alii, non transfusa. Sporangia incognita. Antheridia desunt." SACCARDO in the *Sylloge* (14:446) places this type among the Chytridiales, but neither author appears to recognize the fact that it has any relationship to the Enterobryae, to which it undoubtedly belongs. The only character which might separate it from the type genus *Enterobryus* is found in the presence of definitely differentiated spores, which replace, or succeed, the terminally abjointed segments which are characteristic of all the species of this genus; but whether this character should be regarded as separating the two types generically, or as extending our knowledge of the little known life cycle of the last mentioned genus, it is not at present possible to decide. In the numerous forms of *Enterobryus* which I have examined, none that have been observed growing within the intestine of the host have shown a development of well differentiated spores; although the terminally abjointed segments may be more or less sporelike, according as they are longer or shorter. It does not seem possible, however, to homologize them closely with the spores of the form described by HAUPTFLEISCH, or with those of the new form described later. It is nevertheless quite possible that, as in many cases among the

higher fungi, certain species of the same genus may be sporiferous in a special way, while others are not; or that differences in environment may bring about the sporulation of species which normally reproduce by separated segments only. In the two instances under consideration, for example, the individuals do not, like most species of *Enterobryus*, grow submerged in the more or less fluid contents of the ventriculus, or smaller intestine, in which the food ingested by the host has only partially been digested; and while the species of HAUPTFLEISCH is attached just within the anus, the new form is found growing on the hard external chitinous plates about the opening. As far as the possible food relations of these two forms is concerned, the situation seems to be quite different, since they come in contact with fecal matters only, which might be supposed to exercise a definite influence on their course of development. It should be mentioned, however, that although I have, in one instance at least, obtained abundant material of what appear to be several species of *Enterobryus* growing outside the anus of a *Passalus* from Grenada, B.W.I., none of the individuals, although they are otherwise very similar, show the sporulation which is so conspicuous a feature in the new form to be described.

This form is characterized by the possession of a huge basal cell; its very thick wall often laminate above, filled with a coarsely granular protoplasm, and attached at its base by a well developed sucker-like attachment entirely similar to that of other species of *Enterobryus*. The primary axis is at first continuous (fig. 47*a*), but later a terminal segment of considerable length is separated, and at least one more may be similarly formed, as in fig. 47*b*, in which a terminal scar shows very clearly that a segment of this sort has previously been abjointed. Such a condition, were it found within the intestine, would inevitably be regarded as belonging to some species of the genus *Enterobryus*. After one or more of these segments has been abjointed, and as a result of the activity of the denser multinucleate protoplasm at the end of the cell below the scar (fig. 51), a series of flattened cells begins to be cut off, each of which is supplied with a single large nucleus. Soon after these cells, or spore-segments, have been separated, they become ab-

ruptly compressed, so that above the fourth or fifth cell, as a rule, the series, when viewed edgewise, is thin and flattened, as is shown in fig. 47. The cells appear to be spore mother cells, within which thin-walled, sausage-shaped spores are firmly held by the thickened sheath which surrounds them and is continuous with the wall of the basal cell from which they were originally separated. As far as can be determined from the material available, these spores, which become eventually multinucleate, are separated by the breaking off of the whole or a portion of the series, and are not set free individually, as seems to be the case in the thin-walled species described by HAUPTFLEISCH. What the further history of their development is cannot definitely be stated. It seems probable that the spore groups are ingested by the xylophagous host, together with other spores of fungi which are present on their natural food, and that, separating as a result of the action of digestive fluids, they either pass through a preliminary period of growth attached to the wall of the digestive tract, or, in being voided with the excrement, become attached and develop at the mouth of the anus.

Although this species differs in its very thick walls, and in the form and more or less permanent association of its spores in series, its characters seem to correspond in all essential respects with those which are said to distinguish *Astreptonema*. Fig. 10 of HAUPTFLEISCH'S plate would indicate that his species is characterized by the separation of one or more terminal segments, which precedes the formation of spores. That these may be antheridia, as he suggests, seems quite improbable, and since, as he states, his material was somewhat scanty, it may prove that in this respect as well as in others the two show a very close correspondence. The cytological characteristics seem to be identical. The nuclei in both are large and rather numerous in the primary cell, more so in the denser contents of the distal region, where the spore segments are cut off (fig. 51), there being fewer toward the base, although one seems to be almost always present just above the foot (fig. 49). This foot is entirely similar in both and identical with the corresponding organ of *Enterobryus;* and the spores, although differing in shape and method of association when mature, are produced in a

similar way within mother cells. There can be little doubt as to the generic identity of the two forms, yet their characters are so similar to those of *Enterobryus* that I have preferred to use this generic name, in view of the fact that in no instance has the complete history of a species of this genus been satisfactorily observed.

Enterobryus compressus, nov. sp.—Hyaline to pale dirty yellowish. Basal cell very large and thick-walled, somewhat broader distally, 500–850×28–35 μ, straight or usually slightly curved at the base, attached by a well defined, slightly brownish yellow foot, shaped like an inverted cup, and distinguished by a slight constriction from the basal cell, which bulges more strongly on one side above it. Segments separated from younger specimens about 200×18 μ, their formation followed by the production of spore mother cells which are formed at the distal end of the basal cell, the series above the fourth or fifth cell becoming broad and flat through compression; the cells about 8 μ long by 35 μ broad by 18 μ thick, each containing a single spore which nearly fills the cavity, surrounded by a thick sheath continuous with the wall of the basal cell.

Growing wholly exposed on the anal plates of a large species of *Passalus*, Dominica, B.W.I., no. 2170, M.C.Z.

The unusually thick walls of this species and the coherence of its spore mother cells no doubt are influenced by its aerial habit, as a result of which it may be exposed to very dry conditions. The individuals represented in fig. 47, with two exceptions, are very old, and seem from the broken outline of their distal ends to have already shed a portion of the spore mother cells. In a majority of the sporiferous individuals, however, it is possible to distinguish the scar clearly shown in figs. 50, 51, from which it may be assumed that a segment has been separated, such as is shown in fig. 47*b*. A large number of Enterobryae have also been obtained growing in the same position on a species of *Passalus* from Grenada, which seems to include more than one species, the larger of which resembles the present form in all respects, except for the absence of any sporulating individuals. All of these, although their walls are somewhat thicker than is normally the case, would be referred without hesitation to *Enterobryus*.

The nuclei shown in figs. 48 and 51 are readily observed in the alcoholic material by decolorizing, after staining with Haidenhain's iron alum haematoxylin. The conditions shown are entirely similar to those described by HAUPTFLEISCH, and serve to show that these plants cannot under any circumstances be related to the higher bacteria, as has been suggested. One may admit that

they must be placed among the Phycomycetes; but they appear to occupy a very isolated position, and it is difficult to agree with this author that they have any close relation to the Saprolegniaceae.

In regard to their relation to the host, it may be said that the aerial habit of the present form seems to exclude the theory that these plants are purely commensalists, since they can only come in contact with the voided feces; and this fact, taken in connection with their highly specialized sucker-like attachment, suggests that they may be, to some extent at least, truly parasitic.

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EXPLANATION OF PLATES I–V

The figures are reduced from camera drawings made with Zeiss dry objectives and eyepieces and Leitz water (no. 10) and oil (1/16) immersion as indicated.

Cantharosphaeria chilensis Thaxter

FIG. 1.—Portion of host greatly magnified, showing distribution of perithecia.

FIG. 2.—Mycelium associated with perithecia; 10, 4.

FIG. 3.—Three perithecia among spines on host; D, 2.

FIGS. 4–5.—Ascus and ascospores; 1/16, 18.

Termitaria coronata Thaxter

FIG. 6.—Young individual showing preliminary stage; subdiagrammatic; D, 4.

FIGS. 7–8.—General appearance of mature fungus growing on leg and thorax respectively; former showing blackened primary attachment which shows through hymenium in center; D, 4.

FIG. 9.—Habit of growth on host; ×25.

FIG. 10.—Section of mature sporodochium, showing hypertrophied cells of host below chitinous integument; dark line of primary thallus shown, succeeded by fundamental layer, and sporogenous region, showing two primary zones, in upper of which a further differentiation into two zones is indicated; sporodochium traversed by two hairs arising from integument of host; semidiagrammatic; D, 1.

FIG. 11.—Hymenium seen from above, showing distribution of toothlike projections from sporophores; 1/16, 12.

FIG. 12.—Sporophores with included spores; semidiagrammatic; 1/16, 12.

Termitaria Snyderi Thaxter

FIG. 13.—Portion of preliminary stage, showing margin and chlamydospores; 10, 4.

FIG. 14.—Portion of section of old individual, showing hypertrophied cells of host below slightly intruded primary attachment, blackened primary

layer, with a few chlamydospores *in situ*, fundamental layer, and above it sporogenous region, comprising two zones, lower distally blackened; 10, 4.

FIG. 15.—Sporophores seen end on, showing terminal perforation; 1/16, 12.

FIG. 16.—Sporophores seen in section, showing origin from cells of fundamental layer, spore, and terminal perforation; 1/16, 12.

FIG. 17.—Free spores; 1/16, 12.

Muiogone Medusae Thaxter

FIG. 18.—Young spore developing from proliferous end of old sporophore; 10, 4.

FIG. 19.—Later stage of young spore of third order resulting from proliferation of second order; 10, 4.

FIGS. 20–21.—Older primary spores; 10, 4.

FIG. 22.—Spore showing origin of terminal appendages; 10, 4.

FIG. 23.—Mature spores, appendages bearing a few secondary spores; 10, 4.

FIG. 24.—Portion of appendage with secondary spores; 10, 18.

FIG. 25.—Group of spores in different stages of development.

Muiaria curvata Thaxter

FIG. 26.—Single plant bearing two mature spores drawn in outline; D, 4.

FIG. 27.—Single spore seen in surface view; D, 4.

Muiaria fasciculata Thaxter

FIG. 28.—Single spore seen in surface view; D, 4.

FIG. 29.—Single plant with several spores in different stages of development and numerous sterile filaments; D, 4.

Aposporella gracilis Thaxter

FIG. 30.—Two plants on wing of fly; D, 4.

FIG. 31.—Two branches, one unbroken, other proliferous.

Coreomycetopsis oedipus Thaxter

FIG. 32.—Young individual of unmodified superposed cells; 10, 4.

FIG. 33.—Young individual, division beginning in an intercalary cell; 10, 4.

FIG. 34.—Mature individual in which septa above intercalary cell have disappeared, forming continuous cavity within which spores are being abjointed; 10, 4.

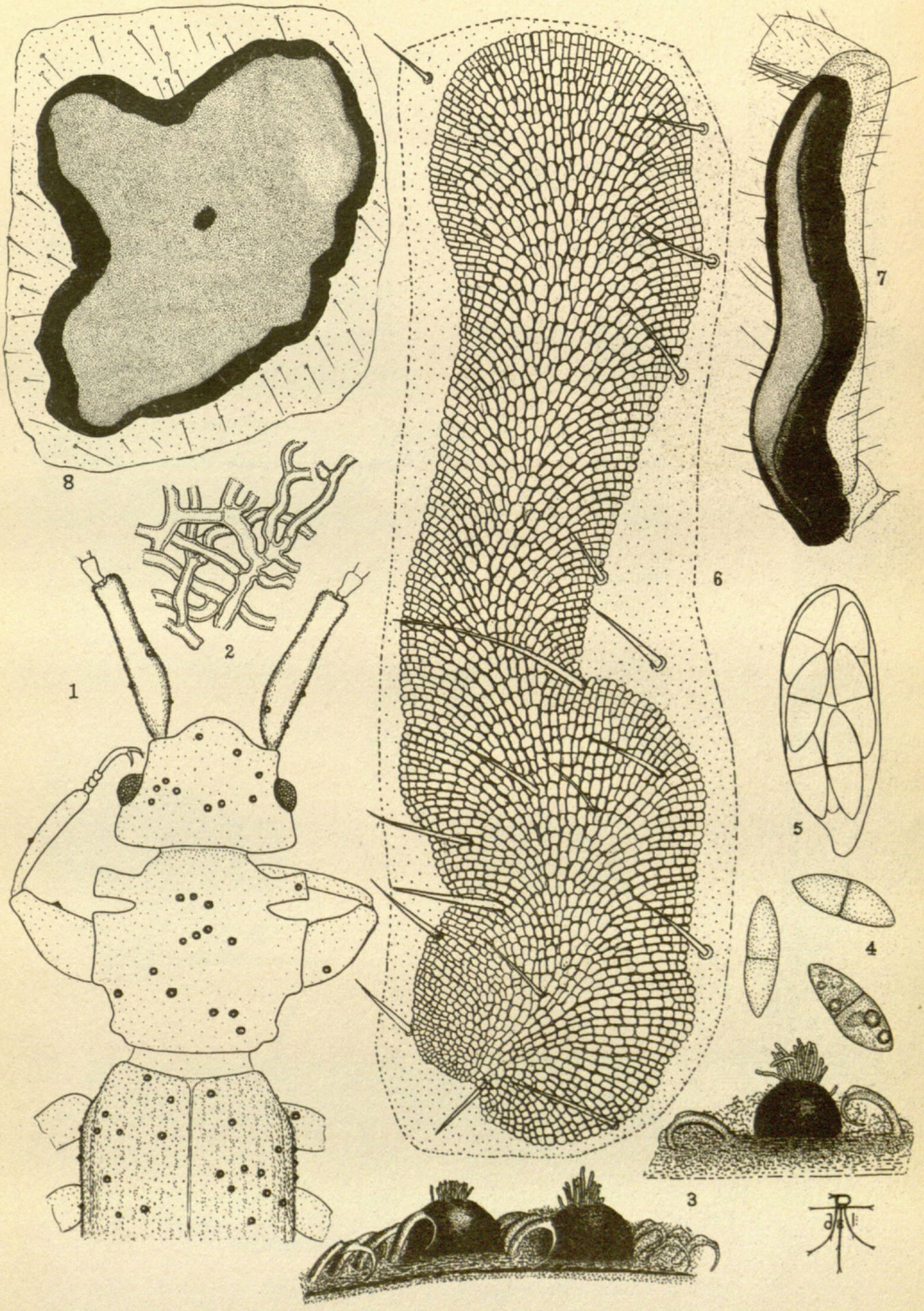
FIG. 35.—Younger individual in which terminal cells are beginning to disorganize, 4 septa still remaining above sporogenous hyphae; 10, 4.

FIG. 36.—Spores separated by crushing; 10, 12.

Thaxteriola nigromarginata Thaxter

FIG. 37.—Mature individual; 10, 4.

FIG. 38.—Two individuals *in situ* on spine of host, left one turned to show partly posterior view; 10, 4.



THAXTER on FUNGUS-PARASITES